

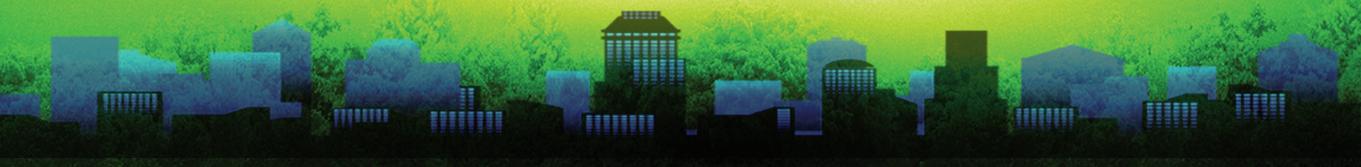


**THE
OPEN UNIVERSITY
OF SRI LANKA**



**15th OPEN UNIVERSITY
RESEARCH SESSIONS - OURS 2017
16th & 17th November**

OPENING MINDS:RESEARCH FOR SUSTAINABLE DEVELOPMENT





**THE OPEN UNIVERSITY OF
SRI LANKA**

**Extended Abstracts
Open University Research Sessions
(OURS 2017)
16th & 17th November, 2017**

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MESSAGE FROM THE VICE CHANCELLOR

It is with great pleasure that I send this felicitation message to the Proceedings of the Open University Research Sessions (OURS) 2017. It is a well-established fact that research forms part and parcel of a high caliber university, as without research, a relevant and modern curriculum cannot exist. Through research an academic discovers, expounds and evaluates new knowledge, ideas, and technologies thus fostering professional excellence that is important for delivering outstanding student education and training.

The Open University of Sri Lanka (OUSL), the premier Open and Distance Learning (ODL) institute in Sri Lanka, over the years has immensely contributed to the higher education landscape of this country. We also have a very strong research culture which has resulted in many noteworthy contributions. The establishment of the Industry Liaison Centre (ILC) at the university has resulted in our staff engaging in research with the industry. As a result, I note that the University, for the first time in its history, has filed patents at the National Intellectual Property Office (NIPO), along with the staff involved.

For the university to further enhance its standing, it is paramount that we further strengthen and advance our capabilities and effectiveness by adopting newer approaches. We are committed to provide the necessary logistic and financial support, where necessary, for research initiatives that an individual or an entity in the University wants to embark on. This year, the university introduced a fellowship scheme for two academics from member universities of the Association of Asian Open Universities (AAOU) to undertake collaborative work with our academics in OUSL. As a result, an academic from Open University of Malaysia (OUM) was at the OUSL engaged in joint work with an OUSL academic. In the coming year, we would like to extend this facility to other institutes and subject areas as well. The International Relations Unit (IRU) is currently working on the logistics pertaining to this. I am sure based on the research experiences that are being shared in this year's research sessions, we will be able to learn and adopt practices for the betterment of our learners.

Let me take this opportunity to express my appreciation to the Organizing Committee of the Open University Research Sessions 2017 and other staff who have contributed their time and effort to make this event a success. I am confident that the OURS 2017 would be an academically enriching and rewarding experience for all the presenters and participants. Thank you very much and all the very best.

Prof. S. A. Ariadurai
Vice Chancellor

PREFACE

This year marks the 15th year of Open University Research Sessions (OURS2017) under the theme of '*Opening Minds: Research for Sustainable Development*', which was previously known as Annual Academic Sessions of the Open University of Sri Lanka. This volume contains the 108 extended abstracts that were accepted for presentation and publication in the proceedings after going through a rigorous peer review process on the basis of originality, significance, and clarity. The abstracts were categorized under seven (07) broad themes including Open Distance Learning, Education, Engineering, Health Sciences, Law, Management and Social Sciences, Life Science, Physical Sciences.

OURS2017 is featured with two speaks from Prof. Sarath Kotagama, Emeritus Professor in Environmental Science, University of Colombo and Prof Ajantha Dharmasiri, Director of Postgraduate Institute of Management. Two key note-speakers will also speak on a given subject in a plenary session on both days of Research Sessions. The rest of the presentations have been categorized into 15 Sessions which will be held as 3 parallel sessions. All the presentations in the Open Distance Learning will be open to all participants at the morning of the 16th November 2017.

Being a collaborative mission, the organization of research sessions and compiling a volume of proceedings require the dedicated effort of many people. Hence, on behalf of the Senate Sub-Committee on OURS2017, we thank all authors in particular, who submitted abstracts to the conference, and all reviewers and language editors who helped us in reviewing and editing papers. Special thank goes to the seven (07) Conveners of the Editorial Board for their untiring effort throughout the abstract evaluation period. Organizing committee appreciates the honorary service provided by the Session Chairs for all 15 Sessions. Conference Secretaries Ms. Disna Eheliyadoa and Ms. Siyumini Perera has been contributed tremendously since the applications are called until completion of the abstract volume. Senate sub-committee is highly appreciated their dedicated service throughout the period. The support extended by Mr. Mudith Somaratne, Acting Director Operation for his cooperation and Mr. B. A. D. J. Balarachandra are also acknowledged.

Last but not least, I sincerely thank all the members of the Senate Sub-Committee of the Open University Research Sessions 2017 for their unstinted support, active participation and significant contribution to all matters pertaining to OURS2017.

I wish all the best for OURS2017!

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PROCEEDINGS

OPEN DISTANCE LEARNING

*The Bachelor of Education (drama and theatre) programme Conducted01
through the distance mode: problems and solutions*

**G.D. Lekamge, A.I. Irugalbandara, K.P.R. Jayawardena, M.N.C. Fernando,
S. Kugamoorthy, B.G.H. Anuruddhika**

*Access and use of electronic technologies by undergraduates of the05
faculty of health sciences*

L.G. Jayatilleke, G.G.W.C. Wijesekara, G.R. Ranawaka

*Student perceptions on open and distance learning (ODL) services;..... 11
with special reference to the open university of Sri Lanka*

A.U.B. Rajaguru, N. Abeysekera

*Teachers' Existing Learning Practices and Communication Skills 17
Conducive to Online Learning*

L.R. Gonsalkorale, M.L. Sudarshana

*Dependence of Graduation Rate on Entry Qualifications in the B.Sc. 21
Programme at the Open University of Sri Lanka: A Case Study*

G. Bandarage

*Students' Perceptions of the Use of Discussion Forums in Learning English 27
Literature.*

J.C.N. Pullenayegem

*Needs Analysis of Prospective Learners to Develop a Psychology 33
Degree Programme in Open and Distance Learning Mode.*

K.S.A. Colombage, G.P. Gamage

EDUCATION

*Developing Language and Early Literacy Skills of a Preschool Developmental 37
Child with Global Delay. Programme at the Open University of Sri Lanka:
A Case Study*

**Anoma Alwis, Malani Munasinghe, T.D.T.L. Dhanapala, B.G. Hemanthi
Anuruddhika, K. Ketheeswaran, Saminda Kuruppu**

Perceptions of ESL Students on Group Presentations as an Assessment Tool43

I.N.J. Bogamuwa, N.K. Abeysekera

Life Skills for Engineers: An Initiative towards Developing Holistic Graduates49

P. Silva, D. Siriwardana, K. Booso

A Study on Teachers' perception on their Socio-Economic Status and Social Recognition in Northern Sri Lanka55

R. Mangaleswarasharma

School Based Teacher Development: Opportunities and Challenges for Teachers in Jaffna District61

S. Kugamoorthy

A Study on Student Teachers' Perceptions on the Continuous Assessment Methods of the Postgraduate Diploma in Education Programme67

S. Kugamoorthy, W.M.S. Weerakoon, W.M.S. Wanasinghe, J.D. Careemdeen

Practical Applicability of Directed Motivational Currents (DMC) as Means of Inspiring ESL Teachers.73

Dilmini Direckze, Hemamala V. Ratwatte

Teachers' Attitudes towards the Use of Information and Communication Technology in the Instructional Process of Secondary Education in Sri Lanka79

K.G.S.K. Perera, S.P. Karunanayaka, A. Ariyaratne

Study on the Facebook Usage of Undergraduates at the University of Vocational Technology, Sri Lanka85

N.W.K.D.V.P. Opatha

ENGINEERING

Investigating the Effect of the Variation of Stitch Density on Seam Puckering93

A.S.S Gunasena, M.E.R Perera

Effect of Sewing Thread Count and Needle Size on Seam Stiffness of 100% Cotton Twill Fabrics.99

T.A.D.K. Gunarathna, W.V.L. Kumara

<i>Fashionable Colour Fastness Failure to Chlorinated Water of Casual Wear</i>	103
I.N. Adikari	
<i>Effect of Electromagnetic Force on the Design of Linear Alternator</i>	107
W. A. D. M. Weragoda, N.T. Medagedara	
<i>Portable Electronic Curd Quality Tester</i>	113
R. P. Gangodagamaarachchi, H.Pasqual, S. Jayathilake	
<i>Study of the Compressive Strength of Kitul Palm Fibre-Reinforced Concrete</i>	119
<i>Composites</i>	
H.A.C.M. Perera, M.A.I. Perera, D.I. Fernando	
<i>Flexural Behaviour of Polyester/Cotton Plain Woven Fabrics with</i>	123
<i>Superimposed Seam</i>	
K.V.C. Kehelpannala, C.N. Herath	
<i>Developing Sanitary Napkins Using Corn Husk Fibres</i>	129
R.A.N.S. Wijesingha, M.A.I. Perera	
<i>Fully-Automated, Economical Metal Bar Feeding Mechanism for</i>	133
<i>Existing Power Hacksaw.</i>	
B.J.M. Nanayakkara, D.C. Wijewardana, V.R. Jayasekara	
<i>Vision Based Autonomous Landing System for an Unmanned Aerial Vehicle</i>	137
A.V.V.S. Bandara, H.D.N.S. Priyankara	
<i>Enhancing the Hyperspace of the OUSL with a Web Page Prediction Model</i>	141
U. I. Katupitiya, D.D.M. Ranasinghe, G.S.N. Meedin	
<i>Dyeing 100% Cotton Plain Fabrics with Natural Dye Extracted from</i>	147
<i>Thespesia populnea (Gan Suriya).</i>	
P. G. Kaushalya, W. A. Wimalaweera, C. N. Herath	
<i>Producing Claddings and Partition Boards Using Induru Fibre</i>	153
W. D. C. Chandanie, M. A. I. Perera	

HEALTH SCIENCES

<i>Awareness of Cervical Cancer, Attitude and Practice towards Cervical</i>	157
<i>Cancer Screening among Female Undergraduates in University of Peradeniya</i>	
Dilumi Jayawickrama, Anuradha Rathnayake	

Travel Characteristics of Older and Disabled People in the Colombo District, 163
Sri Lanka

Varuni Tennakoon, Roshini Peiris-John, Rajitha Wickemasinghe, Shanthi Ameratunga

Prevalence and Associated Social-Reproductive Determinants of 167
Menopausal Symptoms among Pre and Postmenopausal Women in Galle,
Sri Lanka

N. Rathnayake, J. Lenora, G. Alwis, S. Lekamwasam

Prevalence of Nosocomial infections and associated factors among..... 171
patients in the Intensive Care setting of the Colombo North Teaching
Hospital, Sri Lanka

K.A.M.S. Pemasinghe, V.M.D. Vithanage, T.S.N. Fonseka, K.A.M.S.P. Kandearachchi, U.C.P. Fernando, P.P. Jayasinghe

Third Year Student Nurses' Perceptions Regarding Their Clinical Learning 175
Environment

K.A.S.H. Silva, W.A.A.D.S.S. Wimalasena, J.P.C.K. Jayalath, S.T. Miranda, P.W.G.D.P. Samarasekara

Government Pharmacists' Perceptions on Continuing Education..... 181

K.D.S.V. Karunanayaka, R.A.N. Dilsha, R.W.N. Tanuja, R.B.J. Buddhika, P.W.G.D.P. Samarasekara

Culture Specific Mental Imagery in the Treatment of Anxiety..... 187
T. Solomons

Prevalence and Factors Related to Non-use of Modern Family Planning 191
Methods among 15-49 Years Aged Married Women in the Medical Officer
of Health Area Horana.

S.S. Thilakahetti, W.M.P. Wanniarachchi, H.W.K. Kanthi, M.D.I. Perera, L.I. Malwenna, P.W.G.D.P. Samarasekara

Socio-demographic Characteristics of Families, with a Child Less Than..... 197
5 Yearsof Age having a Congenital Heart Disease and the Out of Pocket
Expenditure of Those Families For a Clinic Visit

P.P. Jayasinghe, V.L. Iddamalgoda, K.M.D.S. Kulathunga, W.A.A. Kumara, W.G.W.P.K. Waldeniya, S.D. Darmarathne

- Factors Related to Theory Practice Gap among Student Nurses.....*203
**V.G.A.A. Aththiligoda, H.T.R. Kumara, W.A.N.M. Wijesinghe,
A.D. Chamari, A.S.P.L. Senadheera, B.S.S. De Silva**
- Mothers' Experiences of Having a Child with Autism Spectrum Disorder209
in a Tertiary Care Hospital, Sri Lanka.*
**K. Monika, H.G.I. Wijayarathne, G.A.M.I.L. Gunarathne,
G.G.W.C. Wijesekara, A.V. Pramuditha Madhavi**
- Reasons for Recurrent Admission of Patients with Asthma in District General213
Hospital Embilipitiya*
**W.A.U. Perera, H.V.R. Jeewanthi, K.P.D.N.S. Jayawardana,
M.H.T.D. Krishanthi, R.A.N. Dilsha, P.W.G.D.P. Samarasekara**
- Mothers' Knowledge, Believes and Practices Regarding Febrile Convulsions and 219
Home Management*
**M.S.S.K. Abeysekara, M.P.N.P. Weerasekara, B.V.T.N. Wijesena,
R.A.C.N. Perera, K.A. Sriyani, N.R. Kuruppu**
- Back Pain among Emergency and Orthopaedic Nurses: Prevalence and.....225
Perceived Risk Factors*
**Kavindra Masakorala, Gayani Iddawala, K.H.P. Abeyratna,
Priyanga Munidasa**
- Physical, Social, and Psychological Impacts of Psoriasis229*
**B.M.M. Rukshani, G.R.N.D. Samarakoon, W.S.N Maduka, K.A. Sriyani,
A.S.P.L. Senadheera**
- Comparison of Oral and Depot Antipsychotic Medications in Perspective233
of Relapse Rates in Patients with Schizophrenia*
**K.H.D. Mahesh, Rajeev Weerasundera, Patrick Ball, Hana Morrissey, H. W. A. S.
Subasinghe**
- Factors Related to Attempted Suicide among Young Adults Admitted at the237
General Hospital, Matara*
**T.G.C. Tharanga, V.D.C. Premawardana, M.C.T. Wickramasinghe,
V.A.S. Fernando, B.S.S. De Silva**

<i>Risk Factors for Acute Lower Respiratory Tract Infections in Children: Mothers' Perspective</i>	241
J.M. Palihakkara, E.V.P. Kumari, A.D. Dilshani, E.A.G. Thushari, H.M.S.P. Herath, B.S.S. De Silva	
<i>Effects of Parental Migration on Educational Developments and Mental Wellbeing of Left-Behind School Children in the Kurunegala District: A Case Study in the Mawathagama Educational Zone</i>	247
U.M. Dissanayake, M.B. Sakalasooriya	
<i>Factors Related to Poor Attendance for Pap Smear Screening In Vavuniya</i>	255
V.Janarththany, R. Kalavani, T.Vijayakumar, S.N. Merin Devini H.M.S.P. Herath, B.S.S. De Silva	
<i>Impact of Gender and Age on Taste Perception for Sucrose in Patients with Type II Diabetes Mellitus</i>	261
Dinithi Vidanage, Sudarshani Wasalathanthri, Priyadarshika Hettiarachchi	
<i>Factors Related for Low Back Pain among Nurses at Teaching Hospital, Karapitiya</i>	267
G.H.K.A. Priyadarshini, K.K.J.I. Kodithuwakku, A.G.M. Madushani, S.N. Marakanda, K.A. Sriyani	
<i>Contributory Factors of Coronary Heart Disease among Young Adults</i>	273
S.A.C. Sampath, K.G.U. De Silva, P.C. Wickramasinghe, A. Colombage, P.W.G. D.P. Samarasekara	
<i>Assessment of Risk Factors for Falls among Elderly People in the Home Environment</i>	277
W.W.L.S. Sandamali, P.A.D. Himali, W.A.T.N. Wijesundara, A.A. Edirisingha Arachchi, N.R. Kuruppu, A.V. P. Madhavi	
<i>Factors Related to Self-Care Practices among Patients with Type 2 Diabetes Mellitus: A Descriptive Study</i>	283
H.W.M.S.S.H. Wijesinghe, A.I.K. Wijekoon, M.P. Sooriyaarachchi, H.A.K.G. Jayasinghe, H.U.C. Nuwansala, W.N. Priyanthi	

Barriers to Implement Kangaroo Mother Care among Post- Natal Mothers with Premature Low Birth Weight Babies289
G.G.A.W. Gamlath, P.G.S.S. Wijayarathne, P.A.C.R. Gunadasa, S.S.N.D. Sakalasooriya, N.R. Kuruppu, Kumudini Cooray, W.N.Priyanthi

Knowledge, Attitudes and Practices on Oral Rehydration Salt Solution for Diarrhoea among Mothers with Children under Five Years Old295
T.T.D.D. Fernando, S.D.N. Tharanganie, S.M.C.J. Subasinghe, K.P.S.D. Pathirana, R.B.B.S. Ramachandra, A.S.P.L. Senadheera, W.N. Priyanthi

Knowledge, Practices and Affecting Factors Regarding Contraceptive Methods among Married Women in the Estate Community301
Ramani Kumari, W.S. Wickaramathunga, R.M.C.S. Bandara, A.T.L. Ganegoda, W.N. Priyanthi

The Reasons for Delayed Presentation of Breast Cancer: A Descriptive Study at the Teaching Hospital, Kandy307
H.T.P. Lakmali, A.W.D.S. Dharmathilaka, H.M.S. Herath, K.D.S.N. Weerasekara, R.S.R. Rajakulasooriya, B.S.S. De Silva

LAW, MANAGEMENT, AND SOCIAL SCIENCES

Broadcast Ratings System in Sri Lanka: Issues and Implications313
G.T. Madhubhashini

Comparative Analysis of Collective Management Organizations of Copyrights and Related Rights; with Special Reference to Sri Lanka317
W.A. Sanath S. Wijesinghe

Youth Labour Market in the Northern Province of Sri Lanka.....323
Balamurali Navaratnam, Priyanga Dunusinghe

Nation Branding of Small States through Economic Diplomacy: Prospects and Challenges. (A Case Study of Sri Lanka)327
Hashan Viraj Wijesinghe

<i>Consumer Conformity Behavior in Virtual Communities; A Study of Generation “Y” Consumers in Sri Lanka</i>	333
P. L. W. G. S.D. Piumali, D.T. Rathnayake	
<i>Social Media Usage of Sri Lankan Consumers: Compulsive Consumption Perspective</i>	337
T.H. Rathnayake, D.T. Rathnayake	
<i>Levels of Efficacy Factors in the Usage of Electronic Information Resources among Social Sciences and Humanities Undergraduates in Four Universities in Sri Lanka: An Approach Based on Frequency of Library Use</i>	343
C.N.K. Alahakoon, S. Somaratne	
<i>Innovation Practices of Large-Scale Manufacturing Organizations Located in Industrial Estates in the Western Province of Sri Lanka</i>	349
S. Ranaweera, V. Sivalogathan	
<i>‘God of the Betel Creeper’: Betel as an Object of Folkloric Imagination and Biodiversity in Sri Lanka</i>	355
S. Somaratne, L. Medawattegedara	
<i>Super Heroes, Mutants, Minorities and Marginalization: A Critical Review of the 2016 Hollywood Movie, “Logan”</i>	359
Sameera Tilakawardana	
<i>Determinants of Merchandise Export Performance in Sri Lanka</i>	363
L.U. Kalpage, T.M.J.A. Cooray	
<i>Exploring Pro-Social Moral Reasoning of Sri Lankan School Children Using Eisenbergian Dilemmas</i>	369
U.P. Miriyagalla, B.D.D.Pathirana	
<i>The Need to Identify the Right to a Healthy Environment under Constitutional Reforms</i>	373
K.M.C.R. Karunatilaka	
<i>The Impact of Training and Development on Job Performance: With Special Reference to an Audit Company in Sri Lanka</i>	377
K. P. Nishantha	

The Role of Entrepreneurs' Personality, Characteristics of383
Organizational, Social Influence for Organizational Change
in Construction Industry in Eastern Providence, Sri Lanka
K. Kirushanthy

The Disciplining Mechanism of Power in Selected Literary Works387
by Albert Camus and Franz Kafka
M.N. De Costa

"Tourists' Satisfaction Towards Destinations in Jaffna Peninsula,393
Sri Lanka: With Special Reference to Beach Holiday"
S. Kalimuththu, Nalin Abeysekara, L.P.S. Gamini

Tourists Satisfaction towards Heritage Tourism in Jaffna397
Peninsula: Sri Lanka
S. Kalimuththu, Nalin Abeysekara, L.P.S. Gamini

Major Determinants of Intend to Leave among Operational401
Level Employees in a Manufacturing Facility
V. Sivalogathan, N.A. Mudannayake

LIFE SCIENCES

Rice Varieties Suitable for Machine Transplanting in Rajanganaya.407
R.M.U.S. Bandara, Y.M.S.H.I.U. De Silva, H.M.M.K.K.H. Dissanayaka

Neutral Theory and Species-Area Relationship in Tropical Forests411
J.A.A.P. Jayasooriya, I.A.U.N. Gunatilleke, C.V.S. Gunatilleke, P.M.S.A. Ruwan

Effect of Crude Methanolic Extracts of Emblica officinalis on415
Cholesterol Induced Wistar Albino Rats (Mus norvegicus albinus)
D.M.L.C. Dissanayaka, S.R. Weerakoon, S. Somaratne,
N. Nilakarawasam, C. Ranasinghe

Evaluation of Growth and Yield Performance of Selected Lines of Yard419
Long Bean (Vigna unguiculata sub spp. Sesquipedalis) during Off
Season in Mid Country Wet Zone
T.W.G.F.A. Nijamdeen, P.K.J.de Mel, P. Malathy

- Prevalence and Bionomics of Anopheles Species in a Gem Mining Area in 425*
Moneragala District of Sri Lanka
H. M. P. Hewavitharane, G. R. Ranawaka, M. D. J. S. Saparamadu, R. G. Premaratne, H. T. R. Jayasooriya
- Preliminary Study on Impact of Induced Temperature and Water Stress on Yield . 429*
Parameters of Tissue Cultured Ananas comosus (Pineapple) – Variety Kew
K.I.C. Amarasinghe, P.T.N. Dishani, C.S . De Silva, L.K.R.R.Jayakody
- Comparative Study of Growth Performance of F1 and F2 Rice Hybrids 435*
Cultivars in Sri Lanka
W.S. Priyantha, D.D. Witharana, R.P.D.H. Hemachandra, D.M.O.K.B. Dissanayake
- Impact of Excessive Use of Phosphorus Fertilizer on Soils in the 439*
Central Highlands of Sri Lanka and Possible Health Hazards
Partlee Samarakody, C.S . De Silva
- Farmer’s Perception on Climate Change and Coping Strategies; 445*
A Case Study in Major Irrigation Schemes of Puttlam District
P.T.N. Dishani, C.S. de Silva
- Investigation on Farmer Level Problems for Low Productivity 451*
of Paddy Cultivation in Mahagirilla Agrarian Services Division in Sri Lanka
W.B.O.N. Kumari, D.N. Sirisena, C.S. De Silva
- The Potential of Applying Green Technology for the Open University 455*
of Sri Lanka
G.H.U. Jinendri, B.S.G. Chandrasekera
- Computational Studies on Inhibition of Histone Deacetylation by 461*
Hydroxamic Acid Derivatives: An In-Silico Approach
R. Dushanan, G.R. Ranawaka, S. Weerasinghe, R. Senthilnithy
- Effect of Different Irrigation Methods and Mulches on Leaf Curl 465*
Complex Attack in Chilli in Jaffna District of Sri Lanka
P. Maheswaren, C.S. de Silva, T. Karunainathan

Growth and Yield Performance of Newly Introduced Chilli471
Variety (Capsicum annum L. var. MI 1) Grown under Basin
Irrigation System in Jaffna District of Sri Lanka
Ahilan Krishanpillai, C.S. de Silva

Roles of Different Nearly Neutral Models in Maintaining Species477
Coexistence of Tropical Forests
T.L.M. Ruberu, I.A.U.N. Gunatilleke, C.V.S. Gunatilleke,
R. Punchi-Manage

Neutral Theory and Species Abundance Distribution in Sinharaja481
Tropical Forest
R.S.S. Chandrasena, I.A.U.N. Gunatilleke, C.V.S. Gunatilleke,
P.M.S.A. Ruwan

Mapping and Functional Validation of a Quantitative Trait Loci485
(QTL) For Salt Tolerance in a Sri Lankan Rice Cultivar
B.P. Abhayawickrama, D.R. Gimhani, N.S. Kottearachchi

Reproductive Biology of Dacus persicus (Aak Fruit Fly):489
A Pest of Calotropis gigantea in Sri Lanka
S. Wijeweera, K. De Silva

A Preliminary Survey on Drinking Water Availability during 2017 –493
Flash Floods in Diyagama, Kalutara District of Sri Lanka
K.G.R. Madubashini, B.S.G. Chandrasekera

Preliminary Study on Biomass Mapping along the Coastal Zone497
of Hambantota Region, Sri Lanka Using Landsat Imagery
J. E. Dellysse, B. D. Madurapperuma, K. A. J. M. Kuruppuarachchi

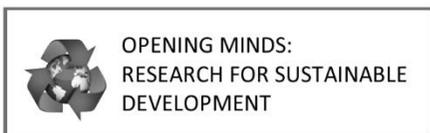
PHYSICAL SCIENCES

Fabrication of Sodium Ion Rechargeable Battery Using Earth Abundant501
Orthosilicates. T.N. Alahakoon, V.P.S. Perera, N. G. S. Shantha,
C.H. Manathunga

Spatial Patterns of Trees in the Sinharaja Forest in Sri Lanka505
Lakmali Ariyasena, Uthpala Ekanayake, Nimal Gunatilleke,
Savitri Gunatilleke, Ruwan Punchi-Manage

<i>Sea Level Variability in the East Coast of Male, Maldives.....</i>	509
<i>K.W. Indika, E.M.S. Wijerathne, G.W.A.R. Fernando, S.S.L. Hettiarachchi</i>	
<i>Investigation of Applicability of Banana Pith as Electrolytic Media for Bio- Batteries</i>	515
<i>C.N. Nupearachchi, G.C. Wickramasinghe, V.P.S. Perera</i>	
<i>Nano Structures of Tin (iv) Oxide Coated with Thin Layer of Silica</i>	519
<i>Using Silicic Acid Synthesised from Rice Husk Ash</i>	
<i>N.F. Ajward, J.C.N. Rajendra, V.P.S. Perera</i>	
<i>Construction of Dye Sensitized Solar Cell Using Natural Dye</i>	523
<i>Extraction from Petals of Erabadu Flower</i>	
<i>G. C. Wickramasinghe, D.L.N. Jayathilaka, V.P.S. Perera</i>	
<i>Challenges of Space Debris and Site Selection Criteria to Install</i>	527
<i>Optical Telescope to Observe Space Debris in Sri Lanka</i>	
<i>T. Chandana Peiris</i>	
<i>Identifying Factors that Affect for the Job Satisfaction of Banking</i>	533
<i>Employees in Sri Lanka</i>	
<i>S. Sankalpa, U. Ekanayake, Ruwan Punchi-Manage</i>	
<i>Temporal Patterns Analysis of Paddy Production in Sri Lanka.....</i>	539
<i>N.B.W.I. Udeshika, T.M.J.A. Cooray</i>	
<i>Application of Classical Time Series Decomposition Method and</i>	545
<i>Wavelet Decomposition Method to Predict the Monthly Temperature in Sri Lanka</i>	
<i>S. Basnayake, Ruwan Punchi-Manage</i>	
<i>Identifying Factors that Affect the Downtime of a Production</i>	551
<i>Process</i>	
<i>W. Nallaperuma, U. Ekanayake, Ruwan Punchi-Manage</i>	

OPEN DISTANCE LEARNING (ODL)



The Bachelor of Education (Drama and Theatre) Programme Conducted Through the Distance Mode: Problems and Solutions

G.D. Lekamge^{1*}, A.I. Irugalbandara¹, K. P. R. Jayawardena¹, M. N. C. Fernando¹, S. Kugamoorthy¹ and B.G.H. Anuruddhika²

¹*Department of Secondary and Tertiary Education, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of Special Needs Education, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

**Corresponding author: Email: gdlek@ou.ac.lk*

1 INTRODUCTION

Good education system demands good teachers. The importance of teachers in determining quality of education is emphasized by many international reports (UNICEF, 1999; UNESCO, 2015) and education and training of teachers was identified as one of the indicators of the quality of a school system by European Commission in 2000. Further, evidence from research suggest that teachers who are more prepared for teaching are more confident and successful with pupils than those who have little preparation (Moon and Robinson, 2003). The empirical evidence about the outcomes of different approaches to teacher preparation and recruitment also suggests that “the extent and quality of teacher education and preparation influences teacher - effectiveness” (Moon and Robinson, 2003). On the contrary, when teachers’ own education and training is limited, “they lack the confidence, knowledge and skills to teach much more than they were themselves taught, or to teach in a different way” (Perraton, 1993). As a result, training of teachers has been among the top priorities of many developed as well as developing countries during the past few decades.

As estimated by UNESCO (2016)

Institute for Statistics, about 69 million teachers must be recruited to achieve universal primary and secondary education by 2030. In order to cope with such massive demands, many countries have introduced distance education for initial training. However, in some initial teacher training programmes, the emphasis placed on subject knowledge, professional studies and practice differs from one programme to the other and they have been criticized for weak integration of theory and practice and poor quality and inadequate time for school practice (Moon and Robinson, 2003). Further, Robinson (1997) concluded “Not all courses worked well or provided good quality though enough have to demonstrate the capacity of distance education for training and educating teachers and for enabling new models of training to be explored”. Therefore, it is a questionable whether those teacher training programmes have been capable in producing quality teachers to the education system.

The Open University of Sri Lanka is a pioneering institution to conduct teacher education programmes through distance mode. It had introduced an innovative teacher education programme in Drama



and Theatre through distance mode to prospective teachers in Sri Lanka in 2009. The levels three and four of the programme are conducted by the Tower Hall Theatre Foundation under the guidance of the University with a view to develop pedagogical knowledge and skills related to drama and theatre. The Faculty of Education is responsible for developing the professional competencies related to teaching of drama and theatre at levels 5 and 6. Three batches of student teachers (102) had been passed out from the University so far and two batches of students (50) are continuing the programme. The Faculty witnessed critical problems in the professional standards and moral conduct of the student teachers who had completed the programme and joined teaching profession that needed immediate attention and proper action of the Faculty. This paper analyses the experience and concerns of teachers and student teachers revealed through focus group discussions, observations and self-reflections which had provided the basis for identification of critical problems faced and fruitful interventions to be executed in the future to improve the quality of teachers produced to the school system.

2 METHODOLOGY

This paper focuses on three objectives formulated in relation to a large scale study:

1. To analyze the perceptions of student teachers and internal academics on the curriculum, instructional material, instructional process of the programme (including assessments and teaching practice) and the quality of graduates produced
2. To identify the problems and issues that would hinder the attainment of the expected outcomes of the programme
3. To make recommendations as solutions to the existing problems and issues identified

The three batches of students who had completed the programme, two batches who have been following the programme (total 134), 10 lecturers who have been playing different roles as day school academics, tutors and master teachers had been considered as the sample of the study.

Multiple methods have been used for data collection to facilitate triangulation of data. They included focused group discussions with student teachers, questionnaires filled by student teachers and lecturers, observations and reflective notes of master teachers about the performance of student teachers in teaching practice. Mean analyses were used to analyze quantitative data and content and thematic analyses were used for the analyses of qualitative data.

3 RESULTS AND DISCUSSION

The focus group discussions took place among internal academics (10) who have been involved in the implementation of the programme revealed some positive and negative viewpoints on the curriculum, instructional material and instructional processes adopted. In relation to the curriculum of the programme, both categories agreed that a good combination of theory and practice has been incorporated within the limits of a distance programme. The academics emphasized the positive contribution of courses such as Educational Psychology, Education Technology and Principles of Education whereas student teachers highlighted Inclusive Education and Guidance and Counseling as the most relevant subjects for their teaching. Further, they wanted IT and English also to be incorporated in to the curriculum and expected more focus on drama and theatre courses at level 5 and 6.

With regard to lesson material, the relevance, user friendliness and readability had come out as outstanding



features. However, all the categories had pointed out the necessity of updating their contents and incorporating the recent developments in the field. Further, student teachers preferred more illustrations and elaborations and simplified versions of the modules. The academics had given a very high rating for the instructional processes followed by them and introduced the day schools as a very good platform for maintaining a friendly humane interaction with student teachers and building their self-confidence and self-regulatory behavior. Academics have expressed a positive opinion on student teachers' participation in group activities and participation in discussions (mean 4.2 and 3.9 respectively) though their attendance and punctuality had received a negative opinion (Table 1).

Table 1: Opinion of Academics on Student Teachers' Participation in the Day Schools

Aspects	Mean value
Punctuality in day schools	2.0
Attendance in day schools	3.0
Giving prompt answers	3.2
Asking questions	3.4
Readiness for day schools	3.5
Paying attention to teacher	3.5
Participation in discussions	3.9
Participation in group activities	4.2

Student teachers requested more day schools through which they would be able to maintain close interaction with staff members and gain new knowledge and skills. This shows student teachers' reluctance to accept modules as their teachers and inability to be physically apart from their teachers. All students had the opinion that the time allocated for teaching practice was not sufficient and their progress would be more satisfactory if internal academics (rather than master teachers) would provide supervision during teaching practice. Academics also

supported for expansion of TP period so as to provide more opportunities for student teachers to interact with exemplary models and develop professional skills related to TL process.

Teaching Practice as a specific strategy incorporated in to the programme has been contributing significantly for the professional development of student teachers though the necessity for further strengthening it to meet the requirements of the programme was highlighted by all categories. However, internal academics and student teachers had contradictory views on the quality of teachers produced. According to academics, the "actors role" emphasized at level 3 and 4 overshadowed their "teaching role" and hindered the accomplishment of professional standards of a teacher. However, student teachers expressed their confidence about their performance during Teaching practice period and assured that they could have done better if more time for TP and support from the institution and schools were provided. The following are some open-ended answers given by the student teachers at the focus group discussions.

'We are new to schools and new to teaching. So training should be gradually done to give the full responsibility at the end. We need to have a transition period'.

'Teaching Practice time is not sufficient. We need more time to familiarize with the school environment'.

'We need a longer period to adjust to school. Need opportunities to be familiarize with the school set up'.

'More model teaching should be provided and TP to be continued from level 5'.

As solutions to the problems in the curriculum, academics suggested to



introduced a course on “Introduction to Teaching Profession” and Optional courses on “Methods of Teaching Dancing” / “Methods of Teaching Art” “Methods of Teaching Music” etc. Student teachers needed integration education courses at level 3 and 4 and drama and theatre courses at level 5 and 6 and opportunity to study English and ICT at the Open University. Revisions of materials to incorporate new knowledge as well as illustrations and AV components came out as solutions from both parties. Increasing interactive sessions with senior academics who are familiar with innovative and challenging teaching-learning methods and techniques making interactive sessions compulsory would further facilitate the empowerment of professional capabilities of student teachers.

The need for developing a supportive culture in the prospective schools for student teachers with the support of school mentors while extending the teaching practice period has emerged as one of the main priorities of the programme. Further, the transference of actor’s role to teacher’s role to be done very smoothly in a systemic manner so that it would not have much interference to their self -esteem, self -confidence and professional conduct.

4 CONCLUSIONS AND RECOMMENDATIONS

Both academics and prospective teachers have requested for a balanced, integrated curriculum with a blend of education and drama and theatre courses. The purpose of using lesson material is lost as prospective teachers prefer day schools to self - learning material. Further, a good combination of human contact and technology is required to improve professional capabilities of prospective

teachers. The length of the TP period to be expanded in order to provide more opportunities to practice what they have learned under the close supervision of a school mentor and more emphasis should be placed on the teachers’ role rather than actors’ role. Finally the study shows the need for developing a framework to assure standards of teachers produced through different training programmes.

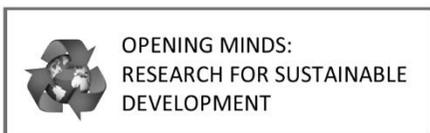
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Access and Use of Electronic Technologies by Undergraduates of the Faculty of Health Sciences

B. G. Jayatileke^{1*}, G. G. W. C. Wijesekara² and G. R. Ranawaka²

¹Centre for Educational Technology and Media, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Faculty of Health Sciences, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: bgjay@ou.ac.lk

1 INTRODUCTION

With the advent of various technologies, The Open University of Sri Lanka (OUSL), as an institution offering instructions through Open and Distance Learning (ODL), has gone through generations of technology integrating audio-visual, multimedia and online learning into the core printed course materials. However, print has remained the core medium of instruction even though many initiatives have been taken to promote offering courses online. It is assumed that one of the main limiting factors is the access to these electronic technologies (e-technologies) by all students; remote students in particular.

According to the World Development Report (2016), more than 40 percent of the world's population has access to the internet, with new users joining every day. Among the poorest 20 percent of households, nearly 7 out of 10 have a mobile phone. The poorest households are more likely to have access to mobile phones than to clean water.

When considering new technologies for learning, student demographics, access to technologies and differences in how students learn from these technologies are the key factors that must be considered when selecting technologies (Bates, 2015). Access is perhaps the most

discriminating criteria among student related factors. If students do not have access to mediated technologies at the right time of the delivery to learn their subjects, the overall outcome would be ineffective even if the course materials are up to the required standards.

Therefore, the purpose of this research study was to find out the availability of electronic technologies (e-technologies) such as desktop/laptop computers and smart phones among the undergraduates of the Faculty of Health Sciences and how they use these e-technologies for learning. We expect the findings to provide some insights into the actual use of e-technologies among the undergraduates of the Faculty and will provide evidence to inform decision makers on the use of e-technologies by OUSL students considering this study as an indicative study.

1.1 RESEARCH QUESTIONS

The following research questions were investigated in this study:

- What types of e-technologies are accessible to the undergraduates of the Faculty of Health Sciences?
- What types of e-technologies do undergraduates use in their learning process?



- What types of e-technologies do they prefer to use in their learning process?

2 METHODOLOGY

The research design used in this study was an exploratory study based on survey research. Data were collected using a specially designed questionnaire to investigate the access and use of e-technologies by the undergraduates of the Faculty of Health Sciences. The survey sample consisted of 3162 students who were following the degrees programmes of Nursing (2674), Pharmacy (266) and Medical Laboratory Sciences - MLS (222). The questionnaire was administered at the end of the contact sessions such as day schools, continuous assessment tests and practical classes. Questionnaires from the nursing undergraduates were collected from all OUSL Regional Centres and for the other two programmes, questionnaires were collected only from the Colombo Regional Centre (CRC) as these two

programmes are delivered only at the CRC. Data were analysed using the SPSS software package and the frequencies, percentages and cross tabs were used in the quantitative data analysis. Content analysis was used to analyse the responses to the open ended questions in the questionnaire.

3 RESULTS AND DISCUSSION

3.1 Response Rate

We received 1680 (53.13%) responses for the study - Nursing: 1474 (55.12%); MLS 84 (37.84%); Pharmacy 122 (45.86%). The nursing sample was representative of students across the eight Regional Centres (Colombo 46%; Kandy 24%; Matara 12%, Anuradhapura 7%, Batticaloa 5%, Jaffna 4%, Badulla 2% and Kurunegala 1%).

3.2 Demographics of the sample

The demographics of the sample are illustrated in Table 1.

Table 1: Demographics of the participants from the three degree programme

		Nursing	Pharmacy	MLS
Gender	Male	09%	54%	52%
	Female	91%	46%	48%
Civil Status	Single	34%	26%	26%
	Married	66%	74%	74%
Employment	Full-time	98%	96%	100%
	Part-time	02%	03%	-
	No	-	01%	-
Ethnicity	Sinhala	91%	89%	93%
	Tamil	08%	10%	06%
	Moor/Malay	01%	02%	01%
Age	<24	01%	-	-
	25-29	30%	05%	01%
	30-34	50%	50%	46%
	35-39	14%	21%	21%
	40-44	04%	08%	18%
	45-49	02%	07%	06%
	>50	01%	09%	07%



Female participants were predominantly higher in the BSc Nursing degree programme (91%) while a higher male participation was observed in the Pharmacy (54%) and MLS (52%) degree programmes. When comparing the other demographics, a similar pattern was observed across all three degree programmes; almost all were employed, majority were married, belonging to the Sinhala ethnic group, and representing almost all the age groups; approximately 50% belonged to the 30-34 age group. The majority undergraduates of the Pharmacy (32%) and MLS (28%) were from the Colombo district. Among the Nursing respondents, majority were from Kandy district (16%), with 10% from Colombo.

3.3 Access to e-technologies

Findings (Figure 1) indicated that a majority of students (89%) from the total sample either own or have regular access, either to a laptop or a desktop computer. A majority (75%) have their own smart phone at present. Access to the internet was 90% and to a CD/DVD drive was 64%. Cross-tabulation indicated that among 10% who did not have the access to both internet and the CD/DVD, were representing 17 districts; 10% each from Kandy, Matara, and Galle, 8% each from Jaffna, Ratnapura, Hambantota, and Gampaha, 6% from Moneragala, Kurunagala, and Colombo, 4% each from Badulla, and Kalutara, and 2% each from Ampara, Anuradhapura, Kegalle, Matale and Polonnaruwa.

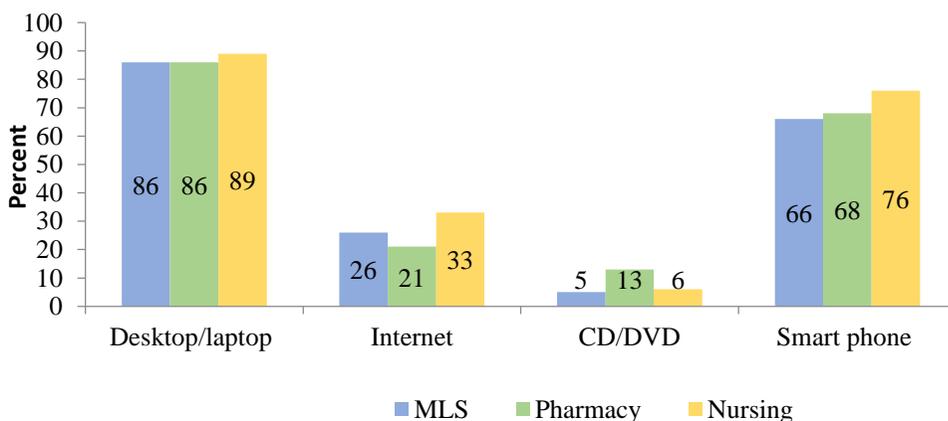


Figure 1: Access to e-technologies by the undergraduates of the Faculty of Health Sciences

3.4 Usage of e-technologies for learning

A majority of the undergraduates (58%) were familiar or confident in using the software package MS Word, while a comparatively lower percentage said they were familiar or confident in using spread sheets (34%), databases (22%) or graphic tools (11%), perhaps because these packages are rarely needed in their work

or study programmes. Among the undergraduates, only 6% said they had no knowledge of using email.

A majority of students had used one or more types of e-technologies for learning (68% Nursing, 79% Pharmacy and 83% MLS); a considerable percentage (42%) has used a Tablet computer for learning,

though 20% said they had not even heard of this device. Even though 75% stated that they have a smart phone, their usage of online courses was comparatively low (15%). This may be that they still use smart phones only for communication rather than for study purposes.

Most of the undergraduates (66%) said they used computers for study purposes from home (70% Nursing, 36% Pharmacy and 52% MLS) while some concurrently accessed from home and office (22% Nursing, 46% Pharmacy and 38% MLS). Findings also revealed that 40% tended to use the computer several times per week and 12% used every day for studies. Out of the daily users of the nursing students, 87% were females, married (65%) and 44% were in the 30-34 age group while 30% were in the 25-29 age group. In contrast, approximately 13% rarely or never used a computer while a minority had never used a computer. Cross-tabulation of computer access with their usage of online courses indicated that 8% of the respondents had never followed online courses even though they had the access.

3.5 Preferred for learning

Among the e-technologies, the most preferred were desktop/laptop computers (MLS 31%, Pharmacy 28% and Nursing 15%) and online (Pharmacy 26%; Nursing 17%, MLS 15%) and the least preferred was through a CD/DVD (Nursing 06%; Pharmacy 05% and MLS 01%). However, still the most preferred choice to learn OUSL courses was through printed material (Nursing 61%, Pharmacy 41% and MLS 53%).

When students were questioned about their willingness to receive the course materials as electronic versions (in PDF format) rather than printed course materials, a majority indicated their willingness (73% Pharmacy, 68% MLS, 58% Nursing). However, still a considerable percentage was reluctant to

study using electronic versions (42% Nursing, 32% MLS, 27% Pharmacy students).

Categorisation of the responses to the open ended questions in the questionnaire through content analysis showed portability, access from anywhere and at anytime, immediacy, easy to get the updates, clarity of the graphics, easy to read, easy to share among colleagues, as an alternative to overcome the delay in getting printed course materials were some of the positive reasons for their willingness to study through Tablet computers. Contrastingly, non-accessibility to computer/internet, non-familiarity with the technology, lack of technical support, more comfortable in using printed material, ease of reading, making notes and highlighting, health issues like eye strain, difficulty in using the monitor for a long time, lack of time in engaging online activities were reasons in favour of preference for printed materials over e-materials.

The most preferred format to receive the electronic version of the course material was through MyOUSL (40%), next, through the departmental webpage (23% for both MLS and Pharmacy, 12% for Nursing), and then through laptops/Tablets (16%). In contrast, the least preferred format was to receive it through online courses (5% MLS, 10% Pharmacy and 14% Nursing) implying the low popularity of online courses among the undergraduates in the Faculty of Health Sciences.

This may be due to the fact that either online courses were not available for their courses, or they have not seen the value of participating in interactive online courses or they were more comfortable in downloading the learning resources from MyOUSL/departmental web page for studying at a later stage as they engage in highly demanding professions.



4 CONCLUSIONS AND RECOMMENDATIONS

Findings of this study showed that a majority of the students have access to either a desktop, laptop, or a smart phone. However, still a considerable percentage (10%) does not have access to a computer with an internet connection, which includes students living in remote areas. Thus the OUSL needs to consider this issue when integrating e-technologies to learning. Even though a majority indicated their willingness to study through electronic versions, print was still the most preferred medium for study. Therefore, findings of this study could be used as an indicative study with respect to integration of e-technologies and need further exploration on the usage of e-technologies among undergraduates across all the Faculties which in turn will facilitate in taking a policy decision with respect to providing e-resources as core materials to OUSL learners.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Student Perceptions on Open and Distance Learning (ODL) Services; With Special Reference to the Open University of Sri Lanka

A.U.B.Rajaguru^{1*} and Nalin Abeysekera²

¹*Department Electrical and Computer Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of Management, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

**Corresponding author: Email: auraj@ou.ac.lk*

1 INTRODUCTION

Universities are in the business of providing higher education, and so it is to be expected that the students' classroom experience is a primary determinant of student satisfaction. Contact with fellow students, course content, equipment and stocking of libraries, teaching quality and the supply of teaching/learning materials and contact with staff (both teaching and non-teaching staff) are some of the factors that determine student satisfaction in Open and Distance Learning. A study in the USA found that students' perceptions of institutional ability to provide a good intellectual environment positively affects their level of satisfaction (Hartman and Schmidt, 1995). It can be seen in some studies done on Student Perceptions in the context of the Open University of Sri Lanka. Ranasinghe and Ranasinghe (2012) revealed that both the undergraduate and postgraduate students in the sample had a positive attitude towards learning English. Furthermore Abeykoon and Alwis (2016) in their study on management students at the Open University of Sri Lanka concluded that institutions are required to pay attention to factors such as quality of pedagogy, learner support, technological and even infrastructure as measure of meeting students' quality expectations. In a study

Ariadurai and Manohanthan, (2008) emphasized the need of enhanced learner support. In the same study they have observed that all OUSL academic and administrative staff should strive to provide a more proactive and supportive learning environment for its students. It is necessary to include follow up studies to analyse the persistence of students with their academic pursuits with enhanced facilities and support services. This study attempts to focus on Engineering Students' perception on "student support services" offered by the Open University of Sri Lanka

It is expected that this study would provide a better understanding of engineering students' perceptions on ODL services offered by the Open University of Sri Lanka. This will provide an insight into the problems faced by ODL learners in relation to the engineering programmes conducted at the Open University of Sri Lanka.

2 METHODOLOGY

The quantitative survey utilized a questionnaire based on earlier research (Wilkins and Balakrishnan, 2011) which consisted of 50 items sub grouped to 11



items based in relation to student perceptions, experience or satisfaction on Program, a five point likert scale (strongly disagree – 1 to strongly agree - 5) on Quality and availability of Study Materials ,the lecture room, IT facilities, laboratory Facilities, services offered by the Institution, quality of instruction received, the duration of interaction with the instructors, feedback received on assignments and examinations, recreational facilities and social life,

student support services provided by the Open University and the challenges faced while learning at OUSL.

The study focused on the expectations and perceptions of ODL students learning at the Faculty of Engineering Technology.250 students were selected using the simple random sampling method, out of which 91 current students at Colombo Regional Center responded. Descriptive analysis of mean and standard deviation were evaluated to obtain results.

Table 1: Services offered by the Institution

		mean	SD	overall Mean	Overall SD
1. Program flexibility, relevance and intellectuality	I have flexibility in selecting the courses	3.51	1.23	3.08	0.95
	My course is relevant to my intended future employment	3.59	1.2		
	My course is intellectually stimulating	3.26	0.84		
2. Quality and availability of Study Materials	The course materials satisfy my learning needs	2.77	1.27		
	Course material understandable and clear	2.73	0.99		
	Appropriate supplementary materials available	2.67	1.12		
	the recommended texts available in the library	3.47	1		
	Technology is used to provide learning resources	3.35	1.21		
3. The lecture room	The lecture rooms have good level of cleanliness	3.21	1.1		
	The lecture rooms have good level of furnishing	3.13	1.08		
	The lecture rooms have good level of lighting	3.18	1.11		
	All lecture rooms have good audio-visual facilities	2.81	1.15		
4. The IT Facilities.	I can always find a computer to work when needed	2.27	1.17		
	Provision of internet facilities is satisfactory	2.77	1.26		
	I use ICT for research and to present my work	3.41	0.98		
5. The laboratory	Laboratory equipment available for the lab	3.24	1.2		
	Facilities at laboratories are satisfactory	3.15	1.2		



3 RESULTS AND DISCUSSION

According to Table One, students are satisfied with program flexibility,

relevance and intellectuality as well as with the laboratory facilities. A segment of the students are of the view that the course materials do not satisfy their learning needs and IT facilities.

Table 2: The quality of instruction you receive

		mean	SD	overall Mean	Overall SD
How do you rate the quality of instruction you receive?	My lecturers make the subjects interesting	2.82	1.19	3.06	1.02
	My lecturers are experts in their fields	3.31	1.02		
	My lecturers use language that I understand	3.3	1.08		
	My lecturers use technology well in their teaching	3.22	1.11		
Is the time of interaction with the instructors adequate?	I have as much contact with my lecturers	2.53	0.73		
	My lecturers are sympathetic if I have problems	2.96	1.14		
	I use email /SMS to interact with teachers	3.05	1.17		
	Use of LMS provide easy interaction with teachers	3.32	1.19		
How often do you receive feedback on assignment and Examinations	Modules are assessed using a variety of methods	3.03	1		
	timetable is organized in a convenient way	3.02	1.01		
	I receive detailed and helpful feedback	2.84	1.09		
	I receive prompt feedback on performance	3.02	0.97		
	I receive prompt feedback on practical classes	3.19	1.1		
	Grades /marks I obtain are consistent with the effort I put into coursework/examinations	3.32	1.17		

Students perceive quality of instruction as comparatively satisfactory and this can be seen as same in receiving feedback on

assignment and Examinations. Nevertheless the time of interaction with the instructors is rated as not adequate.

Table 3: Recreational facilities and social life

		mean	SD	overall Mean	Overall SD
Facilities and social life	My campus has a good range of facilities, e.g. a refectory, sports and leisure provision	2.43	1.3	2.54	0.93
	University has lots of societies for students	2.38	1.12		
	A lot of leisure activities and entertainment are provided for students	2.26	1.16		
	There is a lively social scene on campus	2.51	1.21		
	My university provides accommodation for students	3.05	1.19		



Table 4: Student support services provided by the Open University

		mean	SD	overall Mean	Overall SD
Student support services	Effective institutional network of technical assistance	3.41	1.16	3.30	0.91
	Administrative staff respond efficiently	3.31	1.1		
	University offers a good career guidance and internships service	3.18	1.21		

Table 5: The challenges faced in learning at OUSL

		mean	SD	overall Mean	Overall SD
What are the challenges that you face in learning at OUSL	Volume of study material for the subject appropriate	2.96	1.27	3.12	1.85
	Distance from home to the regional centre	3.27	1.13		
	Attending face to face classes	3.18	1.04		
	Attending Laboratory practical classes	3.22	1.06		
	Working environment conducive to study	2.98	1.1		
	Difficulties in learning technically demanding material	3.1	1.18		
	Lack of experience and/or training with instructional	3.04	1		
	Financial constraints	3.05	1.09		
	Lack of support from family, employer, friends etc.	3.14	1.31		
	Unfavourable home learning environment	3.16	1.17		
	Conflicts between family /Work and study schedule	3.21	1.16		

Table 6: responses by the students

	Overall mean	Overall SD
Services offered by the Institution	3.08	0.95
The quality of instruction you receive	3.06	1.02
Recreational facilities and social life	2.54	0.93
Student support services provided by the Open University	3.30	0.91
The challenges faced in learning at OUSL	3.12	1.85

Students are satisfied with the accommodation provided, but not satisfied with refectory, sports facilities, leisure activities, entertainment, clubs and societies for students. Students perceive that institutional network of technical

assistance and response from administrative staff is satisfactory. But this is not in the case for career guidance and internship services. Table 5 shows that distance to regional centre, attending classes, lack of support from family,



employer, and friends etc., conflicts between family/work and study schedule, learning environment are perceived as major impediments in Open and Distance learning. This is aligned with the research done by Simpson (2012) which discuss two most important sources of support to students apart from the institution for

4 CONCLUSIONS AND RECOMMENDATIONS

It can be seen that Recreational facilities and social life, the quality of instruction received, services offered by the Institution and the challenges faced in learning at OUSL are at an average level and need improvement. Student support services provided by the Open University (3.30) is in the highest category. Anyway

success in Open and Distance learning. One source of support is from families and friends who could give enhanced organizational and motivational support. The second source of support is from other students forming self-help groups and student mentoring (Table 6).

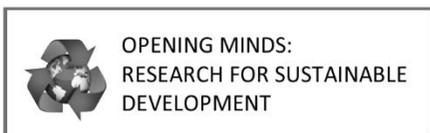
it can be argued that there should be improvement in terms of all sections to achieve sustainable competitive advantage.

It can be recommended having interaction with students in terms of association through societies and welfare activities to understand their needs, wants and expectations. Furthermore continuous studies on student expectations are vital in this challenging environment.

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L.R. Gonsalkorale* and M.L. Sudarshana

*Department of Secondary and Tertiary Education, The Open University of Sri Lanka,
Nugegoda, Sri Lanka*

**Corresponding author: Email: lrgon@ou.ac.lk*

1 INTRODUCTION

The Department of Secondary and Tertiary Education of the Faculty of Education of the Open University of Sri Lanka (OUSL) is planning to introduce online activities/courses for their major programme, the Postgraduate Diploma in Education (PGDE) from the academic year 2018/2019. The conversions of traditional face-to-face courses to online courses has come about due to the rapid expansion and development in the ICT. Nguyen (2015) has said that the physical “brick and mortar” classroom is starting to lose its monopoly as the place of learning. According to Sudarshana (2014), the world has become a global village with the ICT and Education has to move forward with the ICT. Therefore, the trend in the world today is the shift to online learning from the conventional face-to-face learning. Although the department is going to follow suit, it was felt that the department should become aware of whether the student teachers of the PGDE programme are ready to follow online courses and to do online activities before launching online courses/activities. In that sense, it was felt that trying to find out whether they have learning practices that are helpful in following online courses or doing online activities would be useful to the department. Similarly it is a fact that good communication skills of English and particularly skills with the ICT knowledge

would be helpful in online usage for learning. The statistics of the use of computers in Sri Lanka and the computer literacy of the Sri Lankan public was presented in the Computer Literacy Statistics (2016) survey. The survey results reveal that 8.6 percent of the household population aged 5 – 69 years has used E-mail facility at least once during the last 12 months period. The highest e-mail usage is reported from the Colombo district (19.2%) followed by Gampaha (12.6%). The lowest e-mail usage among the districts was reported from the Anuradhapura district. However, the student teachers of the PGDE programme who are graduates of various disciplines can be expected to have a satisfactory level of computer literacy although there are no research findings to prove it. Catalano (2015) identified communication as one of the elements for better online learning. Therefore the necessity was felt to find out the situation of the Sri Lankan graduate teachers with regard to the aspects stated above towards online learning.

1.1 Objectives

- 1 Identify the existing learning practices of teachers which would be conducive to online learning.

- 2 Find the communication skills of teachers which would be conducive to online learning.
- 3 Identify the shortcomings of learning practices and communication skills of teachers with regard to online courses.
- 4 Make suggestions to further develop learning practices and communication skills of teachers with regard to online courses.

derived from the “online readiness questionnaire” developed by Williams (2010) and available under the Creative Commons license. Williams constructed the questionnaire in line with various attributes identified by several other researchers as components of ‘readiness’ and conducive for online learning. In the present study two major aspects out of those attributes, namely existing learning practices and communication skills were selected for investigation.

2 METHODOLOGY

2.1 Population and the Sample

The population of the study was the batch of PGDE students enrolled in the academic year 2017/2018, approximately 3000 student teachers. These students are attached to 8 Regional Centres (RC) and 27 study centres of the OUSL. For convenience, the student teachers sample was selected only from 6 RCs.

Therefore, the sample of student teachers was selected from the student teacher groups of two RCs, namely Matara and Kandy in addition to the four Study Centres (SC), namely Galle, Ampara, Bandarawela and Ambalantota using the technique of stratified random sampling. Thirty student teachers were selected from each centre and the final student teacher sample was 180. The sample was selected from the Sinhala medium student teachers only for the convenience of managing the study.

2.3 Data collection instruments

The major data collection instrument was a questionnaire. This questionnaire was

In addition to the questionnaire, a semi structured interview schedule was also used to collect additional data as well as to clarify data collected from the questionnaire from a small group of student teachers. Particularly, the interviewees were requested to provide suggestions to improve their learning practices and communication skills. The group interviewed consisted of three student teachers from each center selected on a convenient basis and the total number interviewed amounted to 18 student teachers (10% of the total sample).

Data obtained from the questionnaire and the interview was analyzed qualitatively using descriptive methods and also data collected from the questionnaire was analyzed quantitatively by using frequencies and percentages.

3 RESULTS AND DISCUSSION

Data was analyzed under two aspects, namely the student teachers’ existing learning practices and the student teachers’ communication skills. The first aspect consisted of 8 indicators and the second aspect consisted of 4.



Table 1: Student teachers’ existing learning practices conducive for online learning

Criteria	Good		Somewhat good		Not good		Not responded	
	No.	%	No.	%	No.	%	No.	%
Finish the projects started	125	69	46	26	3	2	6	3
Work keeping on track and on time	104	58	69	38	7	4	0	0
Ability to learn by hearing (Audio)	126	70	47	26	4	2	3	2
Read things and learn it best	114	64	60	33	6	3	0	0
Problem solving in a fair manner	113	63	61	34	6	3	0	0
Figure things out to learn well	110	61	64	35	3	2	3	2
Ignore distractions when studying	56	31	101	56	21	12	2	1
Planning activities in advance	113	62	52	29	12	7	3	2

(All the student teachers i.e, 180 of the sample responded to the questionnaire) According to the table, a majority of the student teachers are “Good” in all areas mentioned above except the criterion “ignore distractions when studying”. However, a considerable amount of student teachers were in “somewhat good” level (range of 26% to 56%). There were also some student teachers who were in “not good” level (range of 2% to 12%).

Table 2. Communication skills of the student teachers conducive for online learning

Criteria	Good		Somewhat good		Not good		Not responded	
	No.	%	No.	%	No.	%	No.	%
Learning successfully as a group (with proper communication)	144	80	33	18	0	0	3	2
Ability to communicate in English	60	34	79	44	26	14	15	8
Use e mail and other online tools (academic purposes)	90	50	60	33	27	15	3	2
Can contact somebody to solve computer related problems	99	55	59	33	16	9	6	3

According to the above table, majority of the student teachers are “Good” in selected communication criteria except “ability to communicate in English” criterion. It is clear that student teachers are capable of successfully learning with proper communication skills within the group (80%). With regard to communication in English majority were in the level of “somewhat good”. A considerable amount of student teachers

were in the level of “not good” except ‘learning successfully as a group’ (range of 9% to 15%). During the interviews five out of the eighteen student teachers revealed the difficulties of not having computers and other equipment and revealed that in their day-to-day working life they do not use e mail. Six of the interviewees mentioned the difficulties in working with the English language.

When particularly asked about what projects they have done during their studies and whether they have finished them, seventeen out of eighteen responded positively saying that they have completed all the projects of their

graduate studies. During the interviews the respondents were also asked to provide suggestions on what the University could do to improve their learning practices and communication skills in English.

4 CONCLUSIONS AND RECOMMENDATIONS

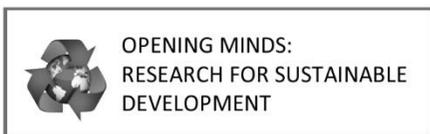
Majority of student teachers were good in their existing learning practices conducive for online learning and also in communication skills in English. But there were a considerable number of student teachers who responded as “not good” (range of 2% to 12%) for the existing learning practices so that it would be helpful both to the university and the student teachers who would be the prospective online learners of the teacher development courses in the future to take suitable steps to improve their learning practices. There were some who were “not good” in communication skills in English as well. These students need

proper coaching to improve their existing communication skills to follow online courses successfully. If possible at least some parts of the prospective online courses should be offered in the mother tongue. Assistance should be given to improve their English language skills. As many students are capable of successfully communicating within the group for learning purposes, online courses can be designed with more online group activities. Student teachers need to be motivated to use email and other communication tools so that students could be given such kind of activities within the online course.

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Dependence of Graduation Rate on Entry Qualifications in the B.Sc. Programme at the Open University of Sri Lanka: A Case Study

G. Bandarage*

Department of Chemistry, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: gband@ou.ac.lk*

1 INTRODUCTION

By definition an Open University offers flexibility in entry qualifications, choice of courses, pace and location of study and educational media methods. These features have made it a preferred tertiary educational option for adult learners. However, it is well known that the graduation rates of Open Universities are much lower than their conventional (face-to-face F2F) counterparts (Simpson, 2015). As such Open Universities must strive to improve academic performance of students leading to increased graduation rates.

The positive correlation between cognitive ability (reflected in entry qualifications of an academic programme) and the academic performance of a student is well established (Hopkins, 1998). However, there are number of other factors that determine the academic performance of distance learners. Learner characteristics including marital status, motivation and study habits have been highlighted (Kithinji, 2017, Logan, 2017).

In Sri Lanka, selections to degree programmes in public F2F Universities are conducted by the University Grants Commission. The minimum entry qualification is stipulated as three passes in the General Certificate of Education, Advanced Level Examination (GCE-A/L) obtained in one sitting (UGC, 2017). However, the minimum entry

qualification to the B.Sc. programme at the Open University of Sri Lanka is three passes in GCE-A/L obtained in any number of sittings (or an equivalent qualification). Students who do not have these qualifications may register in the Foundation in Science programme offered by the Open University and acquire equivalent qualifications. One may argue that a student who has obtained three passes in one sitting possesses a higher cognitive ability than one who has obtained three passes in multiple sittings. As such, in order to improve graduation rates, one may suggest the revision of the minimum entry qualification to the B.Sc. to be three GCE-A/L passes in one sitting. In this communication we examine the validity of this proposal with respect to the B.Sc. degree offered by the Faculty of Natural Science.

Defining a graduation rate in an academic programme in an Open University is not straightforward since students are allowed to work towards a degree for a long period time and some may not intend to complete (Nash, 2005). The most reliable estimate of rate of graduation may be the cumulative graduation rate (Simpson, 2015). However calculation of such rates requires reliable data collected over a long period of time which is not easily accessible as at present for the B.Sc. As such we have used a simple systems view (Moore, 1996, Jackson, 2003) of the B.Sc. in studying the problem at hand.



In systems studies one often uses steady state assumption (Wikipedia, Jackson, 2003). If a system has reached a steady state with respect to a variable, then that variable becomes constant in time. We study the B.Sc. using such a steady state assumption.

1.1 Research questions

1. How far is steady state assumption valid in studying the relationship between entrants and graduates of the BSc programme?
2. How do the graduation rates among cohorts of graduates with different entry qualification compare?

2 METHODOLOGY

The learners entering and graduates produced in the B.Sc. are categorised (represented by symbol α) into three;

Category 1 ($\alpha = 1$):

Three GCE-A/L passes in one sitting and no Foundation in Science qualifications.

Category 2 ($\alpha = 2$):

Three GCE-A/L passes in multiple sittings or equivalent qualifications (e.g. London A/L qualifications) but no Foundation in Science qualifications.

Category 3 ($\alpha = 3$):

Foundation in Science qualifications with or without GCE-A/L passes.



Figure 1: B.Sc. process model

Distance education may be viewed as a system with a set of connected processes (Moor, 1996). There we do not worry about the progress of individual students and concentrate on the macroscopic variables that describes the processes in the system. B.Sc. is a subsystem of the Open University. We represent the total number of entrants and graduates in the B.Sc. in category α ($= 1, 2$ or 3) in a particular year, y , by the variables $S_\alpha(y)$ and $G_\alpha(y)$, respectively; see Figure 1. Then the total number of learners entered and graduates produced in year y are given by,

$$S(y) = S_1(y) + S_2(y) + S_3(y)$$

And

$$G(y) = G_1(y) + G_2(y) + G_3(y),$$

respectively.

We assume that the B.Sc. subsystem is in steady state with respect to the percentage of entrants and the percentage of graduates in each category. In other words we assume that the percentages s_α and g_α in equations (1) and (2) are independent of the year, y .

$$100 \times S_\alpha(y) / S(y) = s_\alpha$$

$$\text{for } \alpha = 1, 2, 3 \dots \dots \dots (1)$$

$$100 \times G_\alpha(y) / G(y) = g_\alpha$$

$$\text{for } \alpha = 1, 2, 3 \dots \dots \dots (2)$$

We define the graduation rate, $R_\alpha(y)$ in each category, α in year y by

$$R_\alpha(y) = 100 \times G_\alpha(y) / S_\alpha(y)$$

$$\text{for } \alpha = 1, 2, 3 \dots \dots \dots (3)$$

By substituting in equation (3) from equations (1) and (2) you obtain



$$R_{\alpha}(y) = (g_{\alpha}/s_{\alpha})[100 \times G(y)/S(y)] = (g_{\alpha}/s_{\alpha})R(y) \quad \text{for } \alpha = 1, 2, 3 \dots \dots \dots (4)$$

Where $R(y) = 100 \times G(y)/S(y)$ is the overall graduation rate in year y . Thus the graduation rate in a category in any year, y , is equal to a constant factor (characteristic of the category) multiplied by the overall graduation rate.

We have studied s_{α} and g_{α} for three years. As shown in the next section their

values from one year to the other are close indicating the approximate validity of the steady state assumption. Using this fact we have obtained a better estimate of s_{α} and g_{α} , (denoted by \bar{s}_{α} and \bar{g}_{α}) by averaging them over the entrant and graduate populations over the three years. These average values were used in final calculations.

3 RESULTS AND DISCUSSION

We have studied the entrant populations in the B.Sc. in the academic years 2014, 2015 and 2016, and the graduate populations in years 2013, 2014 and 2015. The data were obtained from the Open University Management Information

System (OMIS). Relatively few entrants and graduates without entry qualifications in OMIS were omitted from the calculations. Table 1 summarizes the data we used in the calculations.

Table 1: Summary of data

Category α	Number of entrants, $S_{\alpha}(y)$			Number of graduates, $G_{\alpha}(y)$		
	$y = 2014$	$y = 2015$	$y = 2016$	$y = 2013$	$y = 2014$	$y = 2015$
1	817	756	1042	145	194	292
2	29	44	57	8	8	13
3	113	79	109	28	37	50
Total	959	879	1208	181	239	355

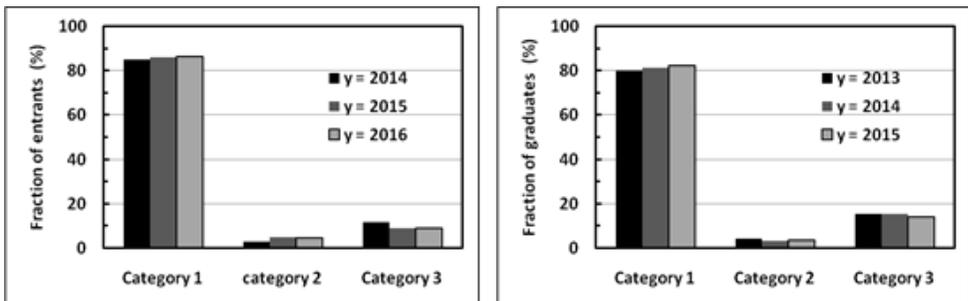


Figure 2: Percentages of entrants and graduates; $100 \times S_{\alpha}(y)/S(y)$ and $100 \times G_{\alpha}(y)/G(y)$.



Figure 2 shows the percentages of entrants and graduates as defined in equation (1) and (2).

It is observed that the largest percentage, 80% – 86%, of entrants as well as graduates is in category 1. Category 2 has the smallest percentage, 3% – 5%. It is important to observe that from year to year percentage of entrants in each category does not change much. The same is true with the graduates. These observations confirm the approximate validity of the steady state assumption we have made.

Table 2 indicates the graduation rate in each category calculated using equation (4) and using \bar{s}_α and \bar{g}_α in place of s_α and g_α .

Table 2 reveals that the graduation rates of students with 3 GCE-AL passes in one sitting and 3 passes in multiple sittings are the same. This is in agreement with the findings of Logan and Kithinji that with distance learners, factors other than cognitive ability are important in determining academic performance. This result indicates that one may not be able to increase graduation rate in the B.Sc. by not allowing registration to the students with three GCE-AL passes in multiple sittings.

Table 2 also indicates that the graduation rate is highest with students who have followed Foundation in Science courses which are offered through the distance mode. This is in agreement with the general observation that the academic performance can be higher with distance learners who have prior experience in distance learning.

With the available data, the validity of the steady state approximation could be verified over three years. Reliability of the results could be improved by performing the calculations over a larger number of years.

4 CONCLUSIONS AND RECOMMENDATIONS

Approximate validity of the steady state assumption for the percentages of entrants and graduates in three categories in the B.Sc. has been verified over three years.

The graduation rate is highest with the entrants who have followed the Foundation in Science courses.

The graduation rates among entrants with 3 GCE-AL passes in one sitting is the same as among entrants with 3 pass in multiple sittings. As such one may not observe an improvement in graduation rate in the B.Sc. by altering the entry qualification to require 3 GCE-AL passes in one sitting. Also, it is observed that the fraction of entrants with 3 passes in multiple sittings is very small. Hence, even in a case where the graduation rate among them is high, such entrants will not have a high impact on the overall graduation rate.

Acknowledgments

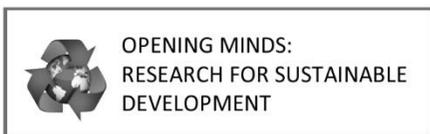
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Students' Perceptions of the Use of Discussion Forums in Learning English Literature

J.C.N. Pullenayegem*

Department of Language Studies, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: jcpul@ou.ac.lk*

I INTRODUCTION

Online discussion forums, the most commonly used tool in online environments, play a significant role in online teaching and learning. A primary reason for its wide use is its asynchronous nature that affords opportunity for learners to interact with peers and their tutor or facilitator and to share knowledge (Nandi *et al.*, 2009). Discussion forums (DFs) are said to promote collaboration and learner autonomy, to give opportunity for learners to reflect and research prior to responding to comments made by peers, and to allow for construction of experiences and knowledge as they engage with the subject matter (Al-Shalchi, 2009).

Research in the use of DFs in English language teaching and learning shows that they provide a suitable platform to enable tutors to make available learning resources, conduct activities, conduct research and give feedback that aid in developing a variety of language skills (Connell, 1998). Also, participation in DFs are said to increase the language learners' collaborative and communicative skills (Krish, 2011).

Despite the success of DFs in the educational environment, several negative factors impact on its use. Mokoena (2013) points out, "discussion forums are powerful tools, but only if students engage in it" (p. 97). Additionally, studies in the use of DFs reveal that student perceptions are closely linked with the success of

interaction that takes place, and therefore suggest that use of DFs in the teaching / learning contexts should be regularly studied and evaluated, to ensure the success of a teaching programme (Nandi *et al.*, 2009).

While research locally and internationally has been conducted in the use of technologies in teaching English literature; use of desktop video conferencing (DVC) (Pullenayegem, 2012), CD/DVDs and YouTube videos (Barad, 2009) there appears to be a dearth of research that focuses on the use of online DFs for teaching English literature. Since student participation is imperative for learning to take place and for the success of the course through this medium, it is essential that learner perceptions be considered in teaching English literature as well. This research focuses on the Drama and *Poetry* Course of the Diploma in English and English Language Teaching offered by the Department of Language Studies of the Open University of Sri Lanka, and examines learner perceptions of the use of online discussion forums to teach and learn English Literature, particularly Poetry.

1.1 Research Questions

The main research question of this study is: What are learner perceptions on using discussion forums in the online



component of the Poetry and Drama Course?

The specific questions are:

1. What are the learners' perceptions of the nature of their postings to the discussion forums?
2. What are the learners' views on the extent of participation in the forums?
3. What are the learners' perceived benefits in participating in the discussion forums?
4. What are the problems encountered when participating in the discussion forums?

1.2 The Context of the Study

The Drama and *Poetry* course of the Diploma in English was offered in a multimode format with face-to-face (f-2-f) day school sessions, use of print materials, with a six-week online component which consisted of the works of the poet John Keats, and was conducted using the Learning Management System (LMS) Moodle. Course content was delivered primarily using DFs commencing with a forum for self-introductions, followed by a forum discussing literary aspects of the Ode, a poetic form. Three forums followed that engaged learners in a discussion thread prompted by questions posed by the tutor focusing on selected aspects of each poem. Assessment was based on participation and contribution to all five discussion forums, three quizzes, as well as an essay submission.

Sixty (60) students registered for the course, with each forum discussion composed of three groups of 20 members who were required to engage in discussion only within their assigned group. To encourage sharing and learning, restrictions were not placed on viewing the comments and contributions of other groups. Each group was assigned a different aspect of three chosen poems. Group members were required to post their own comments on the poems as well

as comment on their peers' comments, thus contributing to the construction of knowledge. The tutor served as facilitator.

2 METHODOLOGY

An exploratory design method was adopted. Data were collected primarily through a questionnaire consisting of seven questions, five closed questions, and two open-ended questions, to ascertain the views of the students on the following aspects of their participation in the discussion forums: (1) the nature of their postings, (2) the extent of participation, (3) the perceived benefits derived through interaction, (4) the perceived benefits derived from course content, and (5) the problems encountered in engaging in the discussion forums.

The responses to the questionnaire and selected online course data were triangulated. The questionnaire was administered to 55 of the 60 who registered. Fifty-five participated in the discussion forums of which (n=46) responded, achieving a response rate of 84%.

3 RESULTS AND DISCUSSION

Table 1 shows, a majority (69.56%) of students felt that the DFs gave them opportunity to share personal opinions and comments raised by group members. These positive responses support the findings that engagement in DFs gives opportunity to share and construct knowledge. However, only 13.04% participants requested clarification of comments made by others. Possible reasons for not asking for clarifications can be attributed to factors such as lack of confidence in topic, lack of time, and shyness.

Table 2 presents students' perceptions of their participation in the individual forums. Forum - 1 had the largest percentage of participants (80.43%), confirmed by online log-in frequencies;



2017. This could be attributed to Forum 1 being least demanding that required students to introduce themselves and welcome their peers. Forum – 4 had the least (63.04%), attested to by online log-in frequencies; (963). Reasons for this could be that the content of the poem under discussion was more challenging and required more in-depth analysis than the other poems, as well as the time factor that appeared to impinge on this.

Online data records of Forums – 2, 3, 4 and 5 indicate that the learners viewed these forum discussions as important; the primary means by which the content of the syllabus was delivered and discussed. Furthermore, allocation of marks which accrued to the Continuous Assessment Mark could be another reason for active participation. The percentage of participants that had read the posts but not participated in the discussion was 10.87%. This is not uncommon among online learners, who are identified as lurkers.

Table 1: Students’ perceptions toward the nature of their postings

	Yes		No		No Response	
	No.	%	No.	%	No.	%
(b) I shared my personal opinion on comments and issues raised by my group members	32	69.56	1	2.17	13	28.26
(a) I asked questions about something that was not Clear	06	13.04	1	2.17	39	84.79

Table 2: Participation in the discussion forums

Online Participation		Yes		No		No Response		Online log-ins
Statement	Forum	No.	%	No.	%	No.	%	No.
(a) I read the posts and participated in the discussion forums	1. Let’s introduce ourselves	37	80.43	-	-	09	19.56	2017
	2. Introduction to the Ode	34	73.91	01	2.17	11	23.91	1786
	3. Ode to a Nightingale	36	78.26	01	2.17	09	19.56	1461
	4. Ode on a Grecian Urn	29	63.04	01	2.17	16	34.78	963
	5. Ode to Autumn	30	65.21	01	2.17	15	32.61	1010
(b) I read the posts but did not participate in the forums		05	10.87	-	-	41	89.13	-

Question 3; on student perceptions of the benefits from interaction with peers at DFs show that the majority (86.96%) viewed DFs as enabling them to interact with their peers in sharing knowledge and ideas, which could be attributed to the opportunity afforded to participants to gain an in-depth understanding, from

diverse perspectives offered from additional research. The second highest majority (78.26%), viewed the DFs as enabling introverts to freely express their views, followed by a lesser majority (54.35%) who viewed the use of DFs as promoting social interaction, indicating that social engagement is viewed as less



important than increasing knowledge of content. Discussion forums as a means of providing opportunity for participants to freely seek clarification on unclear aspects was 65.22%, suggesting that some students lack confidence, or are ill-prepared to participate meaningfully in the discussions. Response to DFs being useful in motivating greater engagement in course content was 65.22%. The least positive responses (36.96%) were on whether DFs increased teaching and learning more than f-2-f. The evident reason for data results, on motivation benefits, and teaching and learning benefits, is student preference for f-2-f sessions above online DFs, as is observed in the following comment: *“I personally feel that the online forum is not as effective as a face-to-face session where arguments can be settled instantly, whereas in a forum you have to wait for a response and logging in is the most difficult procedure due to slow connectivity and buffering”* – (SS-9).

Question 4 sought students’ views on benefits derived from course content. The majority (78.27%) viewed the DFs as contributing positively to engagement with the content of the course. Next, 67.40% agreed they gained greater confidence in expressing views on literary topics, and 67.39%, agreed that it helped in developing their ability to critically evaluate their peers’ comments, and 65.21% concurred that it enhanced their written responses to literary texts.

The final question was on problems students faced in engaging in the discussion forums. The time factor and tight schedule were listed as greatest drawbacks, followed by slow internet connectivity; substantiated by this comment: *“It was very difficult to connect to the forum. It took a long time to connect and time got wasted since the platform was extremely slow”* (SS-14). A percentage of (36.96%) indicated that they lacked access to a computer and the Internet as is observed in the comment

made by this student: *“Madam, since I live in a very remote area in Wilgamuwa. I could not actively participate [in] this. I don’t have the access to the internet in my area”* (SS-17).

These comments give greater insight into some of the reasons for non-participation as well as negative views of the use of the online discussion forum as a tool in teaching and learning English literature.

4 CONCLUSIONS AND RECOMMENDATIONS

The findings indicate that the use of the discussion forums in teaching and learning English literature, particularly poetry, is viewed positively by the learners. Allocation of marks for participation and engagement contributed significantly to increase student participation. Yet, some favour f-2-f learning above online learning due to the prevailing teaching and learning culture.

Also, the time factor which impinged on learner engagement in discussion forums is a perennial challenge faced by online learners. Therefore, online course design should take into consideration the culture of the learners, and appropriate prior preparatory training is needed on pedagogical and technological aspects of working in an online environment, to enable them to recognize its benefits in enhancing f-2-f learning, as well as to equip them to face challenges encountered in discussion forums.

Unsatisfactory internet connectivity due to poor server performance is another contributory factor that can be improved by upgrading the present Learning Management System. Future studies may look into the role of tutors in promoting social learning and learner motivation in conducting online discussion forums in the other genres of literature.



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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Needs Analysis of Prospective Learners to Develop a Psychology Degree Programme in Open and Distance Learning Mode

K.S.A. Colombage and G.P. Gamage*

¹*Department of Psychology and Counselling, Faculty of Health Science, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: gpgam@ou.ac.lk

1 INTRODUCTION

Identifying the perceived needs of prospective learners can be beneficial for the development of new academic programmes and related curriculum. Many needs assessment surveys are reported by medical education and teaching English as a second language programmes (Grant, 2002; Walsh, 2006). Based on this premise, a needs survey was conducted to understand the perceived needs of prospective learners of a proposed Psychology degree programme at the Open University of Sri Lanka (OUSL).

There are opportunities to gain a four-year degree in Psychology (Bachelor of Arts) within the national university system of Sri Lanka. These programmes offer admission based on the z-score and many who do not achieve the required z-score but pass the GCE (Advanced Level) examination and those who have work experience in related subfields in Psychology are unable to obtain academic qualifications in Psychology, unless they opt to enrol at private institutions and universities with the burden of high tuition fees. In this context, Open and Distance Learning (ODL) methodologies are an important modality to disseminate academic education and training programmes in developing nations due to

two main reasons; (i) the significant shortage of qualified and trained individuals to teach/train, and (ii) the need to provide accessible and flexible academic/training programmes for those from various geographic, socio-economic, and professional backgrounds (Lentell, 2007; Nti, 2015). The shortage of degrees in Psychology that produce graduates who are capable of assisting the health sector to manage psychological needs and wellbeing of the country is a major justification for the choice of programme discipline. These were highlighted by several government documents such as the Strategic Framework for Development of Health Services in Sri Lanka (2016) and The Mental Health Policy of Sri Lanka (2005), as well as the recent report on missing persons in Sri Lanka offering a non-governmental perspective under the title 'Living in Uncertainty' (ICRC, 2016). Thus, shortages in the labour market (and in academia) exist within the country that will benefit our future graduates. Hence, the needs assessment was primarily focused on exploring the different aspects of the need for a Psychology degree among prospective learners. Furthermore, it is expected that the results survey will assist the developers of the proposed programme to understand critical elements for the



development of course material as well as the related requirements of prospective learners such as their exposure to the open and distance learning (ODL) mode.

2 METHODOLOGY

2.1 Design

Data was gathered through a web based survey made available on the Department of Psychology and Counselling at OUSL website from December 2015 to March 2016. The survey included eighteen (18) questions. The questions were specifically developed to gather information pertinent to understanding the needs of prospective learners and to gauge the profile of the prospective learner by gathering information such as academic background, employment status, interest in and reasons to pursue a Psychology degree, employer support (if employed), and prior exposure to ODL mode.

2.2 Participants

The online survey participants (N=211) were gathered through the convenience sampling method. It was expected that only those who were interested in a Psychology degree programme would be searching for similar programmes. Some participants were directed towards the website and encouraged to complete the survey if they made enquiries about Psychology programmes offered by the OUSL, either via telephone or in-person.

3 RESULTS AND DISCUSSION

211 participants completed the online survey within three months, from December 2015 to March 2016. A descriptive analysis of the data presented several important factors that can positively influence the content and delivery of the Psychology degree programme.

Prior-Educational Level: The analysis of educational qualifications of prospective learners indicated that 45% of the sample has completed their Advanced Level qualification, which is the minimum entry criterion for degree programmes at the OUSL. The other 55% reported that they have completed either an Undergraduate Degree (16%), Diploma (17%) or other professional qualifications (e.g. CIMA, Law) respectively. A substantial academic standing is a good indication of a learner's structured knowledge base, which Biggs (2007) identifies as aiding a deep approach to learning. This well-structured knowledge base contributes toward forming a deep learning approach. The deep learning approach is where a student reaches a higher cognitive capacity from a thorough understanding of content and applications. Therefore, information on prospective learners' academic background is beneficial for programme content development. What this means in practice is that the content developers (authors) can write material in such a way that the intended audience (the learner) would easily comprehend and be actively engaged in the learning process.

Interest in Programme: The responses to the two questions measuring the interest towards the programme sought to find out "Whether they plan to do the prospective degree and if they are interested in learning within the Open and Distance Learning mode". There was clearly a high interest (90%) amongst the participants who reported their intention to pursue a degree, while 91% stated they would like to join this programme offered via the ODL mode (see Figure 1). This interest could also be a strong indication of the commitment of the participants to complete the degree once they have enrolled in it. This was further supported by the answer given by 64% of the sample as they mentioned that they have had no exposure to the ODL mode. Even though they might not be exposed to or are not familiar with self-directed learning, these prospective learners show a keen interest



in pursuing this degree in an unfamiliar mode. This is a strong indication of their interest in the discipline of Psychology. Hence, this provides insight as to why students are interested in Psychology (i.e. to become counsellors, for personal development, assist in current career path, etc.), so that content can be developed accordingly. For example, relevant case studies could be used to relate to the diverse backgrounds of the prospective learners.

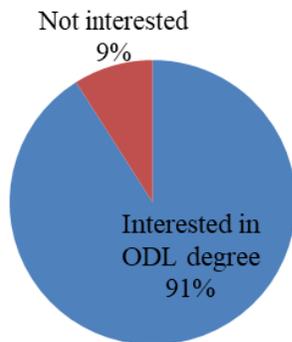


Figure 1: Interest in the proposed programme

Reasons to Pursue Proposed Programme:

As stated in the paragraph above, reasons provided as to why the survey respondents wish to a programme in Psychology is an essential aspect of the learner profile so that course content as well as the nature of courses (subjects) offered can be structured to facilitate this learning need. Similarly, it is also an indication of the propensity of a learner to complete the degree and thereby successfully conclude the journey they embarked on when they decided to enrol in the degree programme. Therefore, it could also help to forecast ‘success’ from the learner’s as well as the institution’s perspectives. The percentage of prospective learners who stated that they intend to pursue this degree to gain an academic qualification was 44%, while 47% mentioned that the motivation was guided by the employment related ‘training/career progression’ reasons. There was a small percentage (less than

10%) that did not comment. These percentages correlate with declarations by respondents of anticipated benefits from completing the proposed degree programme such as career promotions, pay increments, paid leave, and study leave offered by most of their employers (See Figure 2).

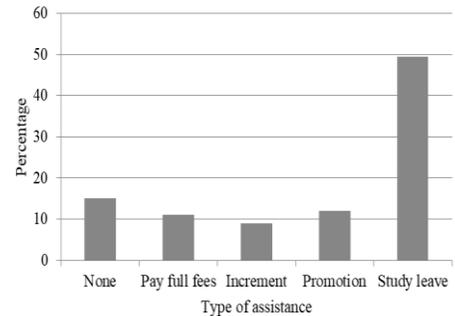


Figure 2: Expected assistance from employers

Employment Status: Nearly 65% of the sample were employed at the time of the survey been conducted while 35% were unemployed or were currently engaged in studies at an education institute. The majority representing one industry were 13% who were employed as teachers/tutors while 10% were from the healthcare sector. The next largest category was the human resources and business sector with 8% of total participants. Even though there were higher percentages of employed individuals, the high costs of comparable degrees offered at private institutions were mentioned as a reason for searching for a programme with less of a financial burden and good quality education/training. Most of the ‘employed’ participants also indicated their preference towards this programme due to the flexibility at OUSL which allows them to study at their own pace while managing work responsibilities and family commitments. This was a crucial factor in their desire to enrol in the proposed degree programme.

4 CONCLUSIONS AND RECOMMENDATIONS

An insight into the needs of prospective learners is essential to develop new programmes and design curricula, especially in a modality such as ODL where self-directed learning receives prominence. A programme designed to cater to the needs of prospective learners is vital to the success of the programme as well as the learner, as these needs directly influence motivation of the learners, commitment and successful completion of the programme. The identification of learner needs provides curriculum developers with information about the target audience of the programme and learning material, so that they can produce material that is relevant, relatable, and comprehensible to the learner as well as to future facilitators to effectively facilitate the learning process. Thus, such a needs assessment, or even a series of needs assessments targeting different aspects of stakeholder needs, will provide important information to the development process of an appropriate, relevant and high-quality study programme. It is assumed that this data driven approach to the development of a degree will benefit the institution and the prospective learners, while also assisting the needs of a country to fill existing gaps in the discipline of Psychology.

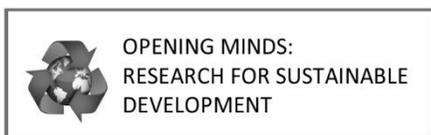
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EDUCATION



Developing Language and Early Literacy Skills of a Preschool Child with Global Developmental Delay

Anoma Alwis, Malani Munasinghe, T.D.T.L. Dhanapala, Hemanthi Anuruddhika, K. Ketheeswaran and Saminda Kuruppu*

Faculty of Education, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: kakur@ou.ac.lk*

1 INTRODUCTION

Early childhood is an important phase of growth and development of any individual's life. This phase of development provides important opportunities for all children, including children with special educational needs, to build a foundation for learning and participation. The experiences an individual gets during this critical stage has an impact on his/ her total development. According to Conti Ramsden and Durkin (2012) most young children make significant progress in language learning during the first 4 years of life. Delays or differences in patterns of language acquisition are sensitive indicators of developmental problems. Simultaneously, this would have consequences throughout an individual's life. Children with Global Developmental Delay (GDD) may face challenges in participating in preschool activities because they show significant delays in one or more developmental milestones. It is important to intervene as early as possible to cater to their needs in order to maximize the benefits to the child through early intervention. Even though, language learning can be a lifelong journey, the majority of that journey takes place in the first five years of life. Language and early literacy skills are fundamental and essential skills that a child needs in order to engage in the learning process effectively. Further, the improvement of the overall communication skills by developing language and early literacy

skills for a child with GDD will enhance the self confidence and self-esteem of the child. Finally, the child will also be able to improve the quality of his/ her life. Therefore, this study focused on developing language and early literacy skills of a child with GDD.

The objectives were as follows,

- To find out the present level of language and early literacy skills of a child diagnosed with GDD
- To develop and implement a plan to improve the language and early literacy skills of the child
- To assess the progress achieved by the child and the effectiveness of the action plan.

2 METHODOLOGY

2.1 Research Design

Action Research and case study designs were applied in the study. Action research presents a more user-friendly, practical approach for conducting research. The present study was conducted for one main purpose: to improve the language and early literacy skills of the child with GDD. Mettetal (2001) stated that three major research designs could be used for action research projects: pre-test/ post-test designs, comparisons of similar classes, and case studies. In this study a



combination of both pre-test/ post-test and case study designs were used. Pre-test/post-test designs were applied to measure the language development and the case study method used to observe what took place.

2.2 The Subject

The subject for the study was a preschool child with GDD. He was born on 20.05.2011. He was 4 years and 4 months old at the time of referral. He had been diagnosed with GDD. His hearing and vision had been tested. He has normal hearing within the limits and normal vision too. In order to maintain anonymity of the child, he was given a fictitious name, Hasitha. He has two siblings in the family and both parents are working.

According to the mother, all the milestones had been delayed for Hasitha. When considering gross motor skills, he had started to walk independently at the age of 2 years and 6 months. Hasitha's fine motor skills had not been established even at the age of 4 years and 4 months. He had started to use his first words at the age of 1 year and 6 months. Hasitha used both verbal and non-verbal communication skills for functional communication with limited words without using sentences.

2.3 Study Setting

The "Support Centre" of the Department of Special Needs Education and the "Supipi Pre-School" of the Open University of Sri Lanka were utilized as the settings of this study.

2.4 Data Collection Methods

Informal assessments and Formal assessments were used to collect data. The data were collected informally by interviewing parents, teachers and by observing the child in the "Support Centre" and in the "Supipi Pre-school". The Observation checklist developed by the Department was used as one of the

data collection instruments. In addition, play based assessments were also carried out as an informal assessment method. The Derbyshire Language Scheme was administered at the end of each two months block to assess development of language and early literacy skills for each cohort as the formal assessment.

2.5 Data Analysis

Data were analyzed descriptively and statistically using simple percentages and graphs. In this report presented only the simple percentages and graphs of data driven by administered Derbyshire Language Scheme focused on language comprehension and expression.

2.6 Procedure

1st Phase- Assessed the status of Hasitha's language and early literacy skills.

2nd Phase- Developed and implemented an intervention plan to improve Hasitha's language and early literacy skills. He received individual sessions on Speech and Language Therapy at the "Support Centre" of the Department of Special Needs Education once a week. Each individual session ran for one hour. He received individual direct therapy at the "Support Centre" and indirect therapy at home. The parental training was done in the unit after each session and a home program was given to them so that they could implement it at home. In addition, information was provided to teachers at the "Supipi Pre-school" to facilitate the improvement of Hasitha's language and early literacy skills.

3rd Phase- Assessed Hasitha's progress and the effectiveness of the action plan.

After every two months, the same assessment was used to re-assess the level at which Hasitha's language skills were functioning. The study was carried out for six months



3 RESULTS AND DISCUSSION

3.1 Hasitha’s present level of language and early literacy skills

Table 1: Vocabulary at the beginning of intervention

Nouns	Verbs
/amma:/, /tha:ththa:/, /ayya:/, /malli/, /akka/ ,/ma:ma:/, /nanda:/, /baba:/, /bo:le/, /bat/, /cup/, / bath/, /wathura/, /apple/, /kesel/, /ala/, /ke:k/,/pa:n/,/te:/,/balla:/,/hawa:/ /haraka/,/naya:/,/maluwa:/, /aliya/, /mala/, /gaha/ , /car/, /atha/,/kata/,/kana/, /bada/, /kakula/, /cap/, /bag/, /chu/,/kakka:/,/teddy/, /t.v/, /ge:/,	/epa/,/oni/,/giya/,/kanawa/,/ bonawa/,/nidi/,/yamu/,/bye/ , /watuna:/, /na/,

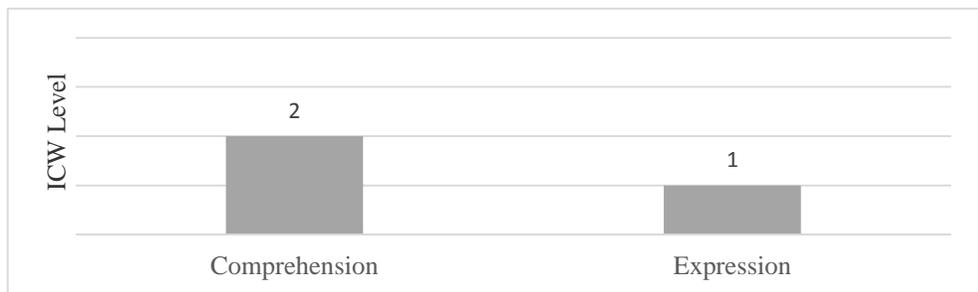


Figure 1: Language Comprehension and Expression at the beginning of intervention

According to Table 1, he had a vocabulary of 50 words at the beginning of the intervention. His vocabulary mainly consisted of high frequency nouns and few verbs. According to Loraine,(2008) a typical 4-year-old child will have about a 1,500–1,600-word vocabulary. There was a significant delay in the vocabulary of Hasitha at the beginning of intervention. His vocabulary was comparable to a child who was around 1 - 1½ years old.

Hasitha’s language skills were assessed using the “Derbyshire Language Scheme” which is a picture-based formal assessment. According to graph 1, he was functioning at 2 ICW level (Information Carrying Word Level) in language

comprehension (for example: he could show the correct pictures for “babage atha” and “ballage oluwa” when he was given the verbal command) and 1 ICW in language expression. He could name the pictures using single words. (“bo:le”, “baba”).

At the beginning of the intervention his language comprehension level was similar to a 2-year old child and language expression level was similar to a child around 1½ years old even though his chronological age was 4years and 4 months. Hasitha was 2 years behind in language comprehension and 2½ years behind in language expression when compared with his chronological age.

3.2 Hasitha’s level of language and early literacy skills after six months

Table 2: Vocabulary after six months

Nouns	Verbs
/amma:/, /tha:ththa:/, /ayya:/, /malli/, /akka/, /ma:ma:/, /nanda:/, /baba:/, /aththa:/, /nangi/, /yaluwa/bo:le/, /bat/, /cup/, pig ana/handa/, /pihiya/, /panawa/, /mese/, /putuwa/, /panawa/enda/, /bath/, /wathura/, /bithhara/, /piti/, /te/, /banis/bathala/, /aappa/se eni/, /yoghurt/, /hodi/apple/, /kesel/, /midi/, /dodam/amba/ala/, /hodi/, /ke;k/, /pa:n/, /te:/, /balla:/, /hawa:/pu:sa/, /ibba/, /kaputa/, /ku kula/, /aliya/, /huuna/, /walaha/haraka/, /naya:/, /maluwa:/, /aliya/, /mala/, /gaha/, /kola/, /thanakola /balun/bubble/atha/, /kata/, /kana/, /bada/, /kakula/, /cap/, /bag/, /chu/, /kakka:/, /teddy/, /t.v/, /ge:/, /oluwa/, /nahaya/, /esa/, /dath/, /car/, /diwa/, /bus/, /van/, /plane/, /boat/, /bike/, /hello/, /pata/pansala/, /kathura/geda ra/kaday/beth/pettiya/, /tap/, /iskole/dora/, /light/carrot/, /gow a/, /omlat/, /kiri/, /biscuit/, /bothale/, /sapatththu/, /potha/, /thoppi/m aalaya/, /loku/, /podii/, /hodai/, /sadu/, /teacher/rathu/nil/kotuwa/	/epa/, /oni/, /giya/, /kana wa/, /bonawa/, /nidi/, /yamu/, /bye/, /watuna:/, /na/, /rasai/, /danawa/, /g annawa/, /enawa/, /duw anawa/, /genawa/, /gath tha/dennna/, /ethi/, /un u/, /balanawa/, /keduna/, /hodanawa/, /kapanaw a/, /adanawa/uayanaw a/, /nanawa/, /hadanaw a/, /ethule/, /eliye/, /uda /, /yata/, /kiyanawa/, /dan na/ganna/

Language Comprehension 3 ICW

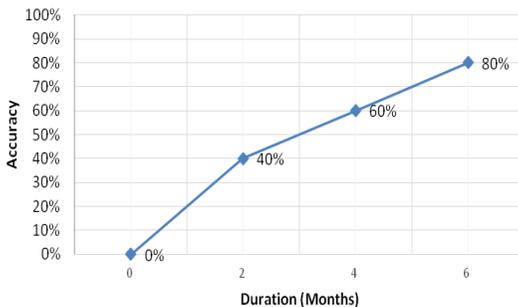


Figure 2: The development of the accuracy of 3 ICW language comprehension

According to Table 2, Hasitha’s vocabulary has expanded from 50 words to 150 words after the intervention. The nouns have increased by 75 words while verbs have increased by 25 words.

According to Figure 2, after the first two months, Hasitha was able to comprehend 3 ICW level sentences (example- “*puusa: bath kanawa*”, “*bolle putuwa uda*”) using pictures in the therapy setting by making

Language Expression 2 ICW

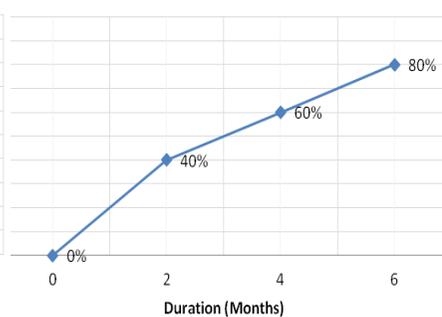


Figure 3: The development of the accuracy of 2 ICW language expression

4/10 given opportunities with 40% accuracy as measured through a language assessment. The intervention continued and after four months’ time Hasitha was able to comprehend 3 ICW level sentences, using pictures in the therapy setting, by making 6/10 given opportunities with 60% accuracy. Finally, after the entire duration of six months, Hasitha was able to comprehend 3 ICW level sentences using pictures in the



therapy setting by making 8/10 given opportunities with 80% accuracy.

At the beginning of the intervention Hasitha had a verbal language comprehension of 2 ICW level. However, after six months he had achieved the target since his level of comprehension had increased up to 3 ICW level with 80% accuracy.

According to Figure 3, in language expression he was able to express 2 ICW level sentences (noun + verb combinations, for example: *amma kanawa, ayya nidi, baba nanawa*), using pictures in the therapy setting, by making 4/10 given opportunities with 40% accuracy. After four months he was able to express 2 ICW level sentences, using pictures in the therapy setting, by making 6/10 given opportunities with 60% accuracy. Finally, after six months he was able to express 2 ICW level sentences with minimum picture cues in the therapy setting by making 8/10 given opportunities with 80% accuracy as measured through the language assessment.

At the beginning of the intervention Hasitha had a verbal language expression of single words. After six months he had achieved the target since his level of expression had increased up to 2ICW level with 80% accuracy.

4 CONCLUSIONS

- Before the intervention the subject's language comprehension skills were delayed by 2 years and language expressive skills were delayed by 2 ½ years.
- Hasitha was able to progress through the intervention plan as he developed his language comprehension and expressive skills. He was able to reduce the gap of the delay by one year in each area. The targets were met and the intervention plan was successful.

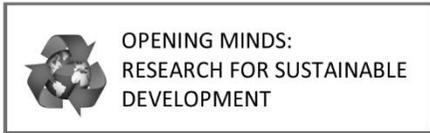
5 RECOMMENDATIONS

- Early identification and early intervention for children with GDD is essential to improve their quality of life.
- Collaborative work among parents, teachers, and other professionals is essential to develop a child with GDD.
- Include a component on early intervention into the curriculums of Early Childhood Development programs.

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Perceptions of ESL Students on Group Presentations as an Assessment Tool

I.N.J. Bogamuwa* and N.K. Abeysekera

Department of Language Studies, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: inbog@ou.ac.lk*

1 INTRODUCTION

Group work is an essential academic aspect of tertiary education, especially at the beginner level, as it acts as a platform upon which students' interactive skills can be developed while minimizing their sense of isolation. Although in many instances team based learning and assessment are under-utilized in distance learning, when designed with a valid purpose combined with explicit rubrics and marking guidelines, it can be beneficial to students as well as academics. By utilizing group work in assessment, students' graduate attributes are developed while allowing assessment of their generic skills in addition to subject knowledge (Centre for the Study of Higher Education, 2002). Moreover, group assignments and presentations are recognized as important learning experiences for students as they are valuable transferable skills for higher level academic activities and work place demands (Madden and Keogan, 2014).

The current study examines the perceptions of students of English as a Second Language (ESL) on the effectiveness of group presentations as an assessment tool in terms of the learning experience and engagement, and their views on the fairness of the assessment. Moreover, it explores the students' suggestions for further improvement in group presentations as an assessment tool.

2 METHODOLOGY

The current study is primarily based on data collected from the students registered for the Diploma in English Language and Literature (DELL) Programme in 2016/17, which consists of six courses covering basic language and literature components in English. The course Advanced Grammar and Communication Skills aims to prepare students for higher academic study at tertiary level or work place demands by developing their written and spoken communication skills. The current study is based on feedback gathered after conducting group presentations as a method of formative assessment. The total number of students (112) were distributed into 14 groups with 8 in each. During the preparatory session prior to group presentations the students were made aware of the evaluating rubrics to ensure fairness and transparency of the assessment. The time allocated for each presentation was 15 minutes and instructions were provided to conduct the presentations using posters. Since the current study is descriptive in nature a questionnaire with a 4-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (4) was administered to them at the end of the group presentation. In addition, post presentation group discussions were held. Out of 95 questionnaires 86 were completed and returned. The responses from the questionnaires were analyzed using descriptive statistics (SPSS 18 package).



The frequency distribution, percentages and Mean values were calculated in order to analyze the perceptions of the students on preparation for and assessment on group presentations. The data were analyzed using basic thematic reduction around the following themes: efficacy and contribution of peer learning, effectiveness and fairness, group member contribution, effectiveness of presentations versus written assessment, transferability of group working and presentation skills, previous experience and suggestions for improvement. The demographic details of the sample are represented in Table 1.

According to Biggs and Tang (2007, p. 219) “The common practice of simply awarding an overall grade for the outcome, which each student receives, fails on all counts”. Thus, assessment criteria for the group presentations in the current study had allotted marks for individual contribution and performance as well as overall group performance.

3 RESULTS AND DISCUSSION

Question 1: To what extent do students feel that preparation for and assessment at group presentations help them in learning?

According to the Table 02 all students agreed that preparation for group presentations helped them in learning subject content. The majority (79%) either agreed or strongly agreed that preparation for group presentations was more challenging and time consuming than a written assignment whereas 21% disagreed. The majority (77.9%) felt that learning was more effective in group presentations than in written assessment (22.1%). Further, 94.2% agreed that effective contribution towards peer learning took place in group presentations while 5.8% disagreed. When considering the Mean values of all the above attributes it shows that the majority of the DELL students had a positive view on efficacy of group assessment and contribution of peers towards learning.

Question 2: To what extent do students prefer preparing for group presentations?

With regard to the preparation for the group presentations, the majority had strongly agreed or agreed that it was more enjoyable and sociable (95.3%) while 87.2% had preferred to prepare for a group presentation than an individual presentation (Table 3). At the same time the majority (93%) had strongly agreed or agreed that they were satisfied with the group member contribution revealing that the students’ motivation and commitment in collaborative work was high. The Mean values also indicate that DELL students had a very positive view regarding the preparation and group member contribution

Question 3: To what extent are students satisfied with the level of transparency and effectiveness of group presentations as an assessment tool?

The Mean values of Table 4 show that these students were very optimistic on the effectiveness and fairness of group assessments as an assessment tool since the majority had either agreed or strongly agreed that the marking rubrics used was fair and effective (98.8%) and transparent (96.5%). Thus, it is clear that these students were satisfied with the level of fairness and transparency and the objectivity of the assessment.

Question 4: To what extent do students prefer group presentations as an assessment tool?

In relation to Table 5, the majority (87.2%) preferred group presentations than individual presentations while 57% either agreed or strongly agreed that facing group presentation is less stressful than facing a written assessment. However, only 57% agreed or strongly agreed that facing group presentation is less stressful than facing a written assessment and the Mean value (2.63) also does not show a strong positive view in this regard.



Question 5: To what extent do students recognize the transferability of group working and presentation skills?

According to Table 6, the value of transferability of group work and presentation skills in meeting higher level academic activities and work place demands successfully was strongly recognized by these students as the Mean value (3.84) indicates a strong positive views on this attribute.

Information gathered through interviews revealed that 50% of students had prior experience of group presentations at various stages such as school and professional courses.

Their overall view on group presentations reflected a variety of comments such as it provided the opportunity to “share ideas and knowledge”, “get to know each other”, “built confidence to conduct a successful presentation” and “identify

one’s skills, talents and potentials”. Further, they were of the opinion that preparation for group presentations motivated and improved soft skills and team spirit. Although some commented on the challenging nature of group presentations they also acknowledged that it was interesting and effective and was “the best tool to assess communication skills”. Nevertheless, some students stated preparation for group presentations proved to be difficult for distance learners especially due to the number of members in the group.

In response to suggestions for improvement in group presentations as an assessment tool the majority commented on the time allocation for preparation and presentation. Some proposed the use of Power Point as the media of presentations, especially those with prior experience. Some claimed that more consideration on individual contribution may improve it.

Table 1: Demographic details of the participants (Frequency and amp; %)

Entry qualification		Gender		Age			First Language			
Selection Test 65 (75.6)	Ad. Certificate in English 21 (24.4)	Female 69 (80.2)	Male 17 (19.8)	18-35 63 (73.2)	36-55 20 (23.2)	56 ≤ 03 (3.5)	S 73 (84.9)	T 12 (14.0)	E 00 --	Other 01 (1.2)

Table 2: Efficacy of group assessment and contribution of peers towards learning

Description	Responses (no of observations and %)				Mean value
	1: SD	2: D	3: A	4: SA	
Preparation helped me to learn Grammar and Communication Skills	00 (--)	00 (--)	47 (54.7)	39 (45.3)	3.45
Preparation was more challenging and consumed more time than a written assignment	01 (1.2)	17 (19.8)	39 (45.3)	29 (33.7)	3.12
Assessment in group presentations is better than written assessment in terms of learning effectiveness	02 (2.3)	17 (19.8)	41 (47.7)	26 (30.2)	3.06
Effective contribution towards peer learning took place in group presentations	02 (2.3)	03 (3.5)	35 (40.7)	46 (53.5)	3.45



Table 3: Preparation and group member contribution

Description	Responses (no of obs. and %)				Mean value
	1: SD	2: D	3: A	4: SA	
Preparation was more enjoyable and sociable than a written assignment	01 (1.2)	03 (3.5)	24 (27.9)	58 (67.4)	3.62
I prefer to prepare for a group presentation than an individual presentation	03 (3.5)	08 (9.3)	38 (44.2)	37 (43.0)	3.27
I am satisfied with the contribution towards the workload by other group members	00 (--)	06 (7.0)	28 (32.6)	52 (60.4)	3.53

Table 4: Effectiveness and fairness of group assessments

Description	Responses (no of obs. and %)				Mean value
	1: SD	2: D	3: A	4: SA	
In my opinion group presentation is preferable to individual presentation as an assessment tool	02 (2.3)	09 (10.5)	47 (54.7)	28 (32.5)	3.17
Facing an assessment in group presentations is less stressful than facing a written assessment	08 (9.3)	29 (33.7)	36 (41.9)	13 (15.1)	2.63

Table 5: Preference for group presentations

Description	Responses (no of obs. and %)				Mean value
	1: SD	2: D	3: A	4: SA	
In my opinion: the marking criteria/rubrics used for assessing presentation skills – fair and effective	00 (--)	01 (1.2)	53 (61.6)	32 (37.2)	3.36
In my opinion: the marking criteria/rubrics used for assessing presentation skills - transparent	00 (--)	03 (3.5)	50 (58.1)	33 (38.4)	3.35

Table 6: Perception of the transferability of group working and presentation skills

Description	Responses (no of obs. and %)				Mean value
	1: SD	2: D	3: A	4: SA	
Developing group work and presentation skills will be useful in workplace/academic situations	00 (--)	00 (--)	14 (16.3)	72 (83.7)	3.84

1: Strongly Disagree, 2: Disagree, 3: Agree and 4: Strongly Agree



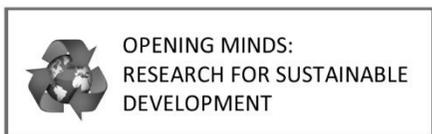
4 CONCLUSIONS

The current study reveals that the majority of the DELL students had a positive view on the efficacy of group assessment, contribution of peers towards learning as well as preparation and group member contribution. These revelations support the idea that when utilized for assessment, group work benefits students and teachers in developing graduate attributes and generic skills such as teamwork, analytical and cognitive, collaborative, organizational and time management skills (CSHE, 2002). Furthermore, they were very optimistic on the effectiveness, fairness and transparency of group assessments as an assessment tool. This is particularly important since pre-grouping, monitoring of initial preparations and discussions of assessment criteria and rubrics took place prior to the group presentations. The majority preferred group assessments than individual presentations as well as written assessments because they found that group presentations were less stressful though challenging and time consuming. This proves that group assessment ensures that learning and assessment are more public and accountable while making assessment more efficient. Since all the students had recognized the transferability of group working and presentation skills it shows that this type of assessment is more authentic, being common practice in work and professional settings. Although this methodology is underutilized as an assessment tool in ODL sphere group assessment provides an opportunity for distance learners to work collaboratively while encouraging effective peer learning. In addition to that, group assessment output can reduce the assessment workload of examiners although it requires substantial time for planning and preparing students. In general, listening and speaking skills in a second language are neglected in assessment due to practical issues. Hence, group presentations can be recommended as an effective remedy.

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Life Skills for Engineers: An Initiative towards Developing Holistic Graduates

P. Silva^{1*}, D. Siriwardana² and K. Booso²

¹*Department of Electronic and Telecommunication Engineering, University of Moratuwa, Katubedda, Sri Lanka*

²*Full Life Coaching*

*Corresponding author: Email: psilva@uom.lk

1 INTRODUCTION

Engineering education has long since emphasized the importance of developing non-technical competence, also referred to as “soft-skills” (UNESCO, 2010). This is reflected in the inclusion of non-technical criteria as mandates by engineering accrediting bodies such as the Accreditation Board for Engineering Technology, and the Institute of Engineers Sri Lanka (ABET, 2014; IESL, 2014).

Despite this emphasis, there is little evidence of inclusion of non-technical skills in educational programs (Trevelyan, 2010). This is especially true for programs in Asia; studies have helped identify that despite the immense technical rigor of Asian engineering courses, the emphasis on professional development is very low (Sarkar *et al.*, 2016). This also echoes with the finding that South Asian engineering graduates were considered less employable for non-technical roles (Trevelyan and Tilli, 2010). Another study found that failures in work settings were mostly due to engineers’ failures in human interactions (Trevelyan, 2010).

The demonstrated need for developing a “holistic” graduate also equipped with essential non-technical skills, led to the development of the Life Skills for Engineers course that is currently offered to the 2nd year undergraduate engineering

students at the University of Moratuwa as an elective. The present paper evaluates the course’s effectiveness and methodology based on the course conducted in 2016. Specifically, the paper evaluates the overall student growth in relation to a number of non-technical competencies which were addressed through the course. The study also takes into account qualitative feedback from students on the perceived usefulness of the course for their professional development. Based on these understandings, the paper seeks to identify what aspects of the course can be further improved for future programmes.

2 METHODOLOGY

2.1 Program Design

The course was designed to develop a number of non-technical competencies. In addition to non-technical skills, the course aimed to develop social awareness. The course was developed based on the P3 Model of Growth – which emphasized the role of the engineering student at self, interpersonal and team (community) levels, and had already been adapted for an engineering development program (Silva and Yarlalagadda, 2013a). The present course is a less-resource intensive



version of the original program (Silva and Yaragadda, 2013b). This version of the course equipped the students through stages 1-6 of the P3 Model which consists of 9 stages. This course was developed around the competencies covered in these 6 stages.

2.2 Course Structure and Components

The course structure included 14 weeks of lectures, across which 7 topics were covered: Introduction to Engineering Success, Awareness for Engineers, Communication for Engineers, Connect for Engineers, Drive for Engineers, Mentoring Skills for Engineers, and Leadership for Engineers. The topics reflect stages 1-6 of the P3 Model, as well as the competencies which were to be developed in the students. All lectures were activity and discussion based to emphasize a coaching style.

A series of online activities were mandated on a tailor-made online learning platform. These activities were designed to engage students in promoting a better understanding of the targeted competencies and understanding their practical application in their personal/academic lives. Additionally, students were required to maintain a self-reflective journal, and design and complete a humanitarian activity in a community as a group project.

The student groups for the humanitarian projects were assigned a “mentor” – a course alumnae to provide additional support and guidance in the course. These alumni “mentors” were provided with a one-day training program to build basic mentoring skills. This training focused more on creating awareness of the role and skills needed as a mentor rather than on training on skills needed to be competent as a mentor.

Participating in the course was considered to be a basic criteria for being trained as a mentor.

A number of assessments were interspersed across the course duration. The central assessment of students’ progress in relation to the six course competencies was through evaluations by the mentors at the beginning, mid and final stages of the course. Additionally, the competency of awareness was also evaluated through two online commenting activities, and through the level of self-reflection in their reflective journal entries. The level of leadership demonstrated was also extensively assessed through the students’ contribution in the humanitarian project presentation at the final stage of the course. Finally, feedback was collected at the end of the course as well.

3 RESULTS AND DISCUSSION

3.1 Quantitative Findings

In the present study, the evaluation is only based on the Mentor evaluations on course competencies at the commencement, mid and final stages of the course. The first assessment was based on students’ performance of an in-class activity at the start of the course. The second assessment was based on students’ performance during the presentation of proposals for a humanitarian project (midterm). The final assessment was based on students’ final presentation of their humanitarian projects at the end of the course. During the three assessments, mentors scored each student on a set of criteria representing the level of each competency that should ideally be demonstrated at that stage in the course.

The scores were computed as percentages. Complete data-sets from 36 students were used for the subsequent analyses presented in this paper.

Figure 1 presents the average scores (as a percentage) that students demonstrated in the 6 competencies of Awareness, Communication, Connecting, Drive, Mentoring, and Leadership as Engineers during 3 stages of evaluation. The above



evaluations were conducted by the Mentors, although it must be noted that the same mentor did not evaluate at all 3 stages.

Figure 2 indicates the average level of overall growth the students demonstrated in the competencies of the P3 model.

Overall growth was calculated by subtracting “final evaluation – initial evaluation” graphs. Different stages of the model demonstrate different levels of growth. The largest growth is seen for the Drive and Connect, followed by Aware and Communicate.

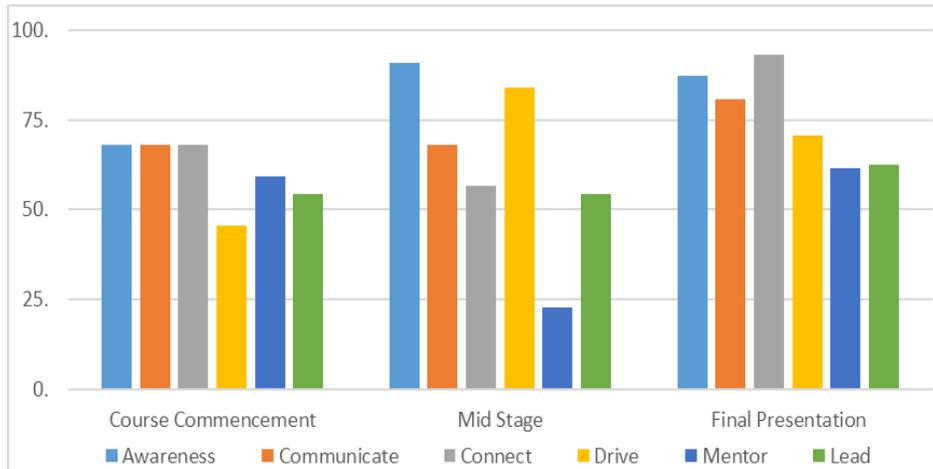


Figure 1: Percentages of competencies achieved over three stages of evaluation

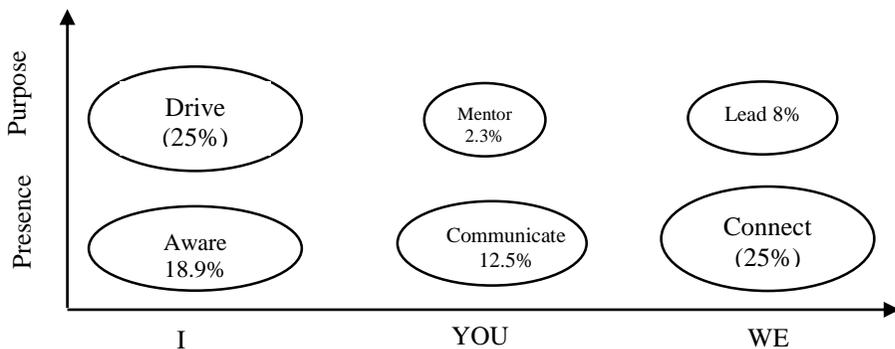


Figure 2. Level of growth in each stage on the adapted P3 Growth Model for the course

3.2 Qualitative Findings

Feedback was received at the end of the course, and students were required to provide feedback on their learning and development. Even though the quantitative data does not reveal consistent growth in all competencies, the qualitative data is very positive, and all students attest to personal growth and development. Identified limitations as per qualitative feedback were mainly related to the work-load of the course being taxing and challenging for a full-time student.

3.3 Discussion

The overall results indicate that the course has been successful in facilitating student development in non-technical areas. The quantitative graphs do not show a consistent development pattern, with most competency scores dropping during the 2nd evaluation stage, and then peaking at the final stage. However, while interpreting these fluctuations, it is crucial to note that the evaluation at each level for the same quality (e.g. Awareness) was conducted at a progressively higher level, meaning that to be considered competent at stage 2 in awareness for example, the criteria evaluated were of a higher standard. This meant that students who did not meet the higher level of competency could have still demonstrated a level of growth that was not captured by the current evaluations. Despite this dip, an overall positive growth on all competencies is seen when comparing the difference between final and the initial rating.

Nevertheless, better methods of evaluating development across the competency should be identified in future installments of the course. Additionally, mentors showed variations in their evaluation abilities, even though two or more mentors evaluated each group and their average scores is what is reported. It was however not possible to maintain the

same team of evaluators over each group throughout the 3 stages, which may have contributed to an anomaly in the evaluation scores. Furthermore, mentors' personal biases during evaluation cannot be accounted for. More extensive training for mentors and standardization of assessments need to occur in subsequent batches.

When understanding the growth effect sizes for each of the 6 P3 competencies, the largest growth is demonstrated in *Drive* and *Connect*. This could be because the humanitarian project component of the subject really put to test the students' ability to connect with diverse communities, and drive themselves towards a purpose which is beyond their selves.

"The humanitarian project helped us learn what we are capable of, and what can we do to the society as educated people. It helped improve our team work ability, presenting skills, and ability to connect."

"Having a powerful purpose and a good driving force, is the power to achieve your targets. So as engineering students this course was so impactful for our motivation. I was able to see beyond the bubble and identify who is a true engineer, and that is what motivates me."

The next highest growth effect is seen for *Awareness* which was also intensively practiced in exercises such as the reflective journal, the gratitude journal (online), and daily wellness meter (online).

"Things that I thought which were my faults/mistakes such as being humble, being so open and helpful, I realized that they were not my weaknesses but my strengths. I learnt how to treat people and how to handle every obstacles, changes and how to get them into my development."



The lowest growth effect is seen for *mentor* and *lead*, which are the two final lessons, and students are not provided many opportunities to practice and hone these skills and competencies.

A crucial point to be noted in understanding the effectiveness of the entire course is that the level of student engagement with the course components is likely to have varied given their other academic commitments. Certain students have expressed that the course workload was far too taxing, making it difficult to provide their fullest for the course.

“This semester had a tight schedule. Even though I completed all the course work on website I found it harder at times due to the heavy load of this semester. It was really stressful.”

“Sometimes the workload too much for us because it was tough to balance all with course works, reports and other things.”

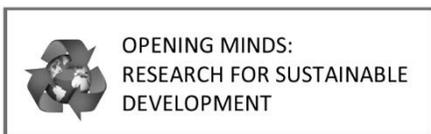
Additionally, certain students’ prioritizing technical subjects when pressed for time may have reduced their motivation towards full and timely engagement with the course components, leading to an overall reduced effectiveness.

4 CONCLUSIONS

The qualitative feedback, and overall growth scores (final score – initial score) would indicate that the course has been effective in supporting student development on the competencies. The course components, contents, and evaluation methods can be improved further based on the qualitative findings to make it more suitable for an undergraduate student.

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A Study on Teachers' perception on their Socio-Economic Status and Social Recognition in Northern Sri Lanka

R. Mangaleswarasharma*

Department of Secondary and Tertiary Education, Faculty of Education, Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: rmang@ou.ac.lk*

1 INTRODUCTION

High quality education is essential for the development of young citizens, with the skills and competencies they need to adapt to the 21st century. The success or failure in achieving quality education lies primarily on teachers. Nyakundi (2012) explains teacher motivation is the most important factor in the promotion of teaching and learning excellence. According to Michaelowa (2002), several factors negatively influence teacher motivation and job satisfaction in developing countries. Guajardo (2011) identifies these factors as workload and challenges, learning materials and facilities, remuneration and incentives, recognition and prestige, accountability and institutional environment and career development. An investigation into the factors that affect teachers' motivation and job satisfaction is therefore necessary to achieve educational goals.

According to the general examination results, in the recent years, the educational achievements of students in northern Sri Lanka have been decreasing dramatically. According to the 2015 December General Certificate in Education (Ordinary Level) results, the Northern Province was ranked last among the nine provinces in Sri Lanka. Further, only 60.38% of the students from Northern Province were eligible to follow Advanced Level classes. Therefore it is necessary to explore the

reasons for this decrease in educational achievement. Several studies have found that teacher motivation and job satisfaction play a crucial role in the educational achievements of students. However in the northern Sri Lankan context, research studies on teachers' motivation and job satisfaction and the factors that influence teacher motivation have not been carried out. Therefore the present study tries to explore the socio economic status and social recognition of teachers in relation to their motivation and job satisfaction in three districts in northern Sri Lanka.

1.1 Conceptual Framework

According to Richardson (2014) teacher motivation is an internal and external factor that stimulates desire or energy in teaching, to be continuously interested and committed to support students' learning goals. Therefore, in order to perform well in their teaching activities, teachers need to be motivated. The American Psychological Association (2007) defines socio economic status as the social standing of a person or a group which can be measured as a combination of education, income and occupation. Literature on the socio economic factors that influence teacher motivation reveals that motivational influences to teach depend on a complex array of personal,



social, cultural, economic and geographical conditions. According to Herzberg Hygienic theory, interpersonal relations, working conditions, and pay are hygiene factors, and absence of these factors can create job dissatisfaction. Issues associated with job satisfaction would adversely influence teacher motivation (Nyam and West, 2014). The review of empirical studies on teacher motivation in low income countries indicate that teacher motivation and job satisfaction are low and negatively impact students' learning in such contexts.

1.2 Research Objectives

The key objective of this study was to explore the socio economic status and social recognition of teachers in northern Sri Lanka. To achieve this, the following specific objectives were formulated.

1. To investigate the socio economic status of the teachers in Northern Sri Lanka
2. To study the social respect and recognition of teachers in Northern Sri Lanka
3. To examine the teachers' views in relation to their self confidence
4. To suggest measures to improve the economic status, social respect and recognition of teachers

2 METHODOLOGY

The study used a survey research design, which came out of a quantitative and qualitative data collection framework. This study involved the population of teachers in Northern Sri Lanka. The target population was teachers in three districts namely Jaffna, Kilinochchi and Mullaitivu in northern Sri Lanka. A total of 150 teachers who participated in a workshop were purposively selected for this study. A researcher designed survey questionnaire was used to collect data

from teachers. For the design of the questionnaire survey, the language used in the survey instrument was Tamil as Tamil is the mother tongue of the teachers in this study. The quantitative data from the questionnaire survey was analyzed using simple descriptive techniques such as frequencies and percentages. The qualitative data for the open ended questions were analyzed by coding and categorizing into emerging themes.

2.1 Participants

A total of 150 teachers were sampled for this study. Among them 46 teachers from Jaffna district, 15 teachers from Kilinochchi and 11 from Mullaitivu responded to the questionnaire survey. The following table describes the characteristics of the sample.

Table 1: Characteristics of the sample

Main characteristics	Sub Group	Total	
		N	%
Gender	Male	16	22
	Female	56	78
Age	>30 years	48	67
	<30 years	24	33
Experience	>10 years	17	23
	<10 years	55	77
Educational qualification	Advanced level	11	15
	Graduates	61	85
Professional qualifications	Professionally trained	47	65
	Not trained	25	35
Subjects	Arts	41	57
	Science	7	10
	Commerce	18	25
	Other	6	8



Table 2: Economic status of teachers

Statements		Jaffna		Kilinochchi		Mullaitivu		Total	
		N	%	N	%	N	%	N	%
Have a reasonable salary	Y	34	74	4	27	5	45	43	60
	N	12	26	11	73	6	55	29	40
Receive less salary as compared to the work being done	Y	26	57	9	60	6	55	42	58
	N	20	43	6	40	5	45	30	42
Income affects teaching work	Y	1	2	6	40	3	27	10	14
	N	45	98	9	60	8	73	62	86
Income is sufficient to meet my basic financial requirements	Y	28	61	2	13	4	36	34	47
	N	18	39	13	87	7	64	38	53
Involve in other supporting jobs for earning	Y	9	20	5	33	2	18	16	22
	N	37	80	10	67	9	82	56	78
There are other earning hands in the family	Y	35	76	11	73	8	73	54	75
	N	11	24	4	27	3	27	18	25
Satisfied with economic level of the family	Y	21	46	5	33	4	36	30	42
	N	25	54	10	67	7	64	42	58
Present economic status should be improved	Y	46	100	13	87	11	100	70	97
	N	0	0	2	13	0	0	2	3

Table 3: Social respect and recognition of teachers

Statements		Jaffna		Kilinoch		Mullaitivu		Total	
		N	%	N	%	N	%	N	%
My ideas are considered in decision making in school related tasks	Y	29	63	9	60	8	73	46	64
	N	17	37	6	40	3	27	26	36
I have enough freedom in planning and implementation of classroom teaching	Y	37	80	8	53	10	91	55	76
	N	9	20	7	47	1	9	17	24
My valuable works are appreciated by the government or educational administration or school administration	Y	34	74	9	60	8	73	51	71
	N	12	26	6	40	3	27	21	29
I have good relationships with students, teachers, parents and the community	Y	46	100	13	87	11	100	70	97
	N	0	0	2	13	0	0	2	3
I feel that I have given importance in the society	Y	46	100	13	87	10	91	69	96
	N	0	0	2	13	1	9	3	4
Total	Y		83		70		86		81
	N		17		30		14		19

3 RESULTS AND DISCUSSION

According to table 2, 60% of the teachers agreed that they have a reasonable salary. However, most of the teachers from Kilinochchi (73%) and Mullaitivu (55%) stated that they are not receiving a reasonable salary. Further, 58% of the teachers who participated in the study expressed the view that they receive less salary compared to the work they do. However they did not feel that their low income affected their teaching. 61% of the teachers from Jaffna district agreed that their income is sufficient to meet their basic financial requirements. However, most of the teachers from Kilinochchi (87%) and Mullaitivu (64%) did not agree with this statement. Further, 22% of the respondent teachers said that they were involved in other supporting jobs to fulfil their basic financial requirements. For the open ended question regarding the supporting jobs, 13.9% of the respondent teachers indicated tuition, 4.2% listed

tuition and agriculture and 1.4% stated self-employment as the supporting jobs they do. 58% of the respondent teachers are not satisfied with the economic level of their family and 97% of them felt that their present economic status should be improved.

From the table 3, 64% of the respondent teachers agreed that their ideas are considered in decision making in school related tasks. Further, 76% of them expressed that they have enough freedom in planning and implementation of classroom teaching. Similarly, 71 % of them accepted the fact their valuable work was appreciated. 97% of the teachers stated that they have a good relationships with students, teachers, parents and the community. Further, 96% of them feel that they are given importance in the society. This results revealed that the social respect and recognition of teachers in Northern Sri Lanka is high and teachers felt their importance in the society.

Table 4: Teacher’s self-confidence

Statements		Districts						Total	
		Jaffna		Kili		Mullai			
		Y	N	%	N	%	N	%	N
I like myself as a teacher	Y	44	95	13	87	10	90	70	97
	N	2	5	2	13	1	10	2	3
I think I have a lot of abilities	Y	46	100	13	87	11	100	70	97
	N	0	-	2	13	0	-	2	3
I am satisfied with my present performance	Y	46	100	12	80	10	90	68	94
	N	0	-	3	20	1	-	4	6
I have self-confidence	Y	46	100	14	93	11	100	71	98
	N	0	-	1	7	0	-	1	2
I feel myself better than others	Y	46	100	10	67	11	100	67	93
	N	0	-	5	33	0	-	5	7
Total	Y		99		83		96		96
	N			1		17		4	4

According to the table 4, 97% of the respondent teachers said that they like themselves and they have lot of abilities. 94% of them stated that they are satisfied with their own performance, while 93% of

them feel themselves to be better than others. Further, 98% of the teachers are confident about themselves. These results revealed that teachers have positive views regarding their self-concept.



The findings of the study indicate that the economic status of the teachers in northern Sri Lanka is not high. But their social respect and recognition are high and their self-concept as teachers is also therefore high.

For an open ended question on the ways to improve the socio economic status of their lives, 28 teachers responded. Their responses are summarized below:

1. Salaries of the teachers should be increased and fixed according to their qualifications and experiences.
2. Incentives should be provided to the better performing teachers.
3. Flexible loans should be introduced to enhance the economic status of teachers.
4. Awareness should be raised in the society to recognize the important role played by the teachers in the development of the nation
5. Special concern should be given during their deployments.

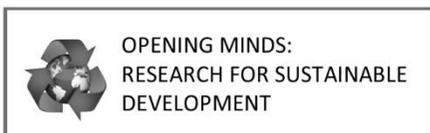
4 CONCLUSIONS AND RECOMMENDATIONS

The study revealed that most of the teachers are not satisfied with their salaries and economic status. They preferred to improve their economic status. A good number of teachers felt that society respects them, recognize them and their service. Further, most of the teachers have positive views about themselves. As teachers expressed their aspirations to improve their economic status, it is recommended that salaries of the teachers should be increased according to their qualifications and incentives should be provided to those who show better performances and good teaching practices. Further, for the teachers who teach in the out stations an additional allowances should be provided to meet their extra expenses.

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School Based Teacher Development: Opportunities and Challenges for Teachers in Jaffna District

Sasikala Kugamoorthy*

Department of Secondary and Tertiary Education, Faculty of Education, The Open University of Sri Lanka, Nugegoda, Sri Lanka.

**Corresponding author: Email: skuga@ou.ac.lk*

1 INTRODUCTION

We live in a modern society where the demands placed upon teachers have become complex. Therefore, teachers should be trained in order to meet the changing needs of the society. Professional training and quality professional development activities should be available to all teachers for development of the society. In the post war context, teachers in Jaffna district face challenges when trying to improve their professional competencies in order to enhance the efficiency and effectiveness of the school activities. School based teacher development activities are important for the improvement of teachers' professional competencies and student achievement in the war affected region. A competent teacher is able to exercise effective discipline and is able to establish a positive relationship with the staff, pupils and parents. The prevailing situation of the current society in Jaffna district expect this type of positive relationship to be rebuilt among the individuals. This will enable the society to move forward and bridge the gap created by the three decades long war.

Teachers' professional development is the key mechanism for the enhancement of classroom teaching and learning and student achievement (Ball and Cohen, 1999; Cohen and Hill, 2000). The Report

'Reviewing the evidence on how teacher professional development affects student achievement' mentions that professional development influences student achievement through three steps. First, professional development improves knowledge and skills of teachers. Second, enhanced knowledge and skills improve classroom teaching. Third, improved teaching elevates student achievement (Yoon *et al.*, 2007). If there is a malfunction in one link, student learning cannot happen as society expected. If a teacher fails to apply new and innovative ideas from professional development practices to classroom instruction, students will not be able to benefit from the teacher's professional development activities. The study on school based teacher development programmes points out that in general, schools do not have the ability to identify student learning achievements through a school based system (Silva *et al.*, 2007).

According to the situated learning approach, knowledge and skills are learned in the contexts that reflect how knowledge is obtained and applied in day to day situations. Situated cognition theory describes learning as a socio-cultural phenomenon rather than the action of individual acquiring general information from a de-contextualized



body of knowledge (Kirschner and Whitson, 1997). In the post war context, school principals need to consider the social condition of the Jaffna district and need to organize school based teacher development activities to fulfil the needs of the society through the teachers as agents of social change.

The main objective of this study is to identify the opportunities and explore the challenges faced by teachers in Jaffna district when they engage in school based teacher development activities effectively. The study focused on four specific objectives:

1. To examine to what extent teachers in Jaffna district aspire to their professional advancement;
2. To evaluate the extent to which the school-based teacher development activities satisfy the professional development needs of teachers in Jaffna district;
3. To identify the challenges encountered by the teachers in Jaffna district when engaging in school-based teacher development activities; and
4. To make recommendations to overcome the challenges when organizing school based professional development activities

2 METHODOLOGY

A Quantitative research approach was used in this study within a framework of survey research design. The population for the study was the teachers who are teaching in Jaffna district. Out of 7643 teachers, two hundred teachers were selected as the sample. The data were collected using questionnaire. The questionnaire focused on collecting data on three identified key areas namely (i) professional development aspiration (ii) what extent the school based teacher development activities satisfy the professional development needs (iii)

challenges encountered by the teachers in engaging in school based teacher development activities. 103 teachers returned their completed questionnaires. The data obtained were tabulated and analyzed by applying elementary quantitative techniques such as frequencies and percentages.

3 RESULTS AND DISCUSSION

Among the 103 respondents 27 are male and 76 are female and 67% of the teachers are graduates. The majority of the teachers (83%) teach at rural schools and 97% of the teachers have more than 5 years of teaching experience.

3.1 Professional Development Aspiration

The following data were collected when teachers were asked to indicate the roles which they aspire to perform for their professional advancement:

As shown in Table 1, the findings revealed that the majority of the teachers in Jaffna districts show their aspiration to perform their role as facilitator to support students' learning and at the same time they expressed their willingness to perform their roles as guide, moral builder, social developer and builder of the values of the society. These findings indicate that teachers realize the importance of their role to guide and facilitate student learning and to develop moralities and values among the children in their region in a post war context. However, they rated administrator role as the least aspired one. The reason for this may be that they feel educational administration is a difficult task in such unrest situations.



Table 1: Roles the teachers aspire to play

Roles	To a Great Extent		Some Extent		Moderate		Least Extent	
	N	%	N	%	N	%	N	%
Facilitator for Learning	50	48.5	47	45.6	06	05.8	-	-
Guide	42	40.7	53	51.4	08	07.8	-	-
Counsellor	28	27.2	57	55.3	18	17.5	-	-
Educational Administrator	11	10.7	42	40.7	41	39.8	09	8.73
Moral builder	53	51.4	42	40.7	11	10.7	-	-
Social developer	51	49.5	38	36.9	10	09.8	01	0.97
Builder the social values	45	43.5	47	45.6	11	10.7	-	-

3.2 Teachers’ satisfaction on school based teacher development activities

The following indications were given to identify to what extent school based teacher development activities satisfy the professional development needs of the teachers in Jaffna district.

Table 2 clearly shows that the majority of the teachers mentioned that the way activities conducted under the school based teacher development satisfied their

professional development needs to some extent and moderately. But it is noted that a considerable number of teachers expressed that the activities satisfied their needs to a least extent. More than 20% of them indicated that experts were not invited to help to update their knowledge and arrangements were not made to share the experiences and documents. Therefore, the results revealed that the school based teacher development activities did not fully satisfy their professional development needs.

Table 2: School based teacher development activities satisfy the professional development needs of teachers

Indications	To a Great Extent		Some Extent		Moderate		Least Extent	
	N	%	N	%	N	%	N	%
Identifying professional development needs timely	18	17.5	50	48.5	22	21.3	08	07.8
Formulating appropriate plans for professional development considering the social needs	11	10.7	36	34.9	42	40.7	11	10.7
Helping to carry out the plan successfully	13	17.5	41	39.8	36	34.9	09	08.7
Giving enough attention to the project which help to develop professional skills based on the present and future needs	16	15.5	39	37.8	33	32.0	09	08.7
Motivating activities related to teacher education	13	12.6	34	33.0	32	31.0	15	14.5
Inviting experts to help update knowledge	08	07.8	39	37.8	29	28.1	20	19.4
Creating opportunities to involve in innovative activities	12	11.6	31	30.1	43	41.7	12	11.6



Giving opportunities to participate educational conferences	15	14.5	26	25.2	38	36.9	19	18.4
Motivating to conduct action research	13	12.6	33	32.0	34	33.0	15	14.5
Implementing professional development activities effectively	10	09.7	43	41.7	35	34.0	06	05.8
Formulating peer groups among teachers for peer learning	17	16.5	39	37.8	26	25.2	16	15.5
Allocating a specific time to share the experiences of professional development activities	11	10.7	37	35.9	33	32.0	15	14.5
Organizing professional development workshops	16	15.5	39	37.8	25	24.2	18	17.5
Making arrangements to share the experiences and documents received from workshops	09	08.7	40	38.8	25	24.2	22	21.3

Table 2 clearly shows that the majority of the teachers mentioned that the way activities conducted under the school based teacher development satisfied their professional development needs to some extent and moderately. But it is noted that a considerable number of teachers expressed that the activities satisfied their needs to a least extent. More than 20% of them indicated that experts were not invited to help to update their knowledge and arrangements were not made to share the experiences and documents. Therefore, the results revealed that the school based teacher development activities did not fully satisfy their professional development needs.

3.3 Challenges encountered by the teachers when they engage in school based teacher development activities

The following statements were given to identify to what extent the teachers encountered challenges when they engage in school based teacher development activities.

As shown in Table 3, the majority of the teachers indicated that they faced

challenges when they engage in school based teacher development activities effectively. More than 50 % of the teachers agreed to a great extent that the funds allocated for school based teacher development was not enough and scholarship facilities were also not available for them. More than 40% of them agreed to a great extent or to some extent that the activities did not identify the present needs of school as well as society, found difficulties in identifying suitable resource persons and not ready to change traditional approaches. Only a very low number of teachers mentioned that they did not face any challenges. More than 20% of them least agreed with some statements and said that they received enough support and guidance, activities are conducted in a proper way, have cooperative attitudes among the peers and shared knowledge and experiences and respected the advice and guidance of experienced teachers. This showed that those teachers need a more supportive environment and the way activities are conducted should be related to the present needs of the school community and society.



Table3: Challenges encountered when engaging in school based teacher development activities effectively

Indications	To a Great Extent		Some Extent		Moderate		Least Extent	
	N	%	N	%	N	%	N	%
Not identifying present needs of the school community	21	20.4	33	32.0	21	20.4	16	15.5
Not identifying present needs of the society	17	16.5	28	27.2	31	30.1	19	18.4
No enough guidance and support	14	13.6	19	18.4	29	28.1	25	24.2
Activities are not conducting in a proper way	16	15.5	21	20.4	28	27.2	29	28.1
Enough funds are not allocated	54	52.4	17	16.5	09	08.7	14	13.6
Problems in identifying suitable resource persons	27	26.2	18	17.5	29	28.1	16	15.5
No any scholarship facilities for teacher development	54	52.4	22	21.3	11	10.7	09	08.7
Not having enough positive attitudes to share the experiences and knowledge	08	07.8	24	23.3	24	23.3	33	32.0
Having cooperative attitudes among peers	16	15.5	18	17.5	29	28.1	32	31.0
Not respecting experienced teachers advice and guidance	14	13.6	19	18.4	32	31.0	29	28.1
Not willing to change accepted traditional approaches	38	36.9	21	20.4	24	23.3	11	10.7

4 CONCLUSIONS AND RECOMMENDATIONS

The study revealed that in the post –war context;

1. Teachers in Jaffna district have aspired to play their professional roles as moral developers and social developers to a great extent.
2. Only 51% of the teachers have showed their willingness to perform as school administrators.
3. A considerable number of teachers (from 8% to 21%) in Jaffna district showed their satisfaction to a least extent about the way activities conducted under the school based teacher development.
4. The majority of the teachers have faced challenges when they engaged in school based teacher development activities effectively.

Teachers in Jaffna district faced many problems in their professional development due to internal situation. Now they aspire to perform their roles towards moral and social development. Therefore, this study suggests that the officers those who organize school based teacher development activities should consider the present needs of the school and society and should address them through such activities.

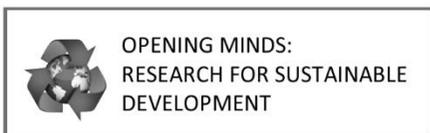
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A Study on Student Teachers' Perceptions on the Continuous Assessment Methods of the Postgraduate Diploma in Education Programme

S. Kugamoorthy*, W.M.S.Weerakoon, W.M.S. Wanasinghe and J.D.Careemdeen

Department of Secondary and Tertiary Education, Faculty of Education, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: skuga@ou.ac.lk*

1 INTRODUCTION

The Post Graduate Diploma in Education (PGDE) is one of the most popular programmes offered by the Faculty of Education of the Open University of Sri Lanka for graduate teachers with the objective to develop their professional skills while they are in the teaching service. The PGDE programme is conducted annually at 18 regional and study centres. This programme is conducted in all three media namely Sinhala, Tamil and English and around 3500 student teachers register for the programme every academic year. Take home assignments and activity based assignment in day schools are considered as the main methods of Continuous Assessment (CA) of the programme. Since there is a large number of take home assignments involved, the Faculty heavily relies on External Marking Examiners for assessing them at different centres.

According to McMillan (2000), assessment enhances teaching and influences student motivation and learning. Navaratna and Silva (2013) recommended that it is needed to educate students on how to use Continuous Assessment as an effective learning tool, especially at the commencement of the

program. A number of research studies (Lekamge and Jayathilake 2002, Lekamge *et. al.* 2013)) has been carried out about the CA system of the PGDE programme and they suggest long term and short term measures to address the problems and issues identified.

The Faculty staff has been spending a considerable time discussing possible interventions to improve the quality of the CA component and some procedures such as participatory approach to set and finalize the assignments, conducting training programmes annually for marking examiners, decentralizing the marking of assignments under the monitoring of assignment coordinators and activity based assignment for each course have been introduced. In 2015, the department of Secondary and Tertiary Education decided to introduce another change to the assessment mechanism of the PGDE programme. Accordingly, the department has introduced Continuous Assessment Test (CAT) for all courses of the PGDE from the academic year 2015/2016, instead of one take home assignment. CAT was conducted at every Regional and Study Centre on the same date and time. After introducing CAT no extensive study was carried out to



evaluate the effectiveness of the new mode of assessment introduced in the CA component of the PGDE programme.

1.1 Objectives of the study

The exploratory study was conducted to identify the strengths and limitations of the new intervention and to make suggestions for further improvement of the CA mechanism. The following specific research objectives were formulated in line with the major objective of the research study:

1. To identify student teachers' perception about the CA methods used in the PGDE programme;
2. To identify how far the CAT assessment method motivated self-learning practices among the PGDE student teachers;
3. To evaluate the challenges faced by the student teachers to complete the CA components of the PGDE programme;
4. To make suggestions to improve the effectiveness of the CA mechanism of the PGDE programme

2 METHODOLOGY

Quantitative and qualitative research approaches were used in this study within a framework of a survey research design. The population for the study constituted student teachers (3200) who have registered for the PGDE programme for academic year 2015/2016. Six hundred (600) student teachers were selected as the sample. The data were collected using a questionnaire. Three hundred and twenty four (324) returned their completed questionnaires. The questionnaire was structured type and focused on collecting data on four identified key areas: (1) perception of student teachers about the three type of CA methods, (2) how far CAT assessment

method motivate self-learning practices (3) challenges faced by the student teachers to complete the three types of CA component and (4) Suggestions to improve the CAT component. There were four main items in the whole questionnaire, and the number of questions in each key area varied. Also, under some of the main items there were several sub items, which were included to get a broader understanding on the aspects related to the main items. Rating scales, structured type questions and few open-ended questions were among those sub items.

3 RESULTS AND DISCUSSION

3.1 Student teachers' perceptions on CA methods

Majority of student teachers (98%) mentioned that they have received the relevant documents (Printed modules, Assignment book, instructions and guidelines, etc.) to complete the activities pertaining to CA component without any delay and they accepted that continuous assessment mechanism helped to motivate them to learn at distance mode as an adult learner. Most of the student teachers believed that CA component helped them to face final examination more confidently. Majority of the student teachers (89%) mentioned that CAT and take home assignments increased their motivation for self-study than activity based assignment. All the respondents expressed their views on how far these three CA methods increased their self-motivation as distance learners.

All the respondents expressed their level of consent with regard to the CAT based on following level of degrees:

- (5) Strongly agree
- (4) Agree
- (3) Neither agree or disagree
- (2) Disagree
- (1) Strongly disagree.



Table 1: Students teachers' views on continuous assessment methods

CA methods	Student teachers views
Take home assignment	Motivate to refer modules and extra reading materials. Part II of the take home assignments increased our involvement to identify actual situations of the classroom and school settings. It motivated to explore new and updated information
Continuous Assessment Test	We thought.... compare to take home assignments we can easily prepare our self for CAT exam. But we realise.... writing answers for short and structured type questions.... we need to study carefully and clearly. Prior notice of relevant sessions helped me to prepare for the test.
Activity based assignment	Increased our presentation and leadership skills, promote collaborative learning; it helped to share our knowledge with others. It provided practical approach into the theory we learned and opportunities to apply theory into practice.

Table 2: Student Teachers Consent on CAT

Statements	5		4		3		2		1	
	N	%	N	%	N	%	N	%	N	%
The knowledge instructed through the PGDE programme is sufficient to face the CAT examination successfully.	78	24	224	69	23	07	-	-	-	-
Time Allocation for CAT examinations is sufficient	58	18	259	80	-	-	03	01	03	01
Clear instructions are given for completion of the CAT.	91	28	217	67	-	-	06	02	10	03
CATs provide sufficient opportunities to relate theory with practice.	65	20	211	65	06	02	19	06	23	07
It is more useful to inform the study sessions in advance which is going to be evaluated under the CAT.	275	85	49	15	-	-	-	-	-	-
The structure of the CAT papers is more helpful to construct and organize the answers.	55	17	217	67	06	02	19	06	32	10
Clear and simple language has been used in the CAT papers.	65	20	211	65	06	02	19	06	23	07
A supportive atmosphere was maintained by the supervisors at the CAT examination centers.	32	10	211	65	16	05	26	08	39	12
Sufficient infrastructure facilities are provided to carry out the CAT examinations.	42	13	185	57	19	06	32	10	32	10

CAT examinations are more useful than Take Home assignments.	233	72	58	18	-	-	23	07	10	03
As adult learner CAT examinations are helped to manage my available time than written assignments.	52	16	224	69	10	03	16	05	23	07
CAT examinations make me to learn in depth than written assignments.	36	11	181	56	19	6	49	15	39	12
Grades received for the CAT examinations are sufficient for my attempt.	81	25	175	54	-	-	29	09	39	12
The feedback given for me after the CAT examination are more useful.	16	5	68	21	23	07	12 3	38	94	29
CAT examinations are increasing our motivation for continuous learning.	55	17	191	59	10	3	32	10	36	11

As indicated in Table 2 the findings revealed that the highest number of the student teachers perceived the CAT method positively. The majority of the student teachers expressed that, CAT examinations are more useful (72%) than take home assignments. This may be because they feel that for the research based assignment they need to spend more time to observe the classroom settings. It

is noted that most of the student teachers disagree (38%) or strongly disagree (29%) with the usefulness of the feedback given for the CAT.

Open ended questions in the questionnaire allowed the student teachers to mention the challenges faced by them in doing the CA component effectively.

Table 3: The Challenges Faced by the Student Teachers to Complete the CA Component

CA methods	Problems faced by the student teachers
Take home assignment	Difficulty of organising relevant answers, some sessions relevant to the assignment are not covered in the day schools. Difficulty of understanding particular problems in the assignment. We have to spend long time to complete assignment. Delay in receiving marked assignments. Personal barriers in writing and submitting assignments before the due dates.
Continuous Assessment Test	Not sufficient time allocated. Knowledge gained in the day school is not enough to face the test. Difficulty of organising short and structured answers. Delay and not receiving CAT marks and no enough feedback.
Activity Based Assignment	Not sufficient time allocated for group activities. Not receiving same opportunity for all to present. Some of the group members not contributed.



The following suggestions are mentioned by the student teachers for improving the CAT method.

- Grades for the CAT examinations should be informed before the next CAT.
- Enough time need to be allocated for CAT.
- Timely feedback should be given.
- It is good to give the answers of the CAT.
- It is preferred to return the marked CAT papers to the students.

4 CONCLUSIONS AND RECOMMENDATIONS

It can be concluded that introducing the CAT into the CA component was very useful for the student teachers to upgrade their knowledge and to face the final examination more confidently as a learning tool. Even though the CAT was a new experience to the student teachers they were motivated to participate in the CAT. Student teachers showed their satisfaction about the overall organization of CAT.

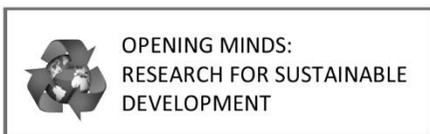
The findings suggest that in order to increase the effectiveness of the CAT method the Faculty of Education need to consider the following recommendations;

1. Grade received by student teachers for the CAT examinations should be informed as early as possible.
2. Establish a proper mechanism to give feedback to the student teachers in relation to the CAT answer scripts
3. Improve the monitoring mechanism with regard to the CA component more efficiently and effectively.

Overall, the study revealed that the new mode of assessment introduced to the CA mechanism of the PGDE programme is positively perceived by the student teachers.

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Practical Applicability of Directed Motivational Currents (DMC) as Means of Inspiring ESL Teachers

Dilmini Direckze^{1*} and Hemamala V. Ratwatte²

¹*Department of PGIE, Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of English, Open University of Sri Lanka, Nugegoda, Sri Lanka*

**Corresponding author: Email: dilmini.direckze@gmail.com*

1 INTRODUCTION

Teachers are the main resource that contributes to high achievement in any educational institute. High achievement can be attained by making classrooms into more creative, enthusiastic learning environments if teachers use their knowledge and skills to formulate a clear vision of an outcome and an effective pathway to achieve that vision. In order to succeed in this endeavour, teachers should maintain strong, pragmatic motivation. Researchers have posited many theories regarding the sustaining of motivation and encourage educationists to apply these theories to their practice. The recent “Directed Motivational Current” (DMC) theory (2016) is a motivation construct proposed by Dornyei to strengthen the long-term sustainability of motivated behaviour in an individual. This model proposes a practical motivational surge through the creation of a vision and future goals. A DMC is well above an individual’s normal motivation because it has a strong sensory element or vision which works with the final goal as well as with each sub-goal along the DMC pathway. One framework proposed by Dornyei, within DMC, to engage individuals or a group on a long-term motivational surge is ‘All-eyes-on-the final-product’. The objective of this study is to test the applicability of the ‘All-eyes-on-the final-product’ framework with a group of English as Second Language (ESL) teachers in Sri Lanka.

2 METHODOLOGY

A five week focused intervention was carried out with four ESL teachers from a government mixed school in the Central Province of Sri Lanka. The teachers had to plan, organize and conduct an English day for primary school learners who had never seen or participated in such an event. The intervention was designed using the DMC markers of the ‘All-eyes-on-the final-product’ framework. Thus, the intervention used the stages of the motivational process identified in the framework. One teacher was advised to lead the group towards the final goal by following the sub-goals planned out. Qualitative data was obtained from the informant teachers, parents of students, the School Principal and other influential persons who attended the English Day celebrations. The researcher also made notes on the behaviour of the teacher-informants with regard to the intervention through the five weeks.

2.1 Participants

Four female ESL teachers who are responsible for teaching English to about 500 primary students participated. Their students learn English primarily at school and do not use the language at home or outside. The parents of most students have not completed their education and do not use English. All four teacher-informants had completed their professional teacher education course at a National College of



Education. Their teaching experience varied from 6 – 18 years and have been working in primary classrooms with minimal facilities.

2.2 Instruments and Procedures

The reflections of the teacher-informants were obtained through interviews using semi-structured questionnaires at different stages of the intervention. The questions were designed according to the ‘All-eyes-on-the-final-product’ framework. In order to strengthen the current study the questions were matched with another motivational framework - the six phase

‘Visionary Training Approach’ designed by Dornyei and Kubaniyova (2014). The ‘Visionary Training Approach’ seeks to increase the capacity of the vision that provides the motivation to achieve a specific goal (see Table 1). The views of the Parents, the School Principal and other influential persons were obtained through one-to-one discussions after the English Day celebrations. The researcher made notes on the observed behaviour of all four teacher-informants with regard to the intervention through the five weeks. The recordings of interviews and discussions were transcribed and analysed. The findings were triangulated.

Table 1: DMC markers and comparative phases of Visionary training approach of questions used in the semi-structured interview

Questions	Main points of the ‘All-eyes-on-the-final-product’ framework	DMC Marker	Phases of “Visionary training approach”
1. What takes most of your time these days?	A tangible outcome and real audience	Investing significant levels of time and effort	1. Creating the vision
2. What was decided to do in the group meeting?		Goal being constantly on the minds (of teachers)	
3. What was your plan for the week?	Clear sub-goals	Goal being constantly on the minds (of teachers)	2. Strengthen the vision
4. What did you do to achieve your target for the week?	Reality and authenticity	Investing significant levels of time and effort	
5. Did the school authority help you with the project?	Reality and authenticity	Teachers experience it as something special	
6. What are the language skills students have learnt?	L2 content	Surpassing expectations	3. Challenge-skill balance
7. Do you see your students develop their L2 skills through your activities?	L2 content	Surpassing expectations	
8. Did you see students’ motivation through your work?	Clear sub-goals	Surpassing expectations	4. Transform vision into action
9. Do you feel “achieved” during the week?	Clear sub-goals	Surpassing expectations	5. Keeping the vision alive
10. What was your responsibility to achieve the final goal?	Project roles and norms	They (teachers) experience it as something special	6. Counter balancing the vision
11. How do you feel about your responsibility regarding English Day?	Project roles and norms		
12. Do you feel you did your responsibility well?	Project roles and norms		



2 RESULTS AND DISCUSSION

The responses and observances with regard to the key stages of the ‘All-eyes-on-the final-product’ will be discussed. The findings reveal interesting facts about teacher motivation as well as the DMC of a group.

2.1 Data Analysis

Responses to the first question (Table 2) clearly show that all the teacher-informants were initially focusing on non-

intervention related work. They were hesitant to discuss about a group project. At the first meeting, the creating of a clear common vision about the group project was observed. Teacher 4 was absent for the meeting. Their response showed that during the last week, the three teachers who were present, had given priority to the group project while teacher 4 was still focusing on another project. The three teacher-informants have acquired a DMC marker by investing significant time and effort on the project. They were ready with a real audience to show the performances.

Table 2: Answers in brief to question no. 1 of semi-structured interview in Week 1 and 5

Week	What takes most of your time these days?				Observations by researcher
	Teacher 1	Teacher 2	Teacher 3 (leader)	Teacher 4	
1	Correcting books and teaching	Housework. I always come late to school.	My own studies	Practicing songs for grade 6 students	Teacher 4 absent from 1 st group meeting. Teachers were reluctant to do a group work.
5	English Day practices and rehearsals	English Day practices specially the oil lamp	English Day work	<u>Secondary</u> section English day	Teachers talked a lot about the common goal.

Table 3: Answers in brief to question 3 of semi-structured interview in Weeks 1, 3, 4 and 5

Week	What was <i>your plan for the week?</i>				Observations by researcher
	Teacher 1	Teacher 2	Teacher 3 (leader)	Teacher 4	
1	Covering the syllabus and selecting students for songs.	I was asked to get the date fixed and prepare a budget.	<i>I wanted to do a better English Day.</i>	Planning secondary section English Day.	Teacher 2 and 4 was not ready for the group project yet.
3	<i>Determined to overcome challenges of the project.</i>	Try to get husband’s help to record a song.	To focus more on correcting pronunciation	To have more items for grade 6 students.	Teacher 4 was not focussing on the project.
4	To give more practice to students and motivate them.	<i>Determined to do a better English day</i>	To prepare speeches and finalize items.	Take grade 6 students to the stage for rehearsals.	Teacher 2 showed the interest of the group work
5	To do the project well. Worried about Teacher 2’s work.	Planned to complete what I volunteered.	To cover absent teachers’ work.	I planned to help primary section with stage décor.	Insufficient, unenthusiastic support from teacher 4.



During the 3rd week, teacher 1 was determined to do a good English day. During the interview, her statements showed that her sudden intense motivation emerged as a result of negative comments and challenges given by teachers outside the group in the primary section. It was observable that her DMC like experience began with a negative influence.

Teacher 2 showed her intense motivational surge during the 4th week. According to her, it was also due to continuous negative comments and challenges given by other teachers in the section who could not accept the positive change of students regarding L2.

The behaviour of the leader (teacher 3), indicated DMC like motivational surge from week 1. Her DMC experience began with an intrapersonal reason: finding a passion.

However, teacher 4 does not appear to have a DMC like experience regarding the primary section project. There could be several reasons: she was absent for the first meeting and was involved in another project. Yet, by the end of week 5, all four teachers were focusing on the group project.

Teacher 1 was worried about teacher 2's delay in completing her responsibilities while teacher 3 made up her mind to do the work of teacher 2 if the project was going to fail due to the movements of teacher 2.

The authenticity of the project was constantly in the minds of three teacher-informants showing they were caught up by DMC like motivation. They strengthened their final goal through various short-term goals such as performing complete rehearsals.

Answering to question number 7, teacher-informants 1, 2 and 3 stated they were not happy about the L2 development of students during the first week (see Table 4). But they have noted a sufficient development during the 5th week. Satisfaction of surpassing the expectations of teacher-informants could be observed during the 5th week. However, the vision and focus of teacher 4 was not compatible with other teachers.

Even though teacher-informants 1, 2 and 3 stated they felt 'achieved' something during 1st and 5th weeks, their expressions and behaviour indicate a qualitative difference in the degree of achievement by the 5th week. (See Table 5). They seemed happy and confident about keeping their vision alive through various sub-goals such as rehearsals on the stage, preparing students to make announcements, performances, and so on.

Answers to question 10 show that teachers 2 and 4 did not have a clear vision of the project at the beginning unlike teacher 1 and 3 (Table 6). However during the process, the highly motivated teachers volunteered and undertook many tasks. They understood the project roles and norms as well as how to counter balance the final goal.

The comments and feedback received from the School Principal and influential persons and parents of students give an indication of what the teachers had accomplished through the group-project. The praise received from those who witnessed the successful English day celebration, indicates that the intervention had achieved its objectives vis-à-vis the teacher motivation and L2 development of students. This confirms the influence of group DMC in motivating teachers.

Table 4: Answers in brief to question number 7 of semi-structured interview in Week 1 and 5.

Week	Do you see your students develop their language skills through your activities?				Observations by researcher
	Teacher 1	Teacher 2	Teacher 3 (leader)	Teacher 4	
1	Not happy	Not enough	Not much	Of course.	Teachers 1, 2 and 3 are motivated to do the project.
5	Yes.	Yes.	Yes. A lot.	Yes.	

Table 5: Answers in brief to question no. 9 of semi-structured interview in Week 1 and 5.

Week	Do you feel you 'achieved' at the end of the week?			
	Teacher 1	Teacher 2	Teacher 3 (leader)	Teacher 4
1	Yes. I covered the syllabus.	Not much.	Yes, with difficulty	Yes, I feel so.
5	Yes, We did it!!! Finally I felt relaxed.	Yes, I feel confident and achieved.	Yes, a lot of hard work but I am happy.	Of course I did.

Table 6: Answers in brief to question no. 10 of semi-structured interview in Week 1 and 5.

Week	What was your responsibility to achieve the final goal of the group?			
	Teacher 1	Teacher 2	Teacher 3 (leader)	Teacher 4
1	Selection of students.	I was asked to do certain duties.	Using audio equipment for practices.	I was asked to help in teaching lessons.
5	So many. I volunteered some work.	A lot as the Head. Yet, I volunteered some more.	I volunteered to focus on overall programme and guide the group.	Not given any. I volunteered to make paper flowers

4 CONCLUSIONS AND RECOMMENDATIONS

The study shows that DMC can be applied practically to inspire a group towards a specified goal using 'All-eyes-on-the final-product' framework. The data also showed that the quality and dynamism of the leadership given is necessary for achieving success. Thus it would appear that 'All-eyes-on-the final-product' framework can be used to inspire and sustain ESL teacher motivation in the context of Sri Lanka.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Teachers' Attitudes towards the Use of Information and Communication Technology in the Instructional Process of Secondary Education in Sri Lanka

K.G.S.K. Perera^{1*}, S.P. Karunanayaka² and A. Ariyaratne²

¹*Department of Information Technology, Faculty of Science and Technology, National Institute of Education*

²*Department of Secondary and Tertiary Education, Faculty of Education, Open University of Sri Lanka, Nugegoda, Sri Lanka.*

*Corresponding author: Email: kgskperera@yahoo.com

1 INTRODUCTION

The implementation of Information and Communication Technology (ICT) plans in the school sector of Sri Lanka commenced way back in 1983 (Department of Computer Education, 2000). In 1994, instead of providing computers to individual schools, a computer centre per educational zone was instituted. In 1999, the Ministry of Education commenced providing schools with ICT laboratories known as Computer Learning Centres, for the purpose of promoting the use of ICT in education. Since then there has been exponential growth in the investment on ICT in the school sector. At present, ICT laboratories have been established in 3,675 schools (Ministry of Education, 2016). Over 100,000 teachers have been trained in basic ICT skills and have been provided introductory courses of Computer Assisted Learning (Pasqual, 2011).

Despite the fact that education systems have heavily invested in ICT since 1980s, there is a dearth of indicators of the levels acquisition of ICT and its usage in education. The mis-match between the

weak evidence and the growing use raises many questions about the nature of ICT-related investments in the education sector in developing countries. (Tolani-Brown *et al.*, 2009). Therefore, it is worthwhile to investigate this scenario in order to identify the factors affecting the unsatisfactory nature of using ICT in education.

This study was conducted with the following objectives: to ascertain the strength of the attitudes of Sri Lankan school teachers towards the use of ICT in their instructional process, and to determine whether there is a significant difference of attitudes among teachers of Science, Geography and English among themselves and with respect to ICT teachers.

1.1 Research Questions

1. What is the strength of internal aspects of the attitudes of teachers which affect the use of ICT in the instructional process?
2. What is the strength of external aspects of the attitudes of teachers



which affect the use of ICT in the instructional process?

3. Is there a significant difference in attitudes among teachers of Science, Geography and English?
4. Is there a significant difference in attitudes among ICT teachers and non-ICT teachers (Science, Geography and English)?

Internal aspects of the attitudes refers to those attitudes directed towards oneself, whereas external attitudes are directed towards external agents who could have an influence on the issue one is interested in (McLeod, 2014). External aspects such as teachers' attitude towards the Principal (Tondeur *et al.*, 2008) and towards the teacher-in-charge of the ICT lab (Dexter *et al.*, 2002) are considered in this context. The selection of subject areas was based on ICT as benchmark for other subjects. Science, Geography and English are purposively selected to represent different subject areas where ICT integration is more practical within the Sri Lankan secondary education curriculum and literature review.

2 METHODOLOGY

2.1 Research Design

The research was designed as a survey conducted by administering attitude questionnaires on a Likert type response scale.

2.2 Sample

The population was the teachers who have received ICT training and are teaching at schools with ICT laboratories. The sample was constituted by 280 secondary school teachers teaching the subjects ICT, Science, Mathematics and Geography, randomly selected and stratified over the subjects taught, representing three Provinces of the country (to represent high, medium and low facility school

sectors) as indicated in Table 1.

Table 1: Composition of the sample

Province	Number of participants				
	ICT	Science	English	Geography	Total
Western	35	30	30	25	120
Southern	20	20	20	20	80
Uva	20	20	20	20	80
Total					280

2.3 Methods of data collection and analysis

Eight attitude questionnaires with a Likert-style scoring scale were administered to the sample of 280 teachers to inquire into the following aspects of their attitudes.

1. The teacher's enthusiasm towards computers
2. The teacher's anxiety about computers
3. The teacher's attitudes about the negative impacts of computers on society
4. The teacher's attitude about the productivity of computers
5. The teacher's avoidance of computers
6. The teacher's attitude towards the principal of the school
7. The teacher's attitude towards the teacher-in-charge of the ICT lab
8. The teachers' computer self-efficiency

Questionnaires 1, 2,3,4,5 and 8 were used to measure the internal aspects of the teachers' attitudes while questionnaires 6 and 7 were to measure the external aspects.

Questionnaires 1 to 5 are standardized tools (Christensen and Knezek, 1998) and



Questionnaire 8 was adapted from a standardized questionnaire (Ulas, 2010).

The assessment of the teachers' attitude towards the Principal (6) and teacher -in-charge of the ICT lab (7) were developed by the researcher based on the information found in the literature review (Tondeur *et al.*, 2008; Dexter *et al.*, 2002).

These two questionnaires were piloted with 29 and 25 teachers respectively. Reliability test (Cronbach alpha) for questionnaires 6 and 7 were 0.91 and 0.76 respectively.

Test of One-way ANOVAs was applied on each questionnaire with Scheffe Posthoc at 0.05 significant level.

A quantity called Proximity to Maximum Possible Value (PMPV) was defined and computed in order to check how close the mean value of a construct returned by each questionnaire was to the maximum possible value. This facilitates the comparison of the relative strength of each attitude.

[PMPV= (mean/maximum possible value that could be scored on the questionnaire)*100]

Reliability test (Cronbach alpha) for questionnaires 6 and 7 were 0.81 and 0.74 respectively.

3 RESULTS AND DISCUSSION

Table 2: Internal aspects of attitudes of teachers measured in PMPV

Attitude	Science	Geography	English	ICT
Enthusiasm towards computers (Q1)	79.82	80.84	79.20	83.33
Anxiety about computers (Q2)	27.77	36.76	35.64	32.97
Attitudes about negative impacts of computers on society (Q3)	58.91	54.96	55.22	52.31
Attitude about productivity of computers (Q4)	79.16	81.87	82.17	83.83
Computer self-efficacy (Q8)	65.59*	67.55	64.78*	73.14*
Avoidance of computers (Q5)	44.20	45.54*	43.08	38.66*

* Significant at .05

3.1 What is the strength of the internal aspects of the attitudes of teachers affecting the use of ICT in the instructional process?

According to the Table 2, measured in terms of PMPV, it is revealed that the teachers' enthusiasm to computers and belief of productivity of computers stayed

at a higher level. Teachers' computer self-efficacy was at a satisfactory level. Teachers do not have a negative attitude about ICT as indicated by the low mean values in anxiety to computers and low mean value in tendency to avoid computers. The agreement of teachers regarding the negative impact of computers on society needs improvement, although it is above 50% mark.



Table 3: External aspects of attitudes of teachers measured in PMPV

Attitude	Science	Geography	English	ICT
Attitudes towards Principal of the school (Q6)	69.3*	78.93*	72.00	73.60*
Attitudes towards ICT lab-in-charge teacher (Q7)	62.0*	67.4	61.7*	76.2*

* Significant at .05

3.2 What is the strength of external aspects of attitudes of teachers affecting the use of ICT in the instructional process?

According to the Table 3, strength of the external aspects of the teachers’ attitudes is also at a satisfactory level. Teachers do not have a negative attitude towards the Principal with respect to the use of ICT in the instructional process and, they have a positive attitude towards the teacher in-charge of the ICT laboratory.

3.3 Is there a significant difference in attitudes among teachers of Science, Geography and English?

It has been found that (Table 3) in the case of internal aspects of the attitudes, differences of attitudes are significant only in Q5 and Q8. In Q5, the difference between Geography teachers and ICT teachers was significant (>.024). In Q8, difference between ICT teachers and English teachers was significant (>.007) and difference between ICT teachers and Science teachers was significant (>.018). It is not surprising that computer self-efficacy differs between ICT vs English and ICT vs Science, but it is hard to explain why there is no significant difference between ICT teachers and Geography teachers in this case. In Q6, the difference between Geography teachers and Science teachers was significant (>.024). In Q7, the difference between ICT teachers and English teachers was significant (>.001) and the difference between ICT teachers and English teachers was significant (>.001). However, the opinions of English and Science teachers was lower than

Geography teachers in both these cases. Even the teacher-in-charge of the ICT Lab also admits that he/she is unable to provide 100% service to non-ICT teachers in the use of ICT for teaching (PMPV=76.2).

3.4 Is there a significant difference in attitudes among ICT teachers and non-ICT teachers (Science, Geography and English)?

As evident from Figure 1, the attitudes of ICT teachers are better than those of non-ICT teachers, in all eight aspects. Except in the case of questionnaire 6 (Teachers’ attitude towards Principal) in all the other cases, the differences of attitudes between ICT and non-ICT teachers are significant as per the t-statistics at 0.05 significance level.

The highest attitude difference is recorded from the attitude of non-ICT teachers towards the teacher in-charge of the ICT. This is not surprising since ICT teachers are the teacher-in-charge of the ICT labs themselves and they were referring to themselves when answering the questionnaires. However, PMPV value is 73.14 indicating that they themselves are not pleased with their contribution to non-ICT teachers in the use of the ICT laboratory.

The next highest difference is reported from Questionnaire 8 (computer self-efficacy) which is again acceptable as ICT is the ICT teachers’ main subject area. Apart from those, the other differences range from 0.19 to 5.61 implying that there is no broad difference in attitudes between ICT and non-ICT teachers.



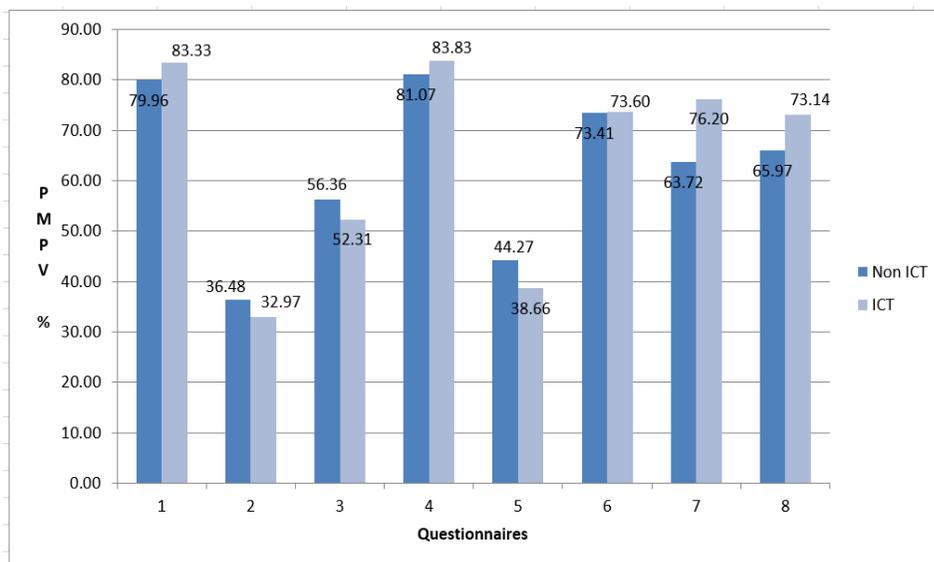


Figure 1: Proximity to Maximum Possible Value of the Overall Mean of each attitude

4 CONCLUSIONS AND RECOMMENDATIONS

The study revealed that teachers have a positive attitude towards the use of ICT in their instructional process. Their enthusiasm and opinions about the productivity of computers were high and these have been cross-checked in terms of anxiety to and avoidance of computers. External factors, which were assumed to be stumbling blocks in the use of ICT in instructional processes, such as the Principal’s involvement and assistance of the teacher in-charge of the ICT laboratory were not found to be negative from the participants’ point of view. Variation of attitudes was not found to be significant among non-ICT teachers except in the case of the attitude towards the Principal’s involvement where Geography teachers had a higher value than that of the Science teachers.

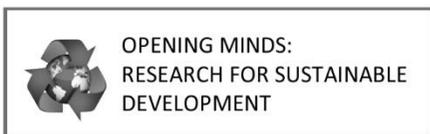
Despite these positively-rated factors and teachers’ sound computer self-efficacy the study demands more investigations of a qualitative nature into the poor use of ICT in the instructional process.

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Study on the Facebook Usage of Undergraduates at the **University of Vocational Technology, Sri Lanka**

N.W.K.D.V.P. Opatha*

University of Vocational Technology, Sri Lanka

**Corresponding author: Email: v.opatha@gmail.com*

1 INTRODUCTION

The starting point of social networking websites can be traced to the 1960s and it has evolved in different ways to what exists at present. Nowadays, social networking plays major roles in education, entertainment and business apart from bridging the gap between people who reside far away from each other. Among the many social networking websites in existence today, Facebook is considered the leading social networking site among internet users around the globe as well as in Sri Lanka. According to statistics from the Pew Research Centre in 2016, there are over 3.5 million active Facebook users in Sri Lanka, and the majority of them are between the age of 18 and 24 years. They form 74% of the total active Facebook users in the country. Moreover, 32% of active Facebook users in Sri Lanka belong to the age group between 25 and 34 (Internet Usage Statistics in Sri Lanka, 2017).

Many researchers have studied the positive and negative impact of Facebook on the academic performance of undergraduates in different universities around the globe. Even though researchers argue about the use of Facebook as an educational tool, many have studied and proved that it can adversely affect academic performance (Arora and Karim, 2016, Zekiri, 2016).

However, in the Sri Lankan context, only a limited number of research studies have been carried out regarding Facebook and its impact on the academic performance of undergraduates (Thuseethan and Kuhanesan, 2014). The University of Vocational Technology, which was established by Parliamentary Act No. 31 of 2008, has undergraduates pursuing two different modes of studies in two faculties. At present, the university has full-time (batch 1) and part-time (batch 2) undergraduates, who are conducting their studies on weekdays and weekends respectively.

1.1 OBJECTIVES

This study expected to build a vast amount of knowledge related to the Facebook usage of undergraduates at the University of Vocational Technology. The following were the research questions for this study.

1. To what extent and for what purposes do undergraduates in the University of Vocational Technology use Facebook?
2. What are their perceptions of the use of Facebook?
3. Is there a relationship between the time spent on Facebook and their academic performance?



2 METHODOLOGY

2.1 Research Design

This research study was designed as a survey, which was conducted among the part-time and full-time undergraduates in various disciplines at the University of Vocational Technology, Ratmalana.

2.2 Sampling Procedure

There is a difficulty in getting responses from all undergraduates of the university. At present, the total student population of the university in both full-time and part-time study programs is 1,198. The characteristics of both these groups (part-time and full-time) are different from each other. Fulltime undergraduates dedicate all their time to studies, whereas part-time undergraduates are employed in various industries and studying for their degree on weekends. Due to these reasons, the research was designed in a way that the sample was determined by using the stratified random sampling method. Two strata were determined for full-time and part-time students, which consisted of equal number of respondents for each stratum, to avoid the biases in results and discussion of results. The total number of respondents was 118.

2.3 Methods of Data Collection and Analysis

This research was carried out by conducting a survey to solicit primary data from respondents. The survey instrument was a questionnaire consisted of close-ended and open-ended questions, which focused on the Facebook usage habits and academic practices of undergraduates at the University of Vocational Technology.

Apart from that, the questionnaire attempted to collect data relating to the undergraduates' perceptions of Facebook usage by using Likert scale type questions.

The Likert scale type questions tried to receive a rating on various opinions which had a rating from 1 to 5.

The questionnaire consisted of questions to receive both categorical and numerical data. The data was analyzed using the software package iNZight, which was developed by the University of Auckland, New Zealand. Spearman Rank Correlation was used to identify the correlation coefficient between the time spent on Facebook by individuals and Cumulative Grade Point Average (CGPA).

3 RESULTS AND DISCUSSION

When considering the extent of Facebook usage, 45% of the undergraduates, who form the largest proportion, have used Facebook for more than 6 years. Fifty-two percent of the undergraduates visit Facebook several times each day 7% of them visit Facebook once a month, which is the lowest proportion. Considering Facebook usage on university premises, 65% of the undergraduates use Facebook on university premises, and the computer laboratories are the most popular (68%) place for students to visit Facebook. On average a full-time undergraduate spends approximately 2 hours, and a part-time undergraduate spends 1 hour and 25 minutes on Facebook. The most popular device which Facebook usage is powered by is mobile phones which is 84%, compared to other different devices.

When considering the purposes for which undergraduates use Facebook, undergraduates are very keen on the updates about friends and families (84%), songs/films/sports (34%) and wedding/photography and bridal (34%). Apart from this, 83% of the undergraduates are using Facebook for educational purposes. However, 75% of them are using Facebook to share lecture materials and to get to know about news



related to their degree programs, at the same time 25% of the undergraduates use Facebook to improve their knowledge related to the subjects that they study and others are interested in areas such as health, photography, etc. Undergraduates have ranked their top five activities on Facebook, i.e.(from first to fifth) moving up and down in the Facebook wall, commenting on Facebook posts, sharing others' posts, uploading photos and videos and chatting with friends

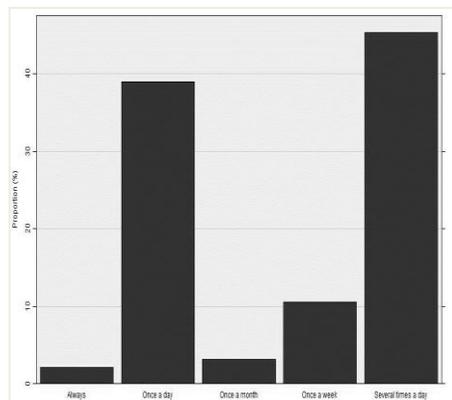


Figure 1: No. of times FB used by undergraduates

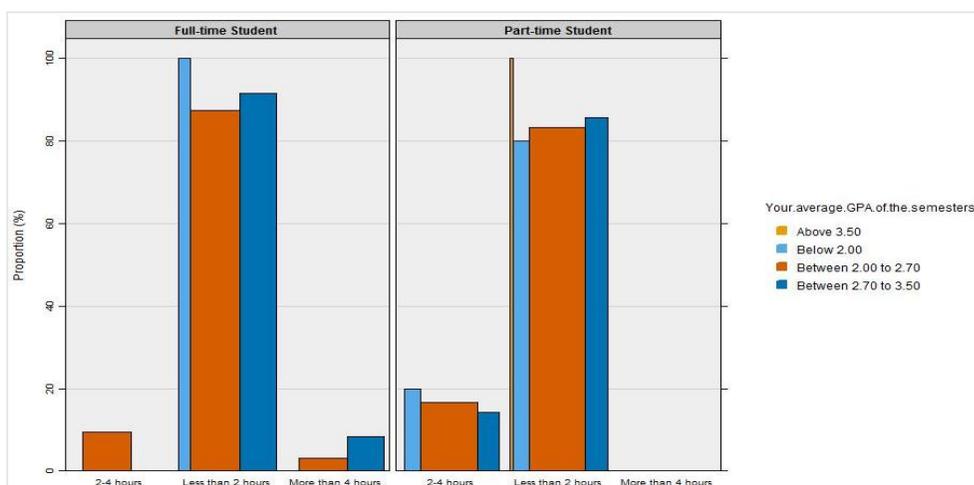


Figure 2: CGPA of the undergraduates according to the time spent on Facebook

When considering the time spent on Facebook and academic performance, seventy-eight percent of the undergraduates, who form the majority, do not use Facebook during the examinations of the degree program.

Spearman's rank correlation coefficient between time spent in hours and the CGPA is -0.41, which indicates that there is a negative relationship between the two variables. However, there are many other factors (cognitive ability, environment) that may influence the CGPA of a student, which are considered to be limitations of the study.

In considering the perceptions of the Facebook usage, 68% of the undergraduates have strongly agreed that Facebook is important to stay connected with society, while 46% have strongly agreed that Facebook is the best social networking site among others which motivates them to use it. Furthermore, thirty two percent of the undergraduates have a neutral view of the question as to whether time spent on Facebook is not a wastage, while they have enjoyed playing games and chatting with friends. Fifty percent of the undergraduates have agreed that if they reduce the time spent on Facebook they can use that time for more educational activities.

Table 1. Perceptions of undergraduates on the use of Facebook

Likert Scale Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Facebook is important to stay connected with the community.	3%	4%	5%	23%	68%
Facebook is one of the best ways to communicate with people around me.	7%	13%	17%	43%	20%
Facebook is the best of the social networking sites, that is why I am using it.	3%	11%	23%	17%	46%
Facebook is helpful in finding my old friends.	5%	7%	9%	35%	44%
It is important to update my status always on Facebook.	16%	39%	20%	21%	4%
I highly expect my friends to react to my posts.	12%	25%	21%	5%	37%
I do not think time spent on Facebook is a waste.	16%	25%	32%	23%	4%
Chatting with my friends and playing games are really enjoyable.	6%	20%	31%	35%	8%
I believe Facebook does not distract me from my studies anyway.	7%	16%	34%	26%	17%
I definitely look for new updates on Facebook each and every morning.	13%	22%	23%	31%	11%
The majority of the content on Facebook has no importance to anybody.	3%	19%	26%	41%	11%
If I reduce the time I spend on Facebook, I can use that time to something valuable.	6%	7%	10%	27%	50%



.4 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this research is to study the Facebook usage of undergraduates of the University of Vocational Technology, where studies are pursued in two different modes. It is clear that there is a significant difference in Facebook usage between full-time and part-time undergraduates with fulltime undergraduates tending to spend more time on Facebook in comparison with part-time students. Being connected with friends and families is portrayed as a key use, while a small proportion of students utilize it to carryout educational activities. Finally, excluding cognitive abilities and other environmental factors, which can influence CGPA, time spent on Facebook, has a negative relationship which is an alarming fact for undergraduates. Although the students still strictly agree that Facebook is important to stay connected with society, they also believe that if they can reduce their Facebook usage the time they save can be spent in a meaningful manner and this can boost their studies.

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ENGINEERING



Investigating the Effect of the Variation of Stitch Density on Seam Puckering

A.S.S Gunasena, M.E.R Perera*

Department of Textile and Apparel Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: meper@ou.ac.lk*

1 INTRODUCTION

Cut fabric panels can be assembled using various techniques such as sewing, thermal bonding and using adhesives. Sewing is the most common method of joining fabric panels in the apparel industry. For the construction of seams, different sewing parameters are used. One of the important sewing parameters is the stitch density. Stitch density may significantly affect the quality of the seams of garments due to the occurrence of seam pucker.

The term seam pucker can be defined as a ridge, wrinkle, or corrugation of the material or a number of small wrinkles running across and into one another, which appear in sewing cut fabric panels together to make appropriate seams (Zadah and Najjar, 2015). It is usually caused by the improper selection of sewing parameters, factors related to sewing machines and material properties, which results in unevenness on fabric surfaces being stitched together, thus impairing their aesthetic value. In severe cases, seam pucker could appear like a wave front, originating from the seam and extending to the entire garment (Hati and Das, 2011). The problem of seam pucker may occur during sewing, after sewing or after washing (Maarouf, 2015). For a good appearance of a garment, the seams should be free from seam puckering. The customer generally pays attention to the

appearance of seams in order to determine the overall quality of the garment. Therefore, the seams of garments must be free from seam puckering. The major causes of seam puckering are the incorrect feeding of cut fabric panels, incorrect sewing thread tension, sewing thread shrinkage, fabric shrinkage, mismatched patterns and structural jamming (Choudhary and Geol, 2013). The structural jamming of the fabric is possible due to the incorrect selection of stitch densities in seam constructions.

The main objective of the research is to investigate the effect of stitch densities on seam puckering.

2 METHODOLOGY

The methodology of the research is described under the sub-topics of designing the experiment, preparation of the samples and the evaluation of samples.

2.1 Designing the experiment

Experimental work is designed to test the selected woven fabric type with specific sewing parameters. A selected range of stitch densities spans the range covered in industrial practice. Though the stitching can be performed at different sewing speeds, 2500 rpm was selected for this experiment because this is the average

speed used in the industry. The experiment is designed to test samples prepared with seam parallel to the warp direction and the seam parallel to the weft direction. During the designing phase of the experiment, the necessary materials, machines, equipment, stitching parameters and a suiTable testing standard were selected.

The fixed parameters of the experiment are given in the Table 1.

Table 2 gives the details of the variable parameters used for the experiment. Ten different stitch densities in the range of 5 spi to 14 spi with an increment of one stitch per inch were selected.

Table 1: Selected fixed parameters for the experiment

Fixed parameters for the experiment	
Fabric	Fibre type: 100% Cotton, Fabric structure: Twill weave, Weight: 224.7 g/m ² , Ends per inch: 72, Picks per inch: 45
Sewing thread	100% Polyester, Ticket Number: 30
Sewing machine	Single needle lock stitch machine, Maximum sewing speed 5000 rpm
Needle	Size: 110Nm
Testing Standard	IS 15312: 2003
Standard conditions	Temperature: 27 ± 2C ^o , Relative Humidity: 65 ± 2%
Seam type	Plain seam
Stitch type	301
Operating speed of the sewing machine	2500 rpm

Table 2: Selected stitch densities for the experiment

Selected stitch densities for the experiment	
Stitch densities (spi)	5,6,7,8,9,10,11, 12, 13 and 14

2.2 Preparation of the samples

The dimension of a cut panel is 500 x 90 millimetres as per the testing standard IS 15312: 2003. The total number of cut panels required to perform the experiment was 200. Out of these 200 cut panels, 100 panels were cut to prepare samples with seam parallel to warp direction, whereas the other 100 panels were cut to prepare samples with seam parallel to weft direction. As the seam was applied in the lengthwise direction, a measuring length of 300 millimetres was marked in the

middle of all the cut panels prior to sewing. When stitching samples, two similar cut panels were kept on top of each other and a row of stitches was applied to the middle in a lengthwise direction. The total number of samples prepared was 100. For each of the chosen stitch densities, ten samples were sewn. Of these ten samples, five were sewn with seam parallel to the warp direction and the other five with seam parallel to the weft direction.



2.3 Evaluation of samples

By using a scale of 0.5mm accuracy, actual distance between the marked measuring points was measured in all sewn samples. The values were obtained for both face and back sides. The

percentage of seam pucker for both face and back sides was calculated for each chosen stitch density by using the following formula.

$$\text{Seam pucker} = \frac{(300 - \text{Measured length}) \times 100}{300}$$

3 RESULTS AND DISCUSSION

Tables 3 and 4 give the average seam lengths of five samples sewn in warp and weft directions for the selected range of stitch density with reference to the face

and back side of the samples. The relevant standard deviations and coefficient variations have also been given in the Tables.

Table 3: Seam parallel to warp direction

Stitch density (per inch)	Face side			Back side		
	Average seam length	Standard deviation	Coefficient of variation (%)	Average seam length	Standard deviation	Coefficient of variation (%)
5	300.8	0.96	0.31	299.4	1.74	0.58
6	300.6	0.48	0.15	299.2	0.97	0.32
7	300.6	1.01	0.33	298.8	0.74	0.24
8	300.8	0.74	0.24	300.0	1.78	0.59
9	301.0	0.89	0.29	299.0	1.26	0.42
10	300.0	0.63	0.21	298.0	1.05	0.35
11	301.2	0.74	0.24	300.2	1.83	0.60
12	300.6	0.48	0.15	300.4	0.48	0.15
13	300.8	0.74	0.24	299.8	0.74	0.24
14	301.2	0.74	0.24	300.8	0.97	0.32

Table 4: Seam parallel to weft direction

Stitch density (per inch)	Face side			Back side		
	Average seam length	Standard deviation	Coefficient of variation (%)	Average seam length	Standard deviation	Coefficient of variation (%)
5	300.0	1.87	0.62	299.6	1.95	0.65
6	299.2	1.46	0.48	299.6	0.80	0.26
7	298.8	1.60	0.53	299.8	0.97	0.32
8	300.2	0.74	0.24	299.2	0.97	0.32
9	299.2	1.72	0.57	297.8	1.60	0.53
10	297.2	1.72	0.57	296.4	1.95	0.65
11	298.4	1.85	0.61	296.4	1.95	0.65
12	301.0	0.63	0.20	300.4	0.48	0.15
13	300.8	0.74	0.24	299.6	0.48	0.16
14	301.0	0.63	0.20	299.6	0.48	0.16



The average seam lengths of the samples of chosen stitch densities do not show significant deviation in all four cases mentioned in Tables 3 and 4. Considering the low values of the standard deviations and coefficient of variations, it can be concluded that the stitch densities do not influence the average seam length of sewn samples. The highest value of standard deviation is 1.95 and the highest value of coefficient of variation is 0.65%. Therefore, the data sets of chosen stitch

densities have very low level of dispersion around the mean seam length values. As the coefficient of variation is less than 5% in all four cases, the change of the average seam length can be considered as insignificant under 95% confidence level.

The minus values in Table 5 indicate the increase of seam lengths, whereas the positive values indicate the decrease of seam lengths.

Table 5: Seam Pucker in both sides of the samples in warp and weft directions

Stitch density	5	6	7	8	9	10	11	12	13	14
Warp- Face side %	-0.26	-0.20	-0.20	-0.26	-0.33	0.00	-0.40	-0.20	-0.26	-0.40
Warp-Back side %	0.20	0.26	0.40	0.00	0.33	0.66	-0.66	-0.13	0.06	-0.26
Weft-Face side%	0.00	0.26	0.40	-0.66	0.26	0.93	0.53	-0.33	-0.26	-0.33
Weft-Back side%	0.13	0.13	0.06	0.26	0.73	1.20	1.20	-0.13	0.13	0.13

Figure 1 shows the seam pucker variations with the stitch densities as per calculations shown in Table 5.

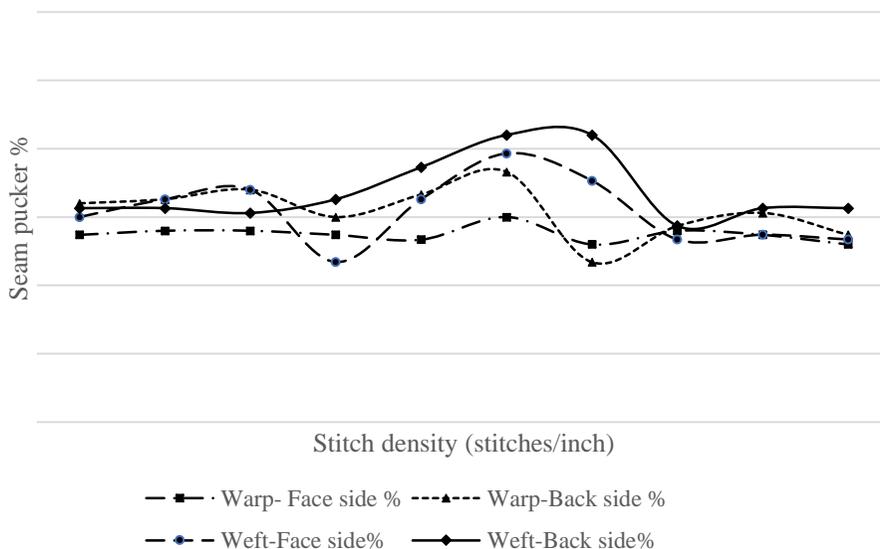


Figure 1: Variation of the seam pucker against different stitch densities



Based on the data given in Table 5 and the 1, it can be seen that the seam pucker in the weft back side is positive for all the stitch densities, except the stitch density 12. The seam pucker of the warp face side is negative for all the chosen stitch densities. In the case of warp back side, it can be seen that the seam pucker is positive between the stitch densities 5 and 10. The variation of the seam pucker in the weft face side does not show any regular pattern. However, for all the four cases, the stitch density 10 shows the highest seam pucker.

4 CONCLUSIONS

It can be concluded that there is a slight increase in the seam pucker from the stitch density 5 to 12 of the samples tested. The highest seam pucker has occurred at and around the stitch density 10. Though the percentage values of the seam pucker is relatively low, the effect will be significant for the long seams, whereas the effect will be insignificant for short seams. Therefore, care must be taken when selecting stitch densities in seam construction of garments. Further research is needed to validate the findings of the research.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Effect of Sewing Thread Count and Needle Size on Seam Stiffness of 100% Cotton Twill Fabrics

T.A.D.K. Gunarathna and W.V.L. Kumara*

Department of Textile and Apparel Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: wvkum@ou.ac.lk*

1 INTRODUCTION

Sewing is a widely used technique to join fabric cut panels in the apparel industry. Seams are formed when two or more fabric cut panels are joined with a stitch. The important characteristics of a seam are strength, durability, elasticity, stiffness, security and comfort, which will affect the performance and aesthetic appeal of a garment. There are several factors affecting the quality and characteristics of a seam such as sewing thread, needle, fabric, sewing speed, stitch density, sewing condition, stitch and seam types. Sewing thread is the important material used to stabilise the seam and the needle is important in stitch formation (Farhana *et al.*, 2015).

It was reported that sewing thread count significantly affects the flexural properties and stiffness of a seam (Farhana *et al.*, 2015). The bending length increased in the vertical seam but did not affect seam allowance to bending length. (Gürarda, 2009). The twill fabric rigidity is higher on the technical backside of the fabric and bending rigidity is different in weft and warp direction (Tohidi, 2013). Although much research has been done to investigate the many factors affecting seam properties, very few studies have been done on the impact of needle size and thread count on the stiffness of a seam. The selection of needle size and

thread size depends on the fabric weight, fabric thickness, seam type, stitch type and machine speed. Seam stiffness affects the comfort, flexibility and appearance of a garment when it is worn. The higher the stiffness, the higher the strength, although the flexibility and comfort is low. Depending on the end use of the garment, the optimum conditions of stiffness can be determined. The aim of this study is to investigate the effect of sewing thread count and needle size on seam stiffness of 100% cotton twill fabrics.

2 METHODOLOGY

2.1 Material

100% cotton twill fabrics of two structures in two weights of medium heavy weight (A) and light weight (B) were used for specimens. The specifications of the fabrics that were used are given in Table 1 and the fixed and variable parameters are given in Table 2.

2.2 Sample preparation

Samples were prepared for two types of twill constructions (1/2 and 1/3), warp-wise and weft-wise, three thread counts



and four needle sizes resulting in a total of 48 combinations. Specimen size is 25 mm±1 in width and 200 mm±1 in length.

Table 1: Fabric specifications

Fabric types	Fabric type	Fabric structure	Yarn density		Mass (g/m ²)	Thickness (mm)
			Warp/cm	Weft/cm		
“A” Fabric	100% cotton	Twill 1/2	28	18	289	0.59
“B” Fabric	100% cotton	Twill 1/3	69	42	177	0.27

Table 2: Fixed and variable parameters

Fixed parameters	Variable parameters	
Thread type -100% Spun polyester thread	Sewing thread count	27 Tex (120tk)
Stitch type- Lock stitch 301		40Tex (75tk)
Seam type- Superimposed plain seam		60Tex (50tk)
Stitch density -5/cm	Needle size(metric)	75
Stitch length -2.5mm		90
Sewing speed – 1500rpm		100
Fabric composition – 100% cotton		110
Vertical seam	Fabric types	Fabric “A”
		Fabric “B”

2.3 Procedure

The seam stiffness test was carried out according to Cantilever method of ASTM D 1388 standard using Shirley stiffness tester. 25mm x 200mm size samples were cut and vertical seams were made using lock stitch 301 type machine. The experiments were carried under standard atmospheric conditions, at 27°C± and 65±2% relative humidity. All the specimens were conditioned under standard atmosphere for 24 hours before testing. Four edges were tested using the Shirley stiffness tester and the overhang length was recorded. Averages of the four readings were taken as the overhang length. 5 samples were prepared for 48 combinations giving a total of 240 samples. From the overhang length, the bending length was calculated using formula (a) given below and then the

flexural rigidity was calculated according to the formula (b) given below.

$$\text{Bending length (C)} = O/2;$$

where O = overhang length (cm).....(a)

$$\text{Flexural rigidity (G) in (gcm)} = WC^3;$$

where W= weight per unit are (g/cm²) (b)

The collected data was analysed using line diagram, linear dimension and regression value (R²) under 95% confidence levels. The higher the flexural rigidity, the higher the stiffness, which means that the seam is more resistant to bending.



3 RESULTS AND DISCUSSION

Table 3 gives the flexural rigidity of 48 test combinations, where two fabrics, warp direction and weft direction, three

thread sizes and four needle sizes were taken as variable parameters. The needle size is determined by the blade diameter (i.e., size 75 is .75 mm) and sewing thread size is given in Tex.

Table 3: Flexural rigidity values of 48 test combinations

Needle size (metric)	Flexural rigidity (mg cm)											
	Fabric "A"						Fabric "B"					
	Warp direction			Weft direction			Warp direction			Weft direction		
	tex 27	tex 40	tex 60	tex 27	tex 40	tex 60	tex 27	tex 40	tex 60	tex 27	tex 40	tex 60
75	5242	5362	5574	4052	5118	5998	2205	2645	2730	3323	3654	3688
90	5248	5326	5569	4502	5796	6717	2394	2571	2722	3423	3715	3739
100	5231	5499	5640	4499	6050	6767	2472	2515	2760	3396	3767	3804
110	5236	5327	5503	5454	6514	7427	2416	2632	2682	3614	3700	3971

Table 3 shows higher values in Fabric "A" than the Fabric "B", it was clear that when the fabric weight increases, the flexural

rigidity values increases showing that the stiffness of the particular fabric is also higher.

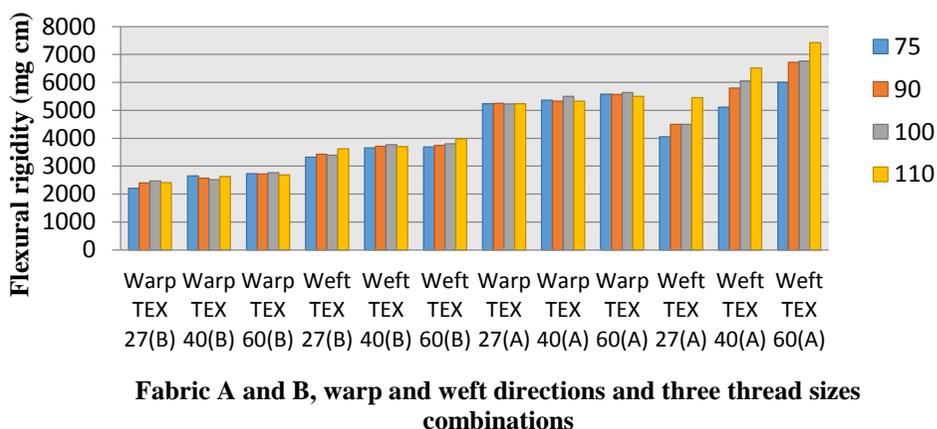


Figure 1: Variation of flexural rigidity value against needle size and 12 combinations of fabric A and B, warp and weft directions and three thread sizes

According to Figure 1, fabric "B" has higher flexural rigidity in weft direction than warp direction and fabric "A" shows higher values in warp direction than weft direction. This can be due to the structure of the twill fabric where the "B" fabric is 1/3 construction and the "A" fabric is 1/2 construction, and where the cover factor or the tensional forces between interlacing points may have given these results.

Flexural rigidity shows a direct proportional relationship to thread count because when the thread count increases it slightly increases the bulkiness of the seam resulting in higher flexural rigidity. In fabric "A", the weft direction shows a direct proportional relationship to needle size. This may be due to the penetration that takes place when forming the stitch because when the needle blade diameter

increases it pushes the yarns along the vertical seam increasing the frictional and tensional forces in-between warp and weft yarns. To determine the correlation between needle blade diameter/ needle size and the seam flexural rigidity linear

dimension/scatter, diagrams were drawn and coefficient of determination (R^2) values were determined for the 12 combinations mentioned above. The R^2 values are given in Table 4 given below.

Table 4: R^2 value against the needle size

Parameters	Flexural rigidity (mg cm)											
	Fabric "B"						Fabric "A"					
	Warp direction			Weft direction			Warp direction			Weft direction		
	TEX 27	TEX 40	TEX 60	TEX 27	TEX 40	TEX 60	TEX 27	TEX 40	TEX 60	TEX 27	TEX 40	TEX 60
X	0.715	0.078	0.156	0.750	0.343	0.865	0.351	0.013	0.764	0.815	0.990	0.938
r value	0.845	0.280	0.395	0.866	0.586	0.930	0.593	0.112	0.874	0.903	0.995	0.968

X: R^2 value against needle size

If $r = 1$ or -1 it is a perfect linear relationship and if $r = 0$ there is no linear relationship between the variables.

As per the results obtained from the experiment, Fabric "A" (medium heavy weight 289 g/m²) in weft direction shows a significant positive relationship with the increase of needle size (needle

blade diameter), the higher the needle size, the higher the stiffness. Even though particular thread sizes show a positive correlation to needle size, a variation of flexural rigidity along with the needle size is insignificant in Fabric "B" (light weight) both in the warp and weft directions and the thread size.

4 CONCLUSIONS

Based on the results of this research, stiffness or flexural rigidity of the seam significantly increases with the increase of fabric weight. The increase of the seam stiffness in relation to the increase of thread size is insignificant. On average, weft direction flexural rigidity values of the seam are higher than the warp direction values.

The seam stiffness of Fabric "A", a medium heavy weight fabric in weft direction shows a significant increase with the increase of the needle size. The relationship of the seam stiffness of fabric "B", a light weight fabric, with the needle size is insignificant. A similar insignificant relationship is also visible in Fabric "A" in the warp direction.

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I.N. Adikari*

*Department of Textile and Apparel Technology, The Open University of Sri Lanka,
Nugegoda, Sri Lanka*

**Corresponding author: Email: indikaa23@gmail.com*

1 INTRODUCTION

Fashionable dyes are becoming increasingly important as people become more concerned about the impact on the environment. Developed countries in particular, prefer casualwear with fashionable colours which are resistant to most external agents such as chlorinated water. The colourfastness of casual wear to chlorinated water is becoming increasingly more important as tap water contains higher ppm chlorine levels. Furthermore, detergents for domestic washing contain higher levels of oxidation agents for the purpose of removing dirt (Texlan laboratory, 2013). The combined result of the use of this water and detergents in laundering, is the higher level of active chlorine causing discoloration or fading of colours in casual wear garments. The fading or discoloration of dyed material is due to oxidation caused by the active chlorine. In general Pigment, Azo, and vat dyes can be used for the dyeing of cotton casualwear and swimwear and these have good colourfastness for chlorinated water (Wikipedia 2016). Colourfastness depends on processing conditions such as dyeing temperature, dyeing time, dye concentration and electrolyte concentration (Alam *et al.*, 2008). Further, Alam *et al.* (2008) report that dye absorption increases with the increase of electrolyte concentration, dyeing temperature and dyeing time but decreases

with the increase of dye concentration. Shimohiro *et al.* (1984) report that the tannin can be more strongly fixed to the fibers by further treating with a metal salt, whereby an excellent colour fastness to chlorinated water can be maintained for a prolonged period of time (Shimohiro *et al.*, 1984).

There are fashionable dyes supplied by chemical suppliers with specific, different hues and brightness for specific colours that meet colour fastness requirements. Most of the time, the dye house needs to formulate a new recipe using the trichromatic RYB colour model as there are no closely matching shades provided by the chemical supplier. This paper presents a few dyeing routes and the colourfastness test results of these few cases, which were required by most of the customers as fashionable colours with different hues and brightness.

1.1 Research Problem

Customers request fashionable colours with different hues and brightness which require the combining of single dyes. After combination, dye stuffs show poor resistance to colourfastness to chlorinated water. The selection of dyes must be according to the customer performance guidelines in which restricted substances

level requirements must be maintained at minimum ppm levels. Furthermore, formulating a new recipe using the trichromatic RYB colour model needs to concentrate on the transparency of effectiveness of effluent plant after water treatment.

1.2 Objectives

Finding suitable, fashionable dye type and dye route which demonstrate resistance to colourfastness for chlorinated water and can be used for colouration of casual wear garments.

2 METHODOLOGY

Fabric samples from cotton casual wear were dyed with fashionable dyes, which are formulated by the dye house using the trichromatic RYB colour model for specific colours, where the required colour cannot be closely matched using the available range of dyes. After dying cotton casualwear with combination of RYB dye recipe, it was tested using the standard AATCC 162 for colour fastness for chlorinated water (5ppm). When the colour fastness to chlorinated water fails, the dye house did some changes to the dye route by changing fixing agent and did the colouring and fastness tests as per the standard AATCC 162.

The samples were evaluated for colour fastness to chlorinated water by comparing the original coloured sample and the sample after washing with chlorinated water. Similarly, colour fastness test results of the fabric sample colours after dying with newly formulated dyes, after changing the fixing agent for newly formulated dyes for all three colours and after washing with chlorinated water are analysed and presented for the purpose of comparison in Table form.

Table 1 shows the selected samples for

applied dye type with recommended dye route, dye type and changes, selected 2nd types of dye for different samples for a total of 9 samples.

Cotton casualwear fabrics fabric samples 1.1 and 2.1 were dyed with Hi-white for Khaki and Brown respectively using dye route: as per the chemical supplier's instruction for Hi-White colours and pre-treatment and Rinse at 6.0pH and each step at 500C for five minutes.

Formulated dye at 6.5pH and temperature 900C for 50minutes. Required Hue and Brightness dye stuff were mixed as given in the Table 2. Fabric sample 3.1 was dyed with Reactive for Green using dye route as above. Samples were tested for colour fastness to chlorinated water applying standard AATCC 162. The mildest version of chlorinated water (5ppm) was used during the test. Table 2 shows the photos comparing the original sample after dying with tested sample for colour fastness to chlorinated water.

Failing Samples 1.1 and 3.1 to colourfastness test, applied formulated Pigment dye at 6.5pH and temperature 600C for 70 minutes for samples 1.2 and 3.2. Similarly, failing Samples 2.1 to colourfastness test, applied formulated Reactive dye at 6.5pH and temperature 600C for 70 minutes for samples 2.2. Samples 1.3, 2.3 and 3.3 were dyed with pigment reactive and pigment respectively to get the required colour as shown in Tables 1 and results are shown in Table 3. Further Table 3 shows the trichromatic dye combination to get the required colour.

3 RESULTS AND DISCUSSION

Table 2 shows the change of colour in Samples 1.1, 2.1 and 3.1 just after dying and after colour fastness test for chlorinated water. As it shows all three samples failed although dye route was selected as recommended by the chemical supplier.



Table 1: Applied dye type and changes to dye route for each sample

	1 st types of dye and sample No.	Changes to dye route and sample No	2 nd types of Dye and sample No.
3 Samples 1.1, 1.2, 1.3 Khaki colour	Hi-White Sample 1.1	Hi-White, fixing agent Sample 1.2	Pigment Sample 1.3
3 Samples 2.1, 2.2, 2.3 Brown colour	Hi-White Sample 2.1	Hi-White, fixing agent Sample 2.2	Reactive Sample 2.3
3 Samples 3.1, 3.2, 3.3 Green colour	Reactive Sample 3.1	Reactive, fixing agent Sample 3.2	Pigment Sample 3.3

Table 2: Change of colour after test of fabric sample dyed with Hi-White and Reactive

Required colour (Hue and brightness)	Mix dyes % and added chemicals	Colour Change	Comparing original sample with tested sample (after colourfastness to chlorinated water)				
Sample 1.1 Khaki Before changing chemicals Dye route: Hi-White	Yellow 0.0797% Red 0.00182% Olive 0.004464% Brown 0.04565%	1.5 (required 3.5)	<table border="0"> <tr> <td style="text-align: center;">Tested</td> <td style="text-align: center;">Original</td> </tr> <tr> <td colspan="2" style="text-align: center;"></td> </tr> </table>	Tested	Original		
Tested	Original						
							
Sample 2.1 Brown Before changing chemicals Dye route: Hi-White	Yellow 0.20165% Red 0.07112% Olive 0.21713%	1.5 (required 3.5)	<table border="0"> <tr> <td style="text-align: center;">Tested</td> <td style="text-align: center;">Original</td> </tr> <tr> <td colspan="2" style="text-align: center;"></td> </tr> </table>	Tested	Original		
Tested	Original						
							
Sample 3:1 Green Before changing chemicals Dye route: Reactive	Yellow 1.02419%, Red 0.38867% Blue 1.20187%	1.5 (required 3.5)	<table border="0"> <tr> <td style="text-align: center;">Tested</td> <td style="text-align: center;">Original</td> </tr> <tr> <td colspan="2" style="text-align: center;"></td> </tr> </table>	Tested	Original		
Tested	Original						
							

The Table shows that the primary colours can be combined to get the required shade other than olive colour with reactive. Olive colour is not suitable for combining to achieve other fashion colour.

4 CONCLUSIONS

Research analysis show that the newly

formulated dye recipe using the trichromatic RYB colour model does not meet the colour fastness requirement to chlorinated water, although the individual single dyes meet the colour fastness requirement with the same dye route. In some cases, with different dye route to the dye route recommended for single dyes by the chemical suppliers meet the colourfastness requirement.

Table 3: Combined dye stuff, dye routes and colourfastness test results of tested 9 samples for three different colours

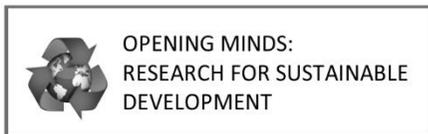
Colour dye	Khaki colour (sample 1)		Brown colour (sample 2)		Green colour (sample 3)	
Hi white	Sample 1.1 and 1.2	Yellow 0.07978%, Red 0.00182%, Olive 0.04464%, Brown 0.04546%	Sample 2.1 and 2.2	Yellow 0.20165%, Red 0.07112%, Olive 0.21713%		
	Change only fixing agent-Dan Fix Paa 40 x 20 min –CC-3.0		Change only fixing agent-Dan Fix Paa 40 x 20 min – CC-1.5			
Pigment	Sample 1.3	Yellow 0.3845% Red 0.08760% Black 0.1617% CC-4.5			Sample 3.3	Yellow 2.45%, Red 1.14% Blue 3.54% CC-4.5
Reactive			Sample 2.3	Yellow 0.556%, Red 0.1218%, Blue 0.1431% CC-4.0	Sample 3.1 and 3.2	Yellow 1.02419%, Red 0.38867% Blue 1.20187%
			Change only fixing agent-Dan Fix Paa 40 x 20 min – CC-1.5			

Most of the fashionable colours with combine dyes are not resistant to chlorinated water, although casualwear coloured with individual single dyes show good colour fastness to chlorinated water. Similarly, dyeing of casualwear with fashionable combine dyes with same dye route show resistance to chlorinated water, although the individual dyes show good colour fastness to chlorinated water with same dye route. It is recommended that fashionable dye producers need to develop new dye route and chemical combinations for dyeing of casualwear with different hue and brightness to meet colour fastness requirements to chlorinated water.

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W. A. D. M. Weragoda and N.T. Medagedara

Department of Mechanical Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: wadmweragoda@gmail.com

1 INTRODUCTION

Linear alternators are devices used to convert mechanical energy into electrical energy. Although linear alternators are used for high power generation, such as the free piston engine and the wave power generator, linear alternators that can be used for low power generation are not commercially available. This research focused on designing a linear alternator to suit low power generation needs. These low power linear alternators can be used to harness energy off exercise machines, with linear motion and even rotary motion via a crank-slider mechanism and thereby store energy in a battery for later use.

Two main factors that have to be considered when designing a Linear Alternator are the total resistance and output voltage. The total resistance depends on the inertia force and the electromagnetic force of the system. With the variation in the dimensions of the linear alternator, and the arrangement of magnets and iron rings of the linear alternator, the Magnetic flux density takes a complex form (<https://www.supermagnete.de/eng/faq/How-do-you-calculate-the-magnetic-flux-density>). The electromagnetic force acting on the translator is determined using COMSOL Multi-physics and the Maxwell's stress tensor to optimize the design. Several simulations were carried-out, analysed, and the method of approaching the optimum solution is presented.

There are two main factors that affect the total resistance to motion; the inertia force due to the mass of the translator and the electromagnetic force due to the magnetic flux distribution. Determining the electromagnetic force is not as straight forward as determining the inertia force. It requires solving complex equations such as Maxwell's stress tensor, utilizing software such as COMSOL Multiphysics and carrying out mesh refinements processes in order to obtain an optimized solution (Bethany, 2017).

1.1 Electromagnetic force

The electromagnetic force can be computed using two main methods, the Lorentz force and the Maxwell's Stress tensor. Since the translator is a magnetic material, Lorentz force method cannot be used to compute the force on the translator (Paudel, 2016)

1.2 Electromagnetic force calculation

The electromagnetic force is obtained by using the Maxwell's Stress tensor given in equation 1 and 2 (Bermúdez *et al.*, 2016).

$$F = \int 2\pi r T_{nd} s \quad (1)$$

$$T_{ij} = \frac{1}{\mu_0} \left(B_i B_j - \frac{1}{2} \delta_{ij} B^2 \right) \quad (2)$$

T = Stress tensor
 n = unit normal vector
 B = Magnetic flux density (T)

μ_o = Permeability of Vacuum $4\pi \times 10^{-7}$
 F = Electromagnetic force

1.3 Variation of magnetic flux with shape of the magnet

$$B = \frac{B_r}{2} \left[\frac{D+z}{\sqrt{R_a^2 + (D+z)^2}} - \frac{z}{\sqrt{R_a^2 + z^2}} - \left(\frac{D+z}{\sqrt{R_i^2 + (D+z)^2}} - \frac{z}{\sqrt{R_i^2 + z^2}} \right) \right] \quad (3)$$

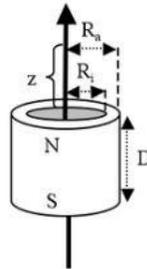


Figure 1: Dimensions of the hollow cylindrical magnet

2 METHODOLOGY

1. Several linear alternator designs such as moving iron, moving magnet and moving coil were studied and the moving iron linear alternator was selected as the design because of its advantages.
2. The linear alternator was initially designed using manual calculation from equations obtained from research papers. (Ding Wang (2016))
3. Parameters and dimensions of that design were varied and results were obtained using COMSOL Multiphysics and the results were analysed and changes were made in the design

The electromagnetic force (given in equation 1) depends on the magnetic flux density as shown by equation 2. Equations 3 shows that, the magnetic flux density varies with the dimension and the shape of the magnet. These equations were used to simulate the model and optimize the design using COMSOL Multiphysics.

Figure 2 shows the 2D axis-symmetric drawing of the arrangement of the permanent magnets and irons incorporated in the linear alternator.

Figure 3 shows the way the electromagnetic force varies with the size of the magnet. This uneven variation is due to the arrangement of magnets, i.e. the pole pitch of the alternator.

The Remnant flux density of the magnets was kept constant and the size of iron and magnet was varied. When a magnet is kept near an iron, the iron is magnetized and a complex magnetic flux distribution is formed, this in turn results in the uneven variation of the electromagnetic force.

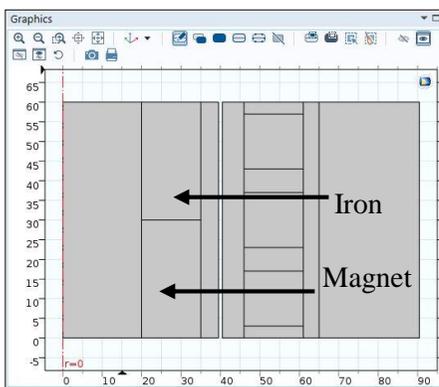


Figure 2: Geometric model of alternator



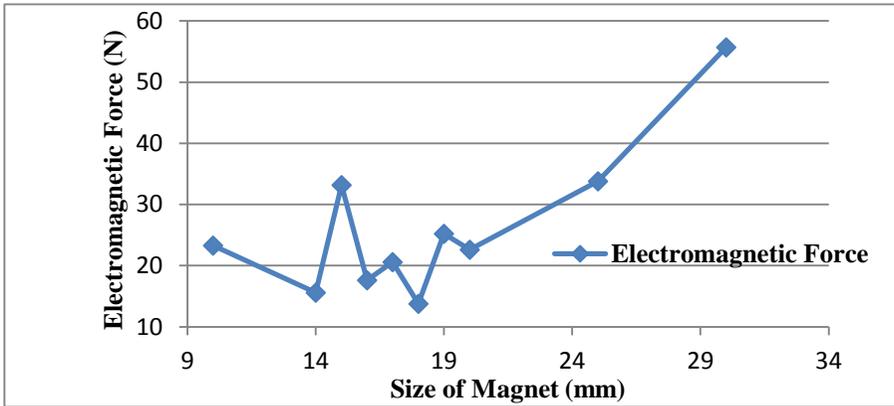


Figure 3: Variation of emf with size of magnet

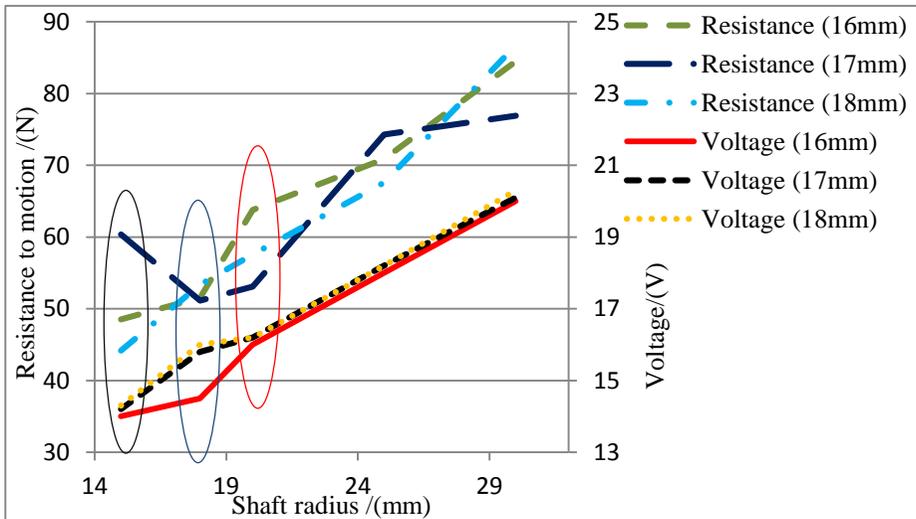


Figure 4: Graph of variation of resistance and voltage with size of the shaft

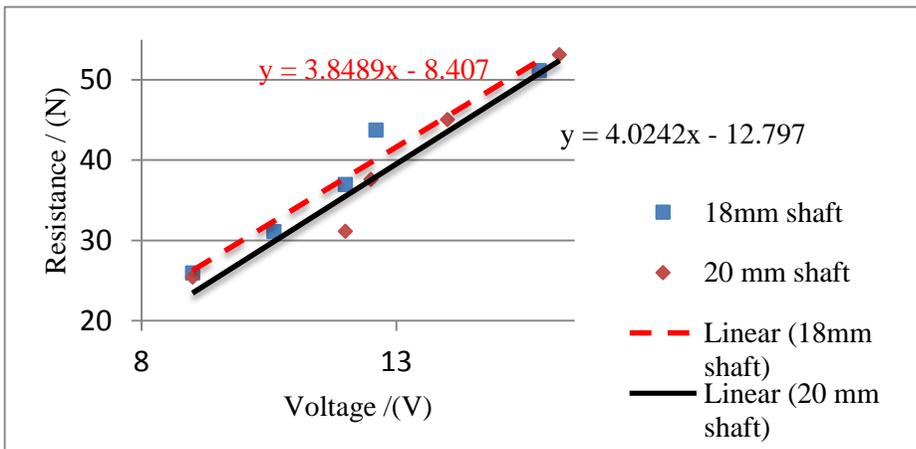


Figure 5: Graph of variation of resistance vs. voltage

Figure 4, shows the variation of the resistance and voltage with the size of the shaft of the translator. When the diameter of the shaft is changed, the inner diameter of the magnet and the iron also change. This will also change the magnetic flux distribution around the magnet, and thus, the resistance to motion. The resistances and the voltages corresponding to the encircled shaft radii were further analysed and two shaft radii were selected. The variation of resistance and voltage of both the shafts (i.e. 18 mm and 20 mm) were plotted as shown in Figure 5. The gradient of the graph of resistance versus voltage for the linear alternator model with the 18

mm shaft is less than that of the 20mm shaft. This indicates that for a unit rise in voltage the unit rise in resistance for the model of 18mm shaft is less than that of the 20mm shaft. Thus, the most suitable design could be obtained if the 18mm shaft is used.

Figure 6 and Figure 7 show the magnetic flux distribution and the output voltage of the final design of the Linear Alternator (LA). The simulation was performed at a translator speed of 1.4 ms⁻¹. An output voltage of approximately 14.5V was produced at this pace. And this could be utilized to charge a battery of 12V.

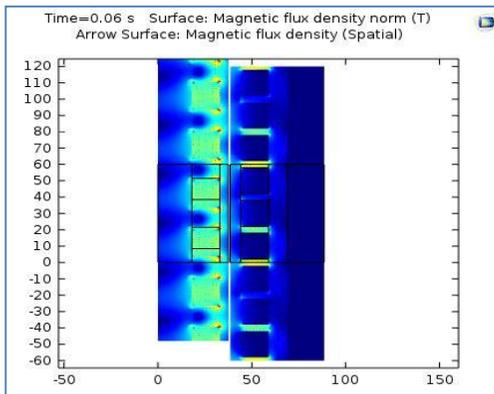


Figure 6: Magnetic Flux distribution of LA

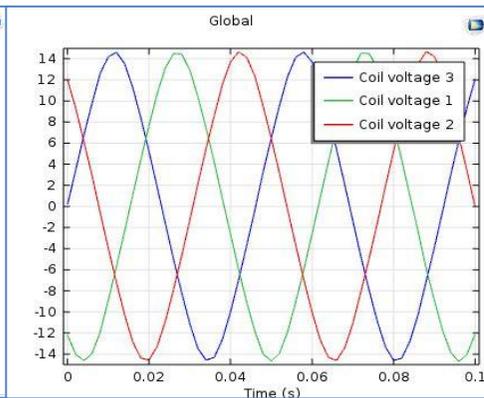


Figure 7: Output voltage LA at 1.4 ms⁻¹

4 CONCLUSIONS AND RECOMMENDATIONS

A 12V battery can be charged with an output voltage of 14.5V, as a 12V battery's float voltage is around 2.25 to 2.3 volts/cell (at 25 degrees C) (i.e. 13.5V to 13.8V for 12V battery). The total resistance depends on the inertia force and the electromagnetic force. The total resistance is around 42 N, which is considerably low. The optimization of the

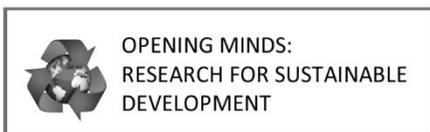
linear alternator was obtained using COMSOL Multiphysics, by selectively altering parameters and comparing the best possible values to suit the design. The electromagnetic force changes with the size of the permanent magnet, iron, alternator shaft and the arrangement of magnets. Further studies and optimization could be done by simultaneously linking MATLAB and COMSOL Multiphysics to determine the reason for the uneven variation of the resistance and to obtain better solutions.



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Portable Electronic Curd Quality Tester

R. P. Gangodagamaarachchi^{1*}, H.Pasqual¹ and S. Jayathilake²

¹*Department of Electrical and Computer Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of Food Science and Technology, Wayamba University of Sri Lanka, Makandura, Gonawila, Sri Lanka*

**Corresponding author: Email: rprasad78@hotmail.com*

1 INTRODUCTION

Curd, the fermented milk product, which is packed in a clay pot is one of the most traditional dairy products in Sri Lanka. Curd should have a pleasant odour, a characteristic flavour, clean, and free from dirt and extraneous matter (SLSI, 1988). The annual buffalo milk production in Sri Lanka was about 49,251,360 litres in 2009 (Department of Census and Statistics Sri Lanka, 2009) and most of this volume is processed into curd and packed into at least fifty million clay pots (Dharmasena, 2005). There are some prescribed standard requirements for the processing of curd, and preservation is one of the requirements with respect to the Sri Lanka Standards (SLS). The requirements for the quality assessment of curd prescribed by the SLSI (Sri Lanka Standard Institution, 1988) can be categorized as the physical (organoleptic) parameters (smell and taste, texture, consistency and colour), chemical parameters (fat, Solids-Not-Fat (SNF) and pH) and the microbiological parameter (Coliform count). Here, the physical parameters can be analyzed by the sensory evaluation (e.g. by visually inspection-texture and colour) and the microbiological parameter are mainly measured in relation to the hygienic quality and 79% of the samples tested are free from coliforms (Tetrapak, 2016; Weerasekara, 2010). According to SLSI standards, curd shall comply with minimum milk fat percentage by

mass, which is 5% (Curd) and 7.5% (Buffalo curd); minimum milk Solids Not Fat (SNF) percentage by mass which is 8.5% for both curd and buffalo curd and the maximum pH value which is 8.5. (Source: SLS 824: Part 1: curd). There is no obligation to obey the rules and regulations prescribed by the SLS, and the main quality parameters are not up to the standard level (Weerasekara, 2010). Moreover, curd manufactures can use preservatives to maintain the product for a long period in order to retain the curd without it expiring quickly (Gunathilake, 2015). However, based on personal communication with the Head, National Poisons Information Unit, NHSL, pots of curd liberally laced with formalin, ascetic acid, and calcium carbonate (aluhunu) are openly sold in food outlets across the country. In addition, these cheap, low quality and harmful preservatives are used to obtain a long shelf life in order to retain the curd without it expiring quickly. Therefore, according to the facts obtained, there is a need to develop an electronic device to test the quality of curd which can be used by public health inspectors. As a solution this paper presents a system focused on the chemical parameters for testing curd quality and to detect the presence of formalin which though used as a preservative in curd is toxic and carcinogenic.



2 METHODOLOGY

2.1 Conceptual model

The overall block diagram of the proposed system is shown in Figure 1 and it mainly consists of a sensory unit, a processing unit and the display unit. In the sensory unit, fat, SNF and pH are measured as the quality parameters and detection of formalin is done by using the formalin sensor. All sensor inputs are compared with the threshold values in the processing unit and that comparison is used to make the decision on the quality of the tested curd sample

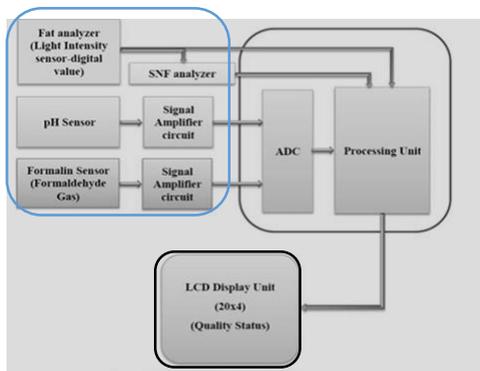


Figure 1: Overall block diagram of the proposed system

2.2 Fat measuring technique

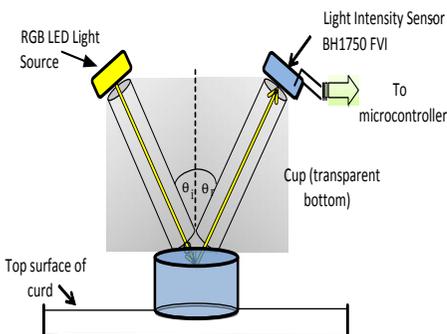


Figure 2: Fat detection mechanism and diffuse and specular reflection of light

The fat measuring sensor is the most important unit in this project as that reading is used for calculating SNF value as well. This sensor was designed and developed by using reflected illuminance of a light source to measure the fat concentration. It was analyzed for wavelengths in the visible range and R, G, B LED was used as the light source to obtain illuminance with different wavelengths.

2.3 The calibration model for the fat sensor

The calibration model for the fat sensor was developed using the linear model created by the linear regression technique of Matlab software (curve fitting tool), by obtaining the results of 20 samples.

With the graph drawn for Fat percentage vs. Light intensity (Ix) (Figure 3), the modelled equation for fat sensor calibration is;

$$f(x) = p1 * x^7 + p2 * x^6 + p3 * x^5 + p4 * x^4 + p5 * x^3 + p6 * x^2 + p7 * x + p8 \quad (1)$$

Where, $f(x)$ = Fat % and x = total intensity Obtained from 7 wavelengths per cycle

Here, the detection of SNF is obtained by using the *Fleischmann formula*. It is essential to analyse the deviation in the density of many milk samples and to obtain the average density value (at 20°C – 25°C), and then acquire the fat value from the sensor.

The Fleischmann formula is given in the following equation,

$$T = 1.2F + 266.5 \times \frac{(d-1)}{d} \quad (2)$$

Where, T = Total solids in mass %, F = Fat in mass % and d = relative density at 20

From the above equation it can be calculated the total solids % and then SNF % by,

$$SNF\% = Total\ solids\ \% - Fat\ \% \quad (3)$$



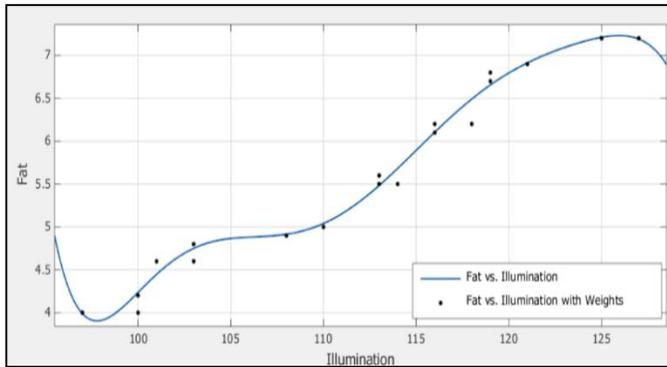


Figure 3: Fat percentage vs. Light intensity (Ix)

Coefficients (with 95% confidence bounds):

- p1 = -2.456e-08
- p2 = 1.955e-05
- p3 = -0.006655
- p4 = 1.257
- p5 = -142.2
- p6 = 9631
- p7 = -3.618e+05
- p8 = 5.816e+06

Goodness of fit:

- SSE: 0.1996,
- R-square: 0.9868,
- Adjusted R-square: 0.9791
- RMSE: 0.129



(a)



(b)



(c)

Figure 4: (a) Control unit (b) Fat probe (c) Formalin probe

2.4 pH detection technique

A pH probe with BNC connector was used as the pH sensor. As the received signal from the probe is too low, it needs adequate amplification for the voltage signal from the pH probe. The OpAmp IC TLC 4502 was used for this and it has a feature of self-calibrating circuitry which digitally trims the input offset voltage to less than 40 μV within the first 300 ms of operation. pH sensor was calibrated using distilled water (pH 7) as the reference solution.

2.5 Formalin detection method

Formaldehyde gas sensor MQ138 was used to identify the presence of formalin. Here, the sensor MQ138 changes its resistivity with the concentration of formalin in the surface of the curd sample.

Once the system had encountered a certain resistivity from the sensor, it will send the reading of resistance of the heater coil to the microcontroller. The microcontroller converts the resistivity (ρ) to its ppm value as referred to in the following equation.

$$ppm = \rho (V_i / 1023)$$

Where,

V_i = supply voltage to the sensor

i.e. 5V and 1023 was set as conversion constant of byte reading of the microcontroller unit.

3 RESULTS AND DISCUSSION

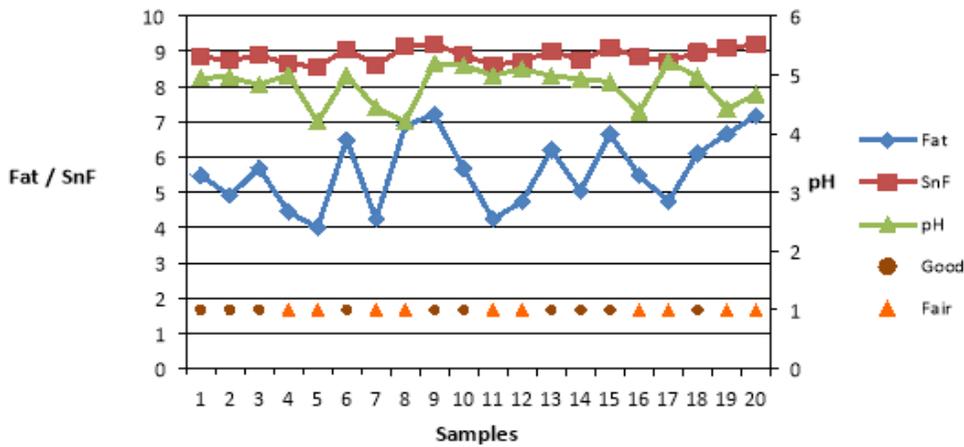


Figure 5: Test results obtained with the proposed system

3.1 Test results of samples for fat percentage

Here, 20 curd samples were tested by the proposed system for Fat, and pH, and the accuracy of the proposed system was checked by comparing these findings with the chemically tested results obtained in the laboratory. The categories of the classes are Good, Fair, and Poor class. The Good class curd satisfies the parameters prescribed by SLS. In addition, the Fair and Poor class curd samples are not in accordance with the parameters prescribed by SLS. Here, the Fair samples have been consisted with the Fat range of 5% to 3.5%, range of 8.5% to 5% and pH range of 4.5 to 4.0. In addition, the Poor samples have been consisted with the Fat value of below 3.5%, value of below 5%, and pH value of below 4.0. The maximum variation of $\pm 0.3\%$ was observed with the results of the fat percentage by the proposed system over the chemically tested results.

4 CONCLUSIONS

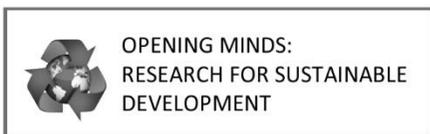
The design of a user friendly portable device to test the quality of curd was presented in this paper as the quality of most curd products available in the market are not up to SLSI standards. The device also allows for the detection of the usage of toxic and carcinogenic agents to preserve the contents. For this work the SLS 824: part 1 was referred to recognize the quality parameters. The proposed device can be used to measure Fat as well as pH by selecting individual parameter test options. It can also be used to get the overall status of the measured sample as “Good sample”, “Fair sample” or “Poor sample” by pressing only one button. As an additional feature the detection of formalin is also included.

According to the results obtained, the accuracy of the device is around 90%. Therefore, food inspectors can use the proposed device to check the curd quality as well as the presence of formalin in curd available at food outlets as this device is easy to use and is low cost.



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Study of the Compressive Strength of *Kitul* Palm Fibre-Reinforced Concrete Composites

H.A.C.M. Perera^{1*} M.A.I. Perera¹ and D.I. Fernando²

¹*Department of Textile and Apparel Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of Civil Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: chamirangikap@gmail.com

1 INTRODUCTION

Concrete is the most versatile building material that is currently in use. It is possible to cast it to fit almost any shape. Fibre-reinforced concrete can be identified as concrete which uses fibrous material to increase its structural integrity. Each of the fibre material currently in use such as steel, cellulose, glass, nylon, polyester, carbon and natural fibres lends varying properties to the fibre-reinforced concrete composites. (Ariyaratna and Bandara, 2014). The study of natural fibres has become popular due to its renewability, eco-friendly and economical nature. (Vajje and Murthy, 2013)

The aim of this research is to develop *Kitul* palm fibre-reinforced concrete composites and study the compressive strengths. The properties of the fibres were identified initially and then the mix designs were developed by varying the percentage of short, discrete *Kitul* palm fibres that are uniformly distributed and randomly oriented.

Three mix designs were developed to determine the influence of varying *Kitul* palm fibre content for the compressive strength of *Kitul* fibre-reinforced concrete composites and to compare the compressive strength with conventional concrete.

2 METHODOLOGY

2.1 Identifying the properties and characteristics of *Kitul* Palm fibre

The morphological structure and the dimensions of the fibres were investigated. The breaking force and elongation were tested according to the standard ASTM D3822. The moisture content was determined by the oven drying method using the standard ASTM D2495.

2.2 Mix Design Development

The British standard of BS 5328 Grade 20 concrete mix ratio 1: 2: 4 in respect of cement, sand and gravel was the mix design ratio selected for this development. The three mix designs were developed by adding 2.5 cm length *Kitul* fibres of 0.5%, 1% and 1.5% based on the weight of the cement. It was observed that the increase of fibre length and the volume decrease the compressive strength due to the formation of air voids. (Libo and Nawawi, 2014)

2.3 Casting Cubes for Compressive Strength Test

First the cubic moulds were prepared by cleaning and lubricating. Then they were filled with concrete in three layers. Each of the layers was compacted by applying



35 uniform blows. The excess concrete was removed from the top of mould and the top surface was finished evenly.

The formed cubes were kept for 24 hours and removed from the moulds. Then the finished cubes were submerged in a water bath for curing. The British standard BS1881-115 was used to determine the compressive strength of the specimens. The compressive strength test was carried out after 7 and 28 days. Three specimens from each mix design were tested and the average compressive strength was calculated. Figure 1 shows *Kitul* fibre reinforced concrete composite specimens de-moulded after 24 hours.



Figure 1: *Kitul* fibre reinforced concrete composites

3 RESULTS AND DISCUSSION

Figure 2 shows the microscopic view of the *Kitul* palm fibres. It was observed under 40X magnification using the optical microscope.

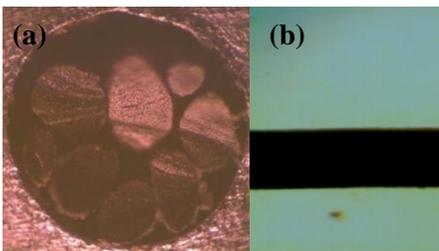


Figure 2: Microscopic view of *Kitul* palm fibres. (a) Cross sectional view (b) Longitudinal view

The cross-sectional view of the *Kitul* Palm fibres were identified as oval shaped and the longitudinal view of the fibres showed featureless evenness. This microscopic appearance cause interlock

between the fibre and the matrix and the evenness helps to carry the load.

Table 1 shows the properties of the fibre. These properties influence the bond between the fibre and the cement matrix. The moisture content of the fibres helps to adhere to mortar because the mix design development process is aqua-based.

Table 1: Properties of *Kitul* palm fibre

Properties	Results
Length (cm)	65.00
Diameter (mm)	0.85
Breaking force (N)	35.67
Tenacity(cn/tex)	10.26
Elongation (%)	45.20
Moisture content (%)	14.00

The compressive strength of the mix designs was compared with grade 20 plain concrete. Therefore, the standard, compressive strength of 20 Nmm⁻² was considered for the comparisons given below. After 7 days the compressive strength should achieve 65% from the value which is 13 Nmm⁻².

- Mix Design I - This was developed by using 0.5% of *Kitul* fibres for the weight of cement. The compressive strength of the specimens after 28 days shown in Table 2.

Table 2: Compressive strength test results of Mix design I after 28 days

Specimen no.	Compres. strength (Nmm ⁻²)	Average compressive strength (Nmm ⁻²)
1	22.0	22.1
2	23.1	
3	21.3	

After 28 days, the average compressive strength gained as 22.1 Nmm⁻². Hence addition of 0.5% fibres increased the compressive strength by 2.1 Nmm⁻²



compared to grade 20 plain concrete. The samples were not tested after 7 days because of the very low value compared with the standard. Therefore, the test was not conducted as it does not have practical importance.

- Mix design II- 1% of *Kitul* fibres were added for the weight of cement in this development. Tables 3 and 4 show the compressive strength test results of the specimens.

Table 3: Compressive strength test results of Mix design II after 7 days

Specimen no.	Compres. strength (Nmm ⁻²)	Average compressive strength (Nmm ⁻²)
1	22.6	25.7
2	26.6	
3	23.5	

The mix design II displayed an average compressive strength as 25.7 Nmm⁻² after 7 days. Therefore, the addition of 1% of fibres increased the compressive strength more than 13 Nmm⁻² compared to conventional grade 20 concrete.

Table 4: Compressive strength test results of Mix design II after 28 days

Specimen no.	Compres. strength (Nmm ⁻²)	Average compressive strength (Nmm ⁻²)
1	28.6	30.1
2	32.2	
3	29.7	

After 28 days the average compressive strength of mix design II was 30.5 Nmm⁻². This is 10.1 Nmm⁻² more than plain grade 20 concrete. Hence, the compressive strength of mix design II showed better results than grade 20 plain concrete.

- Mix design III- The compressive strength test results after addition of 1.5% fibres shows in Tables 5 and 6.

Table 5: Compressive strength test results of Mix design III After 7days

Specimen no.	Compres. strength (Nmm ⁻²)	Average compressive strength (Nmm ⁻²)
1	14	16.6
2	17.3	
3	18.6	

After 7 days the compressive strength of the development was 16.6 Nmm⁻². This is 3.6 Nmm⁻² higher than the compressive strength standard of grade 20 concrete.

Table 6: Compressive strength test results of Mix design III After 28days

Specimen no.	Compres. strength (Nmm ⁻²)	Average compressive strength (Nmm ⁻²)
1	28.2	28.4
2	28.6	
3	28.4	

After 28 days the compressive strength of mix design III increased by 8 Nmm⁻² more than grade 20 conventional concrete.

Figure 3 shows average compressive strength against fibre percentages.

It is apparent that the addition of *Kitul* fibres improves the compressive strength of the fibre-reinforced concrete composite. All the 3 mix designs showed increased compressive strength than grade 20 plain concrete.

From the three mix designs, the best results were obtained from mix design II of 1% *Kitul* fibres reinforced concrete composite.

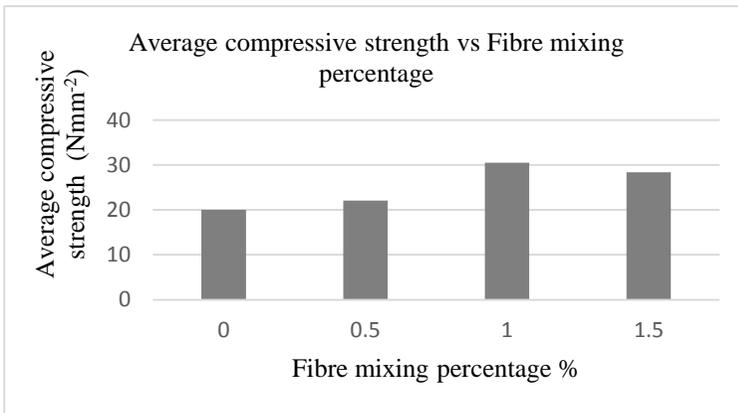


Figure 3: Average compressive strength vs. fibre mixing

4 CONCLUSION AND RECOMMENDATION

The findings of the study indicate that the addition of *Kitul* fibres to concrete improved the compressive strength. From the three mix designs, the addition of 1% *Kitul* fibres gave optimal value. Further increase of fibres decreases the strength as it causes voids, segregation and harshness of concrete and mortar. *Kitul* fibre reinforced concrete composites with 1% of fibre can be used to replace 30Nmm⁻² conventional concrete development in the construction industry.

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Flexural Behaviour of Polyester/Cotton Plain Woven Fabrics with Superimposed Seam

K.V.C. Kehelpannala* and C.N. Herath

Department of Textile and Apparel Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: chathurikakvc@gmail.com

1 INTRODUCTION

The flexural behaviour of fabric influences its aesthetic appearance and functionality. The flexural behaviour of fabric is expressed in the terms of stiffness, which influences the flexibility and drape-ability of fabrics and garments (Ayça, G. 2009 and Megeid, *et al.*, 2013). It measures how the material bends under its own weight. Stiffer materials will restrict the flexibility and flexural behaviour of garments or garment parts (Megeid, *et al.*, 2013). Flexural rigidity is the mechanical property, which is generally used in the computation of the fabric stiffness, relating to fabric areal density and the bending length (Ayça, 2009).

The formation of a seam may change the bending behaviour of fabrics in a garment and it will totally change the aesthetic appearance and functions of garments (Nilgün, *et al.*, 2014). In this research project, the effect of seam parameters such as sewing thread size (ticket number), stitch density, and seam allowance for the variations of flexural behaviour on 65/35 polyester cotton plain woven fabric seamed with superimposed (SSa) seam which is mostly used in garment construction was investigated.

2 METHODOLOGY

2.1 Material

Polyester cotton (65/35) plain woven fabric was used for specimens. Fabric specifications of the material used are given in Table 1 and the fixed and variable parameters are given in Table 2.

Table 1: Fabric specifications

Ends (cm)	Picks (cm)	GSM (gm ⁻²)	Thickness (mm)
57	27	113	0.22

Table 2: Fixed and variable parameters

Fixed parameters	Variable parameters	
		75 Tkt
Vertical seam	Sewing threads	120 Tkt
Sewing speed (4000 rpm)		6 (SA6)
Fabric type (65/35 polyester/cotton)	Seam allowances (mm)	10 (SA10)
Stitch Type - 301		14 (SA14)
Plain seam		10 (SD10)
Needle size 14	Stitch densities (SPI)	12 (SD12)
		14 (SD14)

2.2 Procedure

The experiments were carried out under the standard atmospheric conditions, at 27°C±2 and 65±2% relative humidity. Fabric samples were cut in warp and weft directions. The specimens were in the size of 25mm±1 width and 200mm±1 length. Lock stitch type 301 was used in stitching and vertical seams (i.e. a seam which is parallel to the length direction of the sample) were made in the middle of each specimen. All specimens were conditioned under standard atmosphere for 24 hours before testing. Stiffness tests were carried out according to ASTM 1388-68 using the Shirley stiffness tester. Based on the overhang length measurements, bending length was determined using the formula (1) given below. Sample size was five and four readings were taken for each specimen such as one face up and one face down on one end and then the same for the other end. To calculate the flexural rigidity, following formula (2) was used.

Bending length (C) = O/2;
Where O= over hang length (cm) ---- (1)

Flexural rigidity (G) in (gcm) = WC³;
Where W= Weight/unit area (g/cm²)--(2)

Before investigating the flexural rigidity of sewn samples, the flexural rigidity of unsewn samples (control sample) cut in warp and weft directions was measured.

3 RESULTS AND DISCUSSION

3.1 Flexural rigidity of the control sample

Mean flexural rigidity of control samples cut in warp and weft direction are shown in Figure 1.

According to Figure 1, warp direction shows higher flexural rigidity than weft direction because warp density is higher than weft density. Samples cut in the warp direction, have more warp yarns in unit length. Therefore, they can give a higher bending length and weight per unit area.

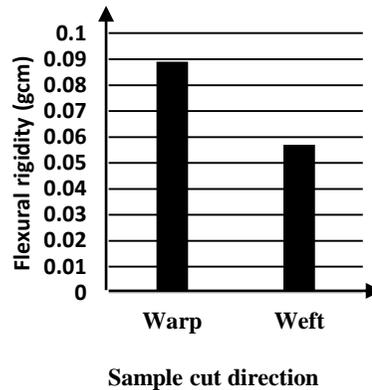


Figure 1: The mean flexural rigidity of the control sample

3.2 Flexural rigidity of plain seam with 75 ticket number in warp and weft directions

Figure 2 shows the mean flexural rigidity of plain seam with 75 Tkt in warp and weft directions respectively for three different seam allowances (SA) and stitch densities (SD).

As shown in the Figure 2, stitch density has a positive correlation to flexural rigidity, because the mass and rigidity of the stitches made by the sewing thread will add to the seam to increase flexural rigidity more than the control sample. Flexural rigidity shows positive correlation to bending length up to seam allowance 10, but seam allowance 14 shows lower flexural rigidity. This may be due to the increase in the weight of fabric with sewn seams. Similar tendencies were also observed in Figure 2 (b).

According to the ANOVA analysis given in Table 3 and 4, seam allowance and stitch density are significantly affected on flexural rigidity and stiffness under 95% level of significance.

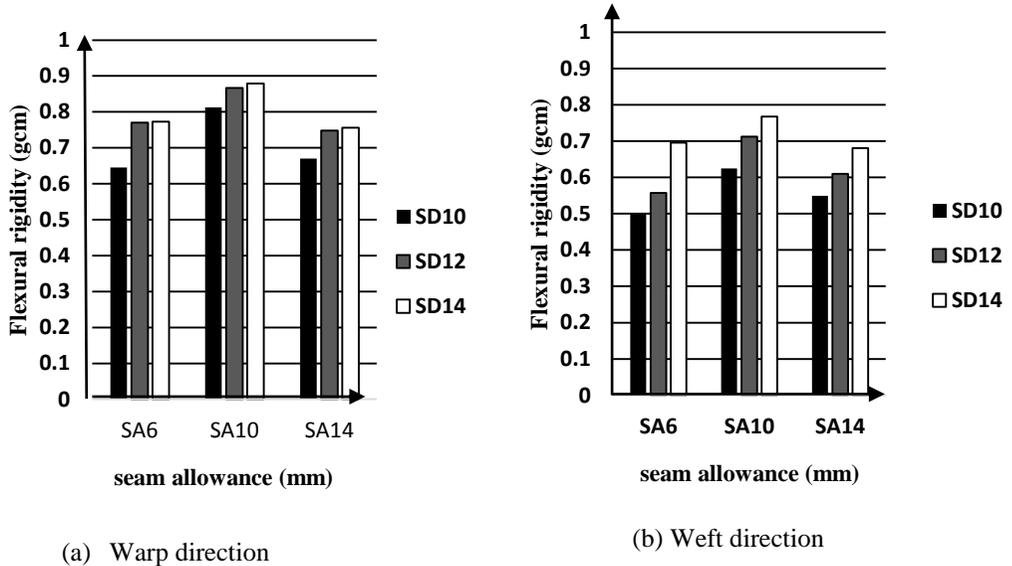


Figure 2: Mean flexural rigidities of plain seam with 75 ticket number

Table 3: ANOVA results for flexural rigidity of samples cut in warp direction and sewn with 75 ticket number

	Sum of squares	Degrees of freedom(df)	Mean square	F value (F _{0.05} = 6.944)
Between SAs'	0.031785	2	0.015892333	40.99484093
Between SD's	0.016109	2	0.008054333	20.77644024
Residual	0.001551	4	0.000387667	
Total	0.049444	8	0.0061805	

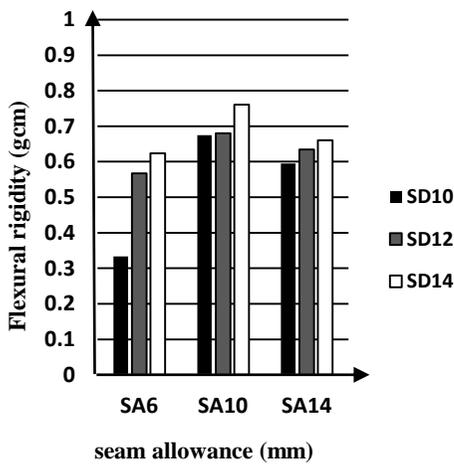
Table 4: ANOVA result for flexural rigidity of samples in weft direction and sewn with 75 ticket number

	Sum of squares	Degrees of freedom(df)	Mean square	F value (F _{0.05} = 6.944).
Between SAs'	0.022372	2	0.011185778	19.34883721
Between SD's	0.037167	2	0.018583444	32.14510859
Residual	0.002312	4	0.000578111	
Total	0.061851	8	0.007731361	

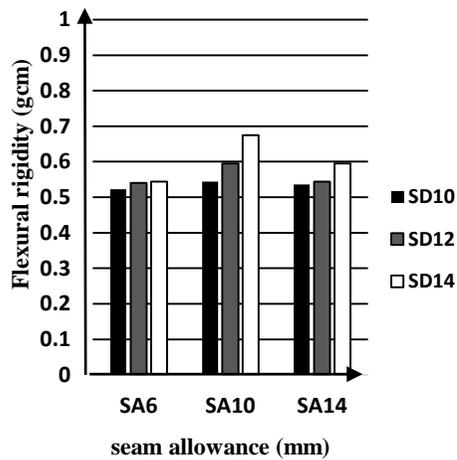
3.3 Flexural rigidity of plain seam with 120 ticket number in warp and weft direction

Figure 3 shows the mean flexural rigidity of plain seam with 120 ticket number. As shown in the Figure 3, the variation of stitch densities shows a positive correlation with flexural rigidity because of the mass and rigidity of the stitches made by sewing thread. Up to seam allowance 10, the flexural rigidity shows a positive correlation with bending length

but seam allowance 14 has a lower flexural rigidity. This may be due to the weight of the fabric. It was observed that there are similar tendencies in Figure 3 (b). Considering the three graphs with SA 6 of Figure 2(a) shows higher value than Figure 3(a). It means fabric samples sewn with 75 ticket number sewing thread have higher flexural rigidity than 120 ticket number.



(a) Warp direction



(b) Weft direction

Figure 3: The mean flexural rigidity of plain seam with 120 ticket number in warp and weft direction

This tendencies can be seen with other graphs also. That was due to the variation of sewing thread thickness. According to ANOVA analysis given in Table 5 and 6,

seam allowance and stitch density are not significantly affected on flexural rigidity and stiffness under 95% level of significant for 120 ticket number.

Table 5: ANOVA result for flexural rigidity of samples in warp direction and sewn with 120 ticket number

	Sum of squares	Degrees of freedom(df)	Mean squares	F value (F _{0.05} =6.944)
Between SA's	0.05947	2	0.029734333	5.64201006
Between SD's	0.03328	2	0.016641333	3.1576484
Residual	0.02108	4	0.005270167	
Total	0.11383	8	0.014229	



Table 6: ANOVA result for flexural rigidity of samples in weft direction and sewn with 120 ticket number

	Sum of squares	Degrees of freedom(df)	Mean squares	F value (F_{0.05}=6.944)
Between SA's	0.00748	2	0.003741444	4.445573965
Between SD's	0.00768	2	0.003838778	4.561225163
Residual	0.00337	4	0.000841611	
Total	0.01853	8	0.002315861	

4 CONCLUSIONS

Flexural behaviour of a fabric has a positive correlation to flexural rigidity-1. Flexural rigidity of unsewn fabrics showed higher values in warp direction than weft direction depending on the warp and weft densities, which means fabrics in warp direction have a lower flexural behaviour than fabrics in the weft direction. After seaming, the flexural rigidity increased (i.e., reducing the flexural behaviour) in both directions compared to unsewn samples. Due to the variations of flexural rigidity, it can be concluded that the flexural behaviour of fabrics will reduce with an increase in stitch density. Further, flexural behaviour will also decrease with more seam allowances, but it will not continuously decrease. When seam allowance increased more than 10 mm, flexural behaviour will also increase. Thus, fabrics sewn with lower ticket number sewing thread will result in all the above effects with higher significance at 95% confidence level. But, these effects are insignificant at 95% confidence level, when the fabrics are sewn with a higher ticket number sewing thread.

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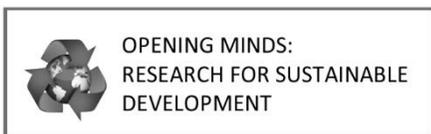
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Developing Sanitary Napkins Using Corn Husk Fibres

R.A.N.S.Wijesingha* and M.A.I. Perera

Department of Textile and Apparel Technology, The Open University Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: nipuni.shalika@gmail.com*

1 INTRODUCTION

With 875 million tons cultivated worldwide in 2012, corn is the second largest agricultural crop grown in the world –. The cultivation of corn generates stover such as stalk, leaves and husk as by products. Cornhusk is the protective cover of the seeds. The United States produces about 20 million tons of cornhusks annually. (Reddy and Yang, 2015). In relation to the industry of developing sanitary napkins, there is now a necessity to develop a natural, super-absorbent layer due to the increased risk of cancer and other diseases caused by the use of tampons and napkins which are composed of super-absorbent gels and layers. The objective of this study is to replace a sanitary napkin with a natural waste product – corn husk fibres - which also has the quality of higher absorbency. Also, it resolves the day to day problem of the garbage produced by the boiling of corn by village sellers.

2 METHODOLOGY

First the fibres were extracted and the properties of the extracted fibres were checked according to the particular ASTM standards. Fibres were tested for their physical properties under the standard testing conditions, 65% \pm 2 Relative humidity 21° \pm 2 °C temperature. Prior to

test, samples were kept for 24 hours under standard conditions. The length was determined by the staple length, the average diameter value, the bundle strength separately for the short fibres and long fibres since the strength depends on the length, by Pressley Strength Testing - ASTM D 3822, and the Moisture Content of Fibres – ASTM D2495 – 07, and the microscopic appearance was checked. Then the sanitary napkin was developed with the extracted fibres. Finally, it was checked for the standards that have been given by the Sri Lanka Standards Institute for sanitary towels – SLS 111:2009. Under this standard, the checking of the Aerobic Plate Count of the developed sanitary napkin, the absorbency of the developed napkin and the testing for pH Value was carried out.

2.1 Designing the experiment

2.1.1 Fibre Extraction

According to the literature survey, it was cleared that, better conditioned cornhusk fibres can be extracted from green immature cornhusks rather than dried mature ones. In case of fibre extraction, three natural methods and one chemical method was carried out. They are;

- Slow moving water retting
- Dew retting
- Stagnant water retting



- Heating with different percentage of NaOH solutions, temperatures and time

2.1.2 Developing the Sanitary Napkin Using Cornhusk Fibres

Extracted fibres were combed and pressed and stitched them together to become thinner and parallel. The napkin was composed of three layers, one polyethylene layer in the bottom as to prevent side leakages, and then the stitched fibre was laid on top of it and on top of that a cotton layer is laid for comfort. Finally, these layers were stitched together using a thinner, non-woven cotton layer on the top. Figure 01 shows the development of such a sanitary napkin.



Figure 1: Developing sanitary napkins using Corn husk fibre.

2.1.3 Preparing the Solution for the Aerobic Plate Count Test – SLS 111:2009

A solution of 0.85% of NaCl was prepared and saline water was added to have a suspension of 100ml (assumption; 1ml = 1g.). So, in the case of the preparation of the NaCl solution, with 0.85g of solid NaCl three equal solutions were prepared. Here one sample is kept as a controlled solution and other two are

used for the experiment. Then the mass of the sanitary towel was measured to the nearest 0.1g which resulted as 10g and autoclaved the samples to be tested and prepared solutions.

After autoclaving, all the testing equipment to be used such as tubes, bottles, beakers, pins etc. were securely covered with Aluminium paper in order to prevent moisture absorption and then sterilized. Temperature was controlled to be more than 800C and sterilization was done for 40 minutes as per the standard. Then, the sanitary napkin was cut into smaller pieces so that it would be easier to make the test suspension. The cut sanitary napkin was put into one solution, the lid was fitted and the contents were agitated well for 2 minutes with the use of an agitating machine. Then it was allowed to stand for 10 minutes. The process of agitating and standing was repeated twice more. Then the test suspension was removed for further testing.

From the initial suspension, further decimal dilutions were prepared by;

Removing 10ml from one of the remaining diluents and transferring 10ml of the previous dilution to the remaining 90ml of prepared diluents bottle. Shake well and this is 10-1 solution. Likewise, the 10-2 suspension was also prepared. Then a 1ml portion of the test suspension was distributed into duplicate sets of three Petri dishes using a pipette. 15ml of freshly melted, plate count agar that had been cooled to 450C was added to each dish. Then the suspension was smoothly mixed in order to have an even surface appearance. Finally, the suspension was incubated at 370C for 48 hours.

2.1.4 Preparing the Solution for Absorbency Test – SLS 111:2009

650 ml of boiling water and 0.4g of methyl paraben was added into a 1 litre capacity beaker and stirred until it dissolved. 80g of the gum acacia was



added and stirred until it was dissolved completely. This made up about 870ml with water and the solution was then allowed to stand for at least 24 hours. The solution was then filtered through a 45-micron sieve. 1.0g of methyl orange, 160ml of glycerine and 90 ml of water was added to the filtrate and mixed. The final volume was 1 litre. It was then mixed thoroughly and allowed to rest for 24 hours the viscosity was then measured. It was measured as 5.5 milipascal. The solution must be shaken before use.

The sanitary towel was first laid on a flat, level, transparent surface. 30ml of the suspension, at the rate of 15ml per minute was then dripped on to the centre of the sanitary napkin from a height of 1mm to 2mm as in the image. After allowing 2 minutes for the napkin to absorb fluid from the surface a 1kg weight piece with the template was kept on the sanitary napkin. The template was removed after one minute and the weight piece as well as the underside and sides of the sanitary napkin was observed for leakages.

2.1.5 Preparing the Solution for testing the pH Value – SLS 111:2009

Fibres were cut into pieces having approximately 5mm sides to allow the test samples to wet out rapidly. To avoid contamination, the materials were handled as little as possible. The samples were in between 2g – 2.5g. The test sample and 100ml of distilled water was placed in a polypropylene glass and the flask was agitated for a short period by hand to ensure that the materials were properly wetted out and then shaken mechanically for 2 hours.

3 RESULTS AND DISCUSSION

Quality corn husk fibres could be obtained by; Dew Retted for 2 days and then, Stagnant Water Retting for about 10 Days and after washing and Again Dew

Retted for about 4 Days. Fibres were tested for their physical properties and table 01 shows the standard test and the obtained results.

Table 01: Results of tests on fibre properties

Fibre Test	Results
Staple Length	22.4cm
Average Diameter Value	0.485mm
Average Tensile Strength (Short Fibres) ASTM D 3822	2.564 lb/g
Average Tensile Strength (Long Fibres) ASTM D 3822	1.738lb/g
Average Moisture Content ASTM D 2495 – 07	7.221%

3.1 Microscopic Appearance

According to the microscope view obtained, the cross-sectional view of the fibre structure is heavily porous. It has a shape which is in between an oval shape and is somewhat similar to a kidney shape but it does not have as much of a kidney shape as a cross-section of cotton fibre. So, it was assumed that this fibre should have a high absorbency rate and it is tested further. The longitudinal view can be seen as a straight fibre. These views are shown in the figures 2.

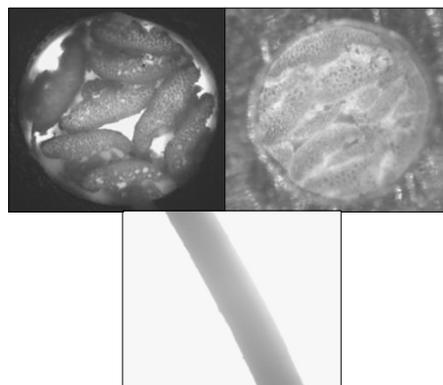


Figure 2: Cross-Sectional view 100 x magnified lighting from the (a) underside (b) upper side of the microscope (c) Longitudinal View in white background



3.2 Aerobic plate count of the developed sanitary napkin – SLS 111:2009

No microbes had grown on the controlled sample. But the other samples had grown colonies. The average colony count was 92. The grown colonies are shown in figure 3.

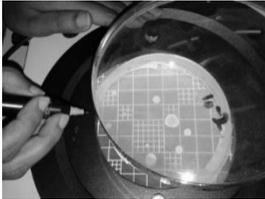


Figure 3: Grown colonies of the uncontrolled sample of the 10⁻² solution.

3.3 Calculation

Aerobic Plate Count

$$\begin{aligned} &= \frac{(\text{No. of Colonies} \times \text{Total Dilution Factor})}{\text{Volume Plated}} \\ &= \frac{92 \times 1/10^{-2}}{10} \\ &= 920 \end{aligned}$$

According to the SLS 111:2009; the aerobic plate count per g, should be lower than 1000 for sanitary towels. According to that standard, this napkin has achieved the suitability in case microbes test.

3.4 Observations regarding absorbency of the developed sanitary napkin – SLS 111:2009

No leakage of test fluid was found on the underside or the sides of the napkin. So, the assumption is that the sanitary napkin was produced up to the satisfactory requirement.

3.5 Testing for pH Value – SLS 111:2009

After 2 hours, the pH value of the material was read as 6.1. So, it can be considered a hygienic product that can be applied

further without causing negative effects to the skin of the wearer.

4 CONCLUSIONS

Today, many of the commercial products use high absorbency gels as the absorbency agent on the interior of the sanitary napkins, which is harmful to the wearer and carries the risk of cancer. As a solution, the production of a sanitary napkin which highly absorbent but composed of completely natural interior layers using a combination of cotton and developed cornhusk fibres is possible as this this project demonstrates.

Acknowledgments

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DEVELOPMENT

Fully-Automated, Economical Metal Bar Feeding Mechanism for Existing Power Hacksaw

B.J.M. Nanayakkara*, D.C. Wijewardana and V.R., Jayasekara

Department of Mechanical Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: maduranga_nan2@yahoo.com*

1 INTRODUCTION

Sri Lanka has historically demonstrated an ease with the technology of casting iron. From the early stages, metal-related industries grew up and spread all over the country. Despite the economy of the industry, middle and small-scale industries and workshops still continue to work with power hacksaws and band saw machines. Direct analysis of these machines found that more time was required, not for the cutting process, but for human intervention such as feeding, measuring, conveying, and clamping. If the work pieces need to be cut on a large scale, then a repetitive action has to be performed. This multiplies idle time resulting in a considerable lag. According to the analysis, nearly a quarter of the total operating time is devoted to human intervention. At an organizational level, a considerable time wastage may cause economic loss.

Automating human intervention may contribute towards cost reduction and improvement in efficiency. Knowledge and basic theories of mechanical motions are considered highly in the designing process. Upon implementing the product, approximately 40% of the process time can be saved. While the product is in performance, the safety of the machine operator can also be assured.

The complete cutting process incurred from a power hacksaw machine, can be separated into 3 major actions; loading, conveying and clamping. These actions are manually conducted through human labour. Therefore, the time that is spent to complete the cutting process increases. By considering the application, a mechanism is introduced to improve the efficiency as well as the economy.

In addition, through this design the safety of the machine operator can also be assured. However, there are a few issues that impact generally on all cutting machines, such as power consumption, machining defects, high cost of maintenance, etc. But if automatic cutting systems are considered, attention should be paid towards cutting tool wearing. So far, there is no prominent and effective monitoring system to measure the cutting tool wear percentage.

During the literature survey, it was noticed that the impact of this matter on cutting machines has had less consideration among researchers. In order to optimize the metal cutting process, we have also attempted to conduct a separate survey to develop a tool wear monitoring system.



2 METHODOLOGY

2.1 Loading unit

The initial functioning unit is the loading unit. If the cutting job is defined by the operator with measurements, the first step is to confirm whether the metal shaft is existing on the conveyor track or not. If the metal shaft exists, then the length of the existing metal shaft will be compared against the provided measurement. Next, the loading unit helps to load metal shafts onto the conveyor track. The maximum number of metal shafts that can pre-stored in the loading unit is 5. The loading unit is designed to support the repetitive cutting processes. (Figure 1)



Figure 1: Loading unit

2.2 Conveying unit

This unit helps to convey the metal shaft according to the measurements given by the machine operator. The shaft conveying speed is maintained at a constant. This helps to measure length without any expensive sensors and transducers. The slippage of shafts over the conveyor is minimized in the designing process of the conveyor roller. The conveying unit will be the main unit that plays a vital role in the repetitive cutting processes (Figure 2).

2.3 Clamping unit

Clampers are designed to power up the clamping unit with the pneumatic source. When designing appropriate clampers, it is important to consider the reciprocating motion of the hacksaw blade while in performance because the chances of

slipping are high. To recognize the cutting position exactly, an inductive proximity sensor is used.

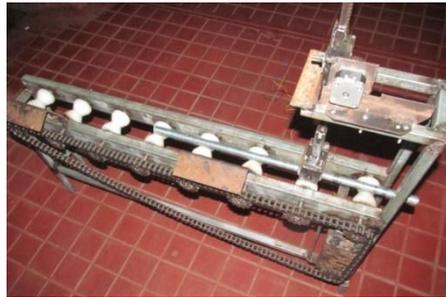


Figure 2: Conveying unit

2.4 Cutting tool wearing monitor and material recognition

If the machine is fully or partially automated, the repetitive cutting action takes place and the machine operator may turn his attention to another activity. During the continuous cutting, the tool wearing situation is very noticeable. Due to this, the machine operator may lose his concentration by having to focus on the wear of the cutting tool. This may lead to machine damage. A tool wear monitoring system observes and notifies the user of the tool wearing percentage so that the machine operator is aware of the status of the machine.

Table 1: Hardness of the selected types of metals

Material	Heat treatment	Hardness (HB)
Iron based alloy	Annealed	200
	Aged	280
Nickel based alloy	Annealed	250
	Aged	350
	Untreated	275
Cobalt based alloy	Annealed	200
	Aged	300
Titanium based alloy	Untreated	200
	Annealed	320
	Aged	375



Prior research indicates that the possible ways of monitoring tool wear-percentage are,

- MLP neural network and multivariate process parameters.
- Cutting tool vibration pattern behaviour.

Before the cutting process starts, it is important to identify the material to be cut. Therefore, the cutting tool material should be changed accordingly. Material identification is an important factor for successful machining.

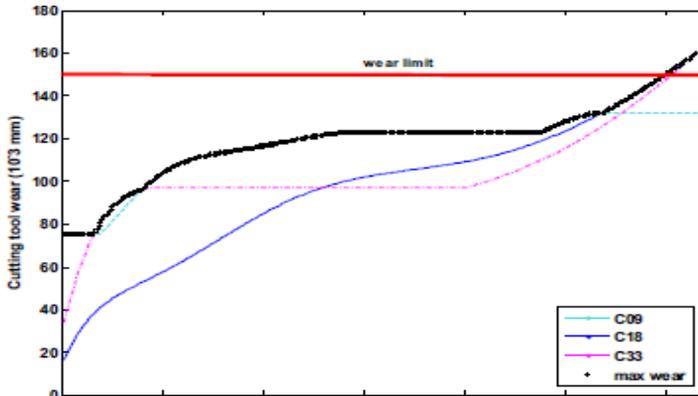


Figure 3. Wear patterns with max wear limit

Table 2: Test records of time values for conventional cutting.

work pieces diameter	Time for clamping and measuring	Time for cutting process
25mm-35mm	1min	3min-4min
35mm-50mm	1min-1.42min	5min-6.17min

3 RESULTS AND DISCUSSION

3.1 Results

Using the current method, the worker spends about 1 minute on the clamping, measuring, and feeding operations. By using the proposed solution, the time spent on these operations can be reduced up to 36 seconds. The percentage of time saved by the designed machine is about 42% which is demonstrated by the test results. Therefore, the efficiency of the power hacksaw cutting process can be improved by automating it. By considering the expensive prices of the CNC machines compared to the budget, it is better to use an automated solution for the existing machine. The mechanisms and the materials used in the design of the

machine are selected in such a way that the cost of production of the machine is minimized.

3.2 Discussion

As mentioned in the introduction, a considerable amount of time has been saved. This may lead to more sustainable process for maintaining the repetitive cutting action. Therefore, the targeted number of work pieces for a day can be increased. The concerns about the safety of the machine operator during performance is also satisfied.

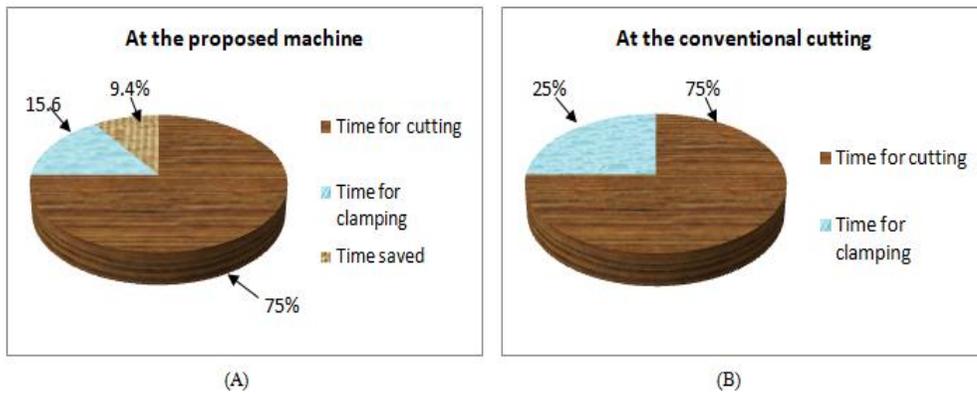


Figure 4: Time comparison, (A) At the proposed machine. (B) At the conventional machine

4 CONCLUSIONS

By considering the cost reduction and improved efficiency, a few mechanisms were selected and designed. During optimization the most appropriate design was selected. Cost reduction is maintained by applying the most suitable mechanisms. Power sources are selected by considering the ease for workshops of any scale. The machine is a combination of three units, the clamping, loading and conveying unit. The machine is automated by connecting these three units to work as a single machine.

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A.V.V.S. Bandara* and H.D.N.S. Priyankara

¹*Department of Mechanical Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: virajithshakya@gmail.com

1 INTRODUCTION

At present, Unmanned Aerial Vehicles (UAV) are commonly used for security purposes, research purposes, rescue purposes, monitoring, disaster management, crop management, communications and surveys. Among all kinds of UAVs, quadrotors have become popular, because they can be controlled easily and they can take off and land without using a runway.

Most autopilot systems are navigated using Global Positioning System (GPS) coordinates. GPS receivers are used to get coordinates. Most of the low cost commercial GPS modules have an error margin of about ± 2.5 meters ("NEO-6 u-blox 6 GPS modules", 2011). When considering small scale quadrotors, this is a considerable error. To assure accurate and precise landing, a vision based system was introduced to a quadcopter.

This paper discusses the vision system. The vision system uses an image of a helipad as the ground target to identify the landing point. The system consists of an on-board controller (Raspberry pi) to process images, a camera module to capture images, an Arduino controller to control the quadcopter navigation system and Pixhawk flight controller to control the quadcopter. The system was implemented and successfully tested

using a quadcopter in real-time. Using the introduced vision system, the error was reduced to the range of ± 0.5 meters.

2 METHODOLOGY

2.1 Vision System

The vision system uses the cascade classifier method for image processing. Object detection using cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine-learning based approach where a cascade function is trained from a lot of positive (images with helipad) and negative (images without helipad) images. It is then used to detect objects in other images. ("Cascade Classification — OpenCV 2.4.13.2 documentation", 2016). Complete quadcopter with vision system is shown in Figure 1.



Figure 1: Quadrotor with complete vision system



Figure 2: Ground target used in the vision system

Here the system detects the image of a Helipad. Initially, the algorithm needs a lot of positive images (Helipad images) and negative images (Images without helipad) to train the classifier.

Matlab software is used to train the cascade classifier and after that OpenCV is used to recognize the helipad. After detecting the helipad, it draws a circle around the detected object. The coordinates of the centre of the drawn circle is used to navigate the quadcopter. The Helipad shown in Figure 2 is used as the ground target of the vision system.

1.2 Vision Based Navigation System

A navigation system is used to navigate the quadcopter according to the data acquired from the vision system. The frame size of the captured image is 256x256 pixel. The vision system gives the coordinates of the centre point of the detected helipad after capturing the image. The movement of the quadcopter is obtained according to the position of the helipad. Figure 3 shows the allocation of coordinates for the image frame and captured image is divided into nine regions as shown. Movements according to the X and Y coordinates are shown in Table 1. If the target coordinates are located in section A, B or C, the quadcopter moves forward. If the target coordinates are located in section G, H or I, the quadcopter moves backward. If it is located in section D and F, the quadcopter moves left and right respectively. If it

detects the target coordinates in section E, it gives the landing command to the quadcopter.

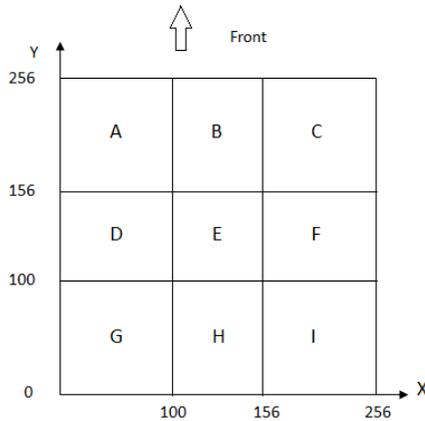


Figure 3: Allocation of coordinates for the image frame

Table 1: Movement of the quadcopter according to the centre coordinates

Section	X range	Y range	Movement
A	0-100	156-256	Forward
B	100-156	156-256	Forward
C	156-256	156-256	Forward
D	0-100	100-156	Left
E	100-156	100-156	Land
F	156-256	100-156	Right
G	0-100	0-100	Reverse
H	100-156	0-100	Reverse
I	156-256	0-100	Reverse

Usually, the quadcopter is navigated by transmitter signals. The transmitter emits 1000 μ s to 1900 μ s PWM signal. It uses four separate signal channels for roll, pitch, yaw and throttle. Quadrotor movements according to the transmitter



signals are shown in Table 2. Here the navigation system uses roll and pitch signals to adjust the position of the quadcopter to obtain the desired target coordinates. When the vision system takes over the controls, it bypasses the transmitter signals using Arduino. Arduino generates the PWM signals for each roll and yaw channels to obtain the necessary movement.

Table 2: Quadrotor movements according to the transmitter signals

Channel	PWM range (µs)	Movement of the quadrotor
Roll	1000 -1499	Left
	1500	Hold Position
	1501 - 1900	Right
Pitch	1000 – 1499	Forward
	1500	Hold Position
	1501 - 1900	Reverse

Table 3: Navigation data without vision system and with vision system

Case	Distance to desired landing	Direction	Average Error (m)	Average Error (m)
01	50	North	+2.0	+0.4
02	50	East	+3.4	+0.5
03	50	South	-2.5	-0.3
04	50	West	+2.8	+0.5
05	50	Northeast	-2.2	-0.4

3.2 Discussion

The accuracy of GPS is dependent on the quality of the GPS receiver, the number of satellites connected to the GPS module and the position of GPS satellites etc. However, the vision-based autonomous landing system is designed to navigate

3 RESULTS AND DISCUSSION

3.1 Results

Trials were done for cases with GPS and with vision-based system in bright sunlight conditions.

Twenty trials were done at each case and Table 3 shows the average test data of the quadcopter navigation system for both cases. A 50m distance was applied in each direction to the system.

Then the quadcopter was set to autonomously navigate itself to the desired target and the error was measured.

Error = [Distance to desired landing point – Distance to the point which quadcopter landed]

and land a quadrotor in an accurate position without being affected by the GPS error. According to the test results as shown in Table 3, the GPS error was reduced to the range of ±0.5m. This system was designed to be used with any type of quadcopter to assure precise landing.

4 CONCLUSIONS AND RECOMMENDATIONS

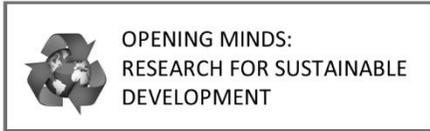
The design and implementation of a vision-based autonomous landing system for a quadcopter was discussed in this paper and has been tested successfully.

The camera module used in the vision system has an angle of 42 degrees. ("Camera module - raspberry pi documentation", 2013) The range of the vision system can be extended by using a wide-angle camera for the vision system. The captured image frame can be divided into more sections to increase the accuracy of the vision system. The stability of the quadcopter can be improved by reducing the vibration of the quadcopter. For further developments, a vibration analysis should be carried out to reduce vibration.

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U. I. Katupitiya, D. D. M. Ranasinghe and G. S. N. Meedin

*Department of Electrical and Computer Engineering, Open University of Sri Lanka,
Nugegoda, Sri Lanka*

**Corresponding author: Email: ddran@ou.ac.lk*

1 INTRODUCTION

The problem of predicting a user's behaviour on a web-site has gained importance due to the rapid growth of the world-wide-web and the need to personalize and influence a user's browsing experience. In addition, the busy lifestyles of users makes them unlikely to tolerate latency in their browsing. Since web sites are constantly competing to attract and retain new visitors, it is of much importance to provide the best possible service to the user who logs onto the site. Therefore, feedback on navigation patterns that occur will significantly aid site owners to efficiently organize the hyperspace they present to their visitors.

The Open University of Sri Lanka is an education institute with a huge number of students. One of its fundamental issues is to provide the information requested by the users, efficiently and accurately. Therefore, the focus of this paper is to develop a system to predict the next web page a user is likely to visit which will aid the university to organize the hyper space in a more efficient manner.

1.1 Literature survey

The focus of this survey was to study and compare the different techniques

available to predict the next web page a user is likely to visit. Jalali M, *et al.* (2010), proposed an online and offline phase recommendation system called WebPUM. In Chimphlee *et al.*, (2010) an integrated prediction method was proposed by combining the Markov model, Association rules and Fuzzy Adaptive Resonance Theory (Fuzzy ART). Sonavane (2012), address the problem of matching pattern sequences by considering the maximal length common to both sequences and uses the Longest Common Subsequence (LCS) algorithm to overcome this short coming. Kaur *et al.*, 2013 proposed a system architecture for predictions based on Fuzzy Clustering. Langhnoja *et al.* (2013) have used the association rule mining technique combined with the DBSCAN clustering algorithm to predict user behaviour from large data sets. Jarkad, and Bhonsle (2015) have used a graph partition algorithm for clustering the data. Charpate *et al.* (2015) have used a higher order Markov model for predictions along with page ranking. Bohra and Sharma (2016) have performed a comparative analysis of web-mining approaches for efficient mining of server log formats using Apriori and FP Growth techniques. Based on the literature review it is evident that the use of clustering over classification is preferred mainly due to



less the fact that it is less complex and the apriori algorithm is used mostly for association rule mining while predictions are mostly done using higher order Markov models.

2 METHODOLOGY

Considering the facts obtained from the above survey on predicting the next web page users are likely to visit on the OUSL website, association rule mining was used along with kth order Markov model. Figure 1 contains the overall design of the proposed methodology for the prediction system. E-sources for web usage mining are server log files, cookies, data tags, login information., client or server-side scripts etc. files used in this project are in NCSA (Common or Access) combined log format. A portion of the log file format is given in Figure 2.

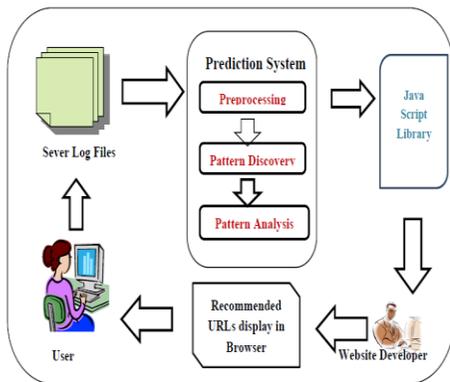


Figure 1: Proposed system architecture

```

175.157.62.8 - - [04/Sep/2016:12:40:13 +0530] "GET /home/index.php/exam-results HTTP/1.1" 200
8782 "-" Mozilla/5.0 (Windows NT 6.1; rv:47.0) Gecko/20100101 Firefox/47.0"

103.21.166.51 - - [04/Sep/2016:12:40:14 +0530] "GET /home/index.php/exam-results HTTP/1.1" 200
8782 "http://www.ou.ac.lk/home/index.php/exam-results" Mozilla/5.0 (Linux; Android 4.4.4; E2105
Build/24.0.A.5.14) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/51.0.2704.81 Mobile
Safari/537.36"
    
```

Figure 2: Log file in combined log format

The fields in the NCSA Combined Log Format are:

```

<host><rfc931><username><date:time>
<request><statuscode><bytes>
<referrer> <user_agent> <cookie>
    
```

Data fields obtained from log files as shown in Figure 2 have to be separated before applying the cleaning procedure. This process of separating out different data fields from single server log entry is identified as data field extraction. OUSL log files use space as the separator.

After field extraction a portion of the separated log is given in Figure 3. Next, we will look at the different stages of data pre-processing in detail.

IP Address	Date	Request	Code	Size	Country	Referer	UserAgent
141.0.15.40	04-Sep-2016:0	GET /home/index/200	200	1097	Norway	-	Mozilla/4.0 (Windows 98; US; Opera 12.16 [en]

Figure 3: Log data after field extraction

2.1 Data Cleaning

Accessorial resources embedded in the HTML file, robot requests and error requests are to be cleaned. In doing so the following steps were followed.

1. Identify web log records with filename extensions that includes *.gif, *.js, *.jpg, *.jpeg, *.png and *.css, in the requested field and remove those records from the web logs database.
2. Identify records with failed HTTP status code by examining the status code field of every record in the web access logs that has status code greater than 299 and status code less than 200 and remove those records from the web logs database.
3. Identify records with value “GET” in the method field and only retain those in the web logs database. That is, delete the records with the value “POST” or “HEAD” in the method



field as they do not represent the request from common users.

4. Identify records with text “robot” or “spider” or crawler” in the cs (User-Agent) field and remove those records from the web logs database.

2.2 User and Session Identification

If there are two requests with the same IP address and with different browser name or operating systems then it is considered as requests from two different users. It was assumed that each user has a unique IP address while browsing the website. The same IP address can be assigned to other users after the user completes browsing. A set of user clicks is usually referred to as a click stream. A click stream across a web server is defined as a user session. The timeout mechanism is used as the session identification method. In doing so the followings rules are being employed to identify a user session.

1. If there is a new user, and hence, there is a new session;
2. If the refer page is null in one user session, there is a new session;
3. If the time between two page requests exceeds 30 minutes period, it is assumed that the user is starting a new session. In line with these rules, the web logs of OUSL were analysed and entries were sorted by session ID.

2.3 Path Completion and pattern identification

In order to identify patterns of usage, the complete path of one’s browsing session has to be recorded. Sometimes several reasons such as local and agent cache ‘post’ techniques and the hitting of the browser’s back button can result in incomplete paths. In order to find patterns, data with similar features has to be clustered. Based on the literature survey, the k-means algorithm was employed for

clustering. To find the co-existence relations between clusters, an apriori algorithm in association rule mining is applied. The final stage of the implementation is identification of the patterns that can be used for next page access predictions.

3 RESULTS AND DISCUSSION

Log files pertaining to the period from the 4th of September 2016 to the 8th of September 2016 of the Open University website was used for the analysis. Figure 4 shows the spider hits and normal hits along with the total hits before pre-processing. Figure 5 shows the total number of hits after pre-processing and the same comparison is given in Table 1 as well.

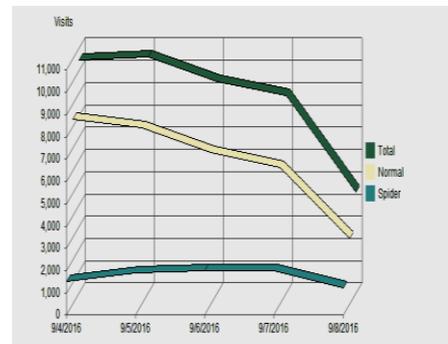


Figure 4: Visits before pre-processing



Figure 5: Visits after pre-processing

As Table 1 indicates there are no spider hits and failed hits after pre-processing. Therefore, the total number of hits are reduced. During this period there were 91,418 log records after cleaning log files and there were 5,165 different users and 5,704 different sessions.

Type of hits	Before Pre-process	After Pre-process
Total Hits	2,159,986	233,037
Normal Hits	641,100	233,037
Spider Hits	27,731	0
Average hits / Day	431,997	46,607
Failed Request	68,793	0

As Table 1 indicates there are no spider hits and failed hits after pre-processing. Therefore, the total number of hits are reduced. During this period there were 91,418 log records after cleaning log files and there were 5,165 different users and 5,704 different sessions.

Table 1: Comparison of no. of hits before and after processing

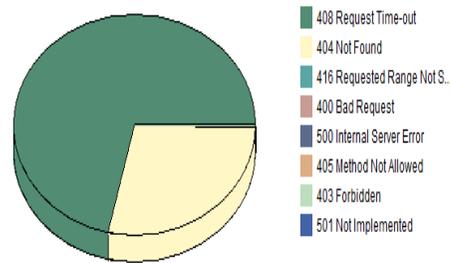


Figure 6: Types of http error codes

In addition, during the pre-processing stage various http error codes were also removed from log files. It was noticed that the highest error code is 408 (Request Timeout) and the next is 404 (Request Not Found). This is diagrammatically shown in Figure 6. The outcome of the pattern analysis was that the next page a user is most likely to visit is the exam results page with a 72% prediction rate. When compared with the actual page views as given in Table 2, it is evident that the prediction is correct.

Table 2: Actual page access results

Pages	Page Views
/home/	28507
/home/index.php/exam-results	26726
/apps/examresults/examresultfiles/getresult.php	20465
/home/index.php/find-a-programme/ undergraduate-programmes	5496
/home/index.php/find-a-programme/ up-comming-programmes	4599
/home/index.php/find-a-programme/ diploma-programmes	4599



4 CONCLUSIONS

The results obtained through this analysis will be particularly important for the Open University of Sri Lanka in organizing the hyperspace of the university, which is the main window of communication. The period where the log data was accessed was an exam result announcing period. Therefore, it is clearly evident that the students will access the exam result page after logging on to the home site of the university. The accuracy of the prediction could have been improved further by applying the techniques in different time lags for predictions. Considering the importance of getting to know the next web page, future work will incorporate this system as a java Script library to allow the web developer to integrate it into the website.

Acknowledgement

We thank the IT division of the Open University of Sri Lanka who provided the web logs from 4th of September 2016 to 8th of September 2016 of the Open University website.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Dyeing 100% Cotton Plain Fabrics with Natural Dye Extracted from *Thespesia populnea* (Gan Suriya)

P. G. Kaushalya*, W. A. Wimalaweera and C. N. Herath

¹*Department of Textile and Apparel Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: kaushiigaya@gmail.com

1 INTRODUCTION

Natural dyes are known for their use in the colouring of food substrate, leather as well as natural protein fibres like wool, silk and cotton all of which have been major areas of application since pre-historic times (Samanta *et al.*, 2009). Natural dyes can be extracted from many natural sources. Among them, plant dyes can be extracted from the leaves, seeds, flowers, fruits, barks, roots and wood (Allen, 1971). *Thespesia populnea* is an example of a tree, which contains tannin in its bark. The common name of this tree is Gansuriya. *Thespesia populnea* is a small to medium sized evergreen perennial tree grown in the coastal, tropical and sub-tropical areas. It is a flowering plant belonging to the Malvaceae family.

In Sri Lanka, this plant is not used for any special purposes. However, the bark and leaves of *Thespesia populnea* are ideal for skin diseases.

The main objective of the study is to extract a natural plant dye from this commonly available plant source to dye cotton fabrics. To meet this objective, the study provides the information on suitable extraction methods, dyeing procedures to dye cotton fabrics and the fastness properties of the extracted dye for light and washing.

2 METHODOLOGY

The experimental procedure includes the dye extraction from the stem bark of Gansuriya, mordanting, dyeing and assessing colour fastness of the dyed 100% cotton samples.

2.1 Materials used in dye extraction, dyeing and mordanting

Several materials and equipment were used for the extraction process as given below.

Dried Gansuriya bark chips, water, a scale to measure, pH papers, a thermometer and a burner, Sodium Hydroxide (NaOH), Sodium carbonate (Na₂CO₃), lemon juice, vinegar, de-sized and bleached 100% plain cotton fabric of 6cm x 7.5cm, Potassium Aluminium Sulphate (KAl(SO₄)₂•12H₂O), Copper Sulphate (CuSO₄), Ferrous Sulphate (FeSO₄) and Sepalika flowers *Nectanthes arbor-tristis*.

2.2 Dye extraction by changing pH

Aqueous extraction was carried out using 1l of clean well water. The cut bark chips were dried under shade and 100g of dried bark chips was added to the water. The water bath was heated to 100°C over 75 minutes. To observe the extraction efficiency and colour yield by the changing pH at the extraction, several acids and alkalis were added to the water



bath. Vinegar and lemon juice were added separately to adjust the pH of the extraction liquor in to the acidic state to keep the pH level as 5 and 3 respectively. NaOH and Na₂CO₃ were added separately to adjust the pH into the alkaline state to keep the pH as 13-14 and 8-9 respectively.

2.3 Dye extraction by changing temperature and duration

To determine the most suitable temperature and duration for dye extraction, experiments were carried out using 30 minutes, 45 minutes and 60 minutes and two dyeing temperatures of 500°C and 1000°C while the other conditions were kept constant. The extracted liquor was filtered.

2.3 Pre mordanting process

The fabrics to be dyed are subjected to mordants before dyeing. Here, 3 metal salts; alum, CuSO₄, FeSO₄ and as a natural mordant Sepalika flowers were used.

2.4 Dyeing process

Dyeing was carried out according to the dyeing curve in Figure 1 to dye non mordanted and pre-mordanted samples using dye liquors extracted in neutral, acidic (pH 4-5) and alkaline (pH 12-13) conditions.

2.5 Experiments to evaluate the optimum dyeing duration

To determine the optimum dyeing duration, experiments were done using four different dyeing durations while the other conditions were kept constant. Furthermore, below dyeing curve has been used as the base and improved to evaluate the optimum dyeing duration.

500 mL of neutrally extracted dye liquor to dye, 1.10 g non mordanted fabric sample and 10 g of common salt were used. The temperature of the dye liquor was raised to 500°C and the fabric samples were immersed in the dye liquor. They were kept at that temperature for 15 minutes. Within about 5 minutes, the temperature was raised to 950°C. It was kept for another 10 minutes at that temperature to dye over 30 minutes. To dye over 40 minutes, 60 minutes and 75 minutes, the samples were kept for 25 minutes, 40 minutes and 55 minutes at that temperature respectively. Then the temperature was reduced to room temperature over 10 minutes. Dyed samples were left steeped in the dye baths for a further 6 hours at room temperature. Finally, the samples were washed with cold water and dried in the shade.

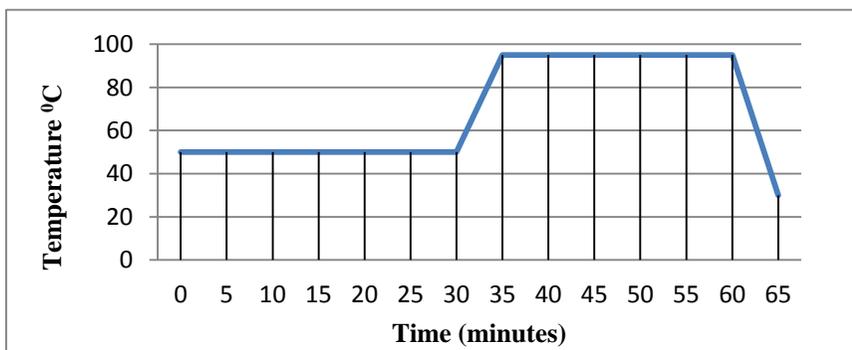


Figure 1. Dyeing curve



2.6 Experiments to evaluate the optimum dye steeping duration

To determine the optimum dye steeping duration, experiments were done using three different steeping durations while other conditions were kept constant. 500 mL of neutrally extracted dye liquor was used to dye 1.10 g of non-mordanted fabric samples. The temperature was raised to 500°C and the fabric sample was immersed in the dye liquor and was kept for a further 30 minutes. Then within about 5 minutes, the temperature was raised to 950°C. The dye bath was kept for another 25 minutes at that temperature. Then the temperature was allowed to reduce to room temperature. The dyed sample was left steeped in the dye baths for an additional 30 minutes at room temperature. According to the same method, the dyeing was carried out for other samples but the steeping duration was changed to 6 hours and overnight respectively. Finally, all the samples were washed with cold water and dried in the shade. The differences between the colours were visually assessed under the colour assessment cabinet using the grey scale (ISO 105 AO3: 1993).

2.7 Experiments to evaluate the dye affinity at different pH

The dye affinity of the dye under different pH values from acidic to alkali was evaluated. Neutrally extracted dyes of both dyes were taken as the dye liquors. De-sized and bleached cotton and mercerized cotton fabrics were dyed. The temperature of the dye liquors was raised to 500C and the fabric samples were immersed in the dye liquors. Then they were kept at that temperature for 30 minutes. Within about 5 minutes, the temperature was raised to 950°C. To improve the alkalinity of the dye liquors, NaOH was added during dyeing and pH was adjusted to 13. To improve the acidity, lemon juice was added during dyeing and the pH was adjusted to 4. It

was kept for another 25 minutes at that temperature. Then the temperature was allowed to reduce to room temperature. The dyed samples were left steeped in the dye baths overnight at room temperature. Finally, all the samples were washed with cold water and dried under shady conditions. The differences between the colours were visually assessed under the colour assessment cabinet using the grey scale (ISO 105 AO3: 1993).

2.8 Colour fastness evaluations of the dyes

Colour fastness tests were done for dyed samples to assess their fastness properties to light and washing. Non-mordanted and mordanted samples dyed at neutral, alkaline and acidic conditions were subjected to these fastness tests.

(a) Wash fastness test

Wash fastness was tested using the beaker dyeing machine. The dyed sample fabric size was 10cm x 4cm and the weight of a single sample was 1 g. First, non-dyed cotton fabric pieces of 5cm x 4cm were stitched to each dyed samples. 50 mL of water was added to each beaker in the beaker dyeing machine. 5 g/L common liquid detergent was added to each beaker. The temperature of the beaker dyeing machine was adjusted to 500°C. The dyed samples were attached to the hooks of the beaker lid and washed for 45 minutes. After washing, all the samples were dried in an oven at a temperature below 600C. Changes in colour were visually assessed under the colour assessment cabinet using the grey scale (ISO 105 AO2: 1993).

(b) Light fastness test

Light fastness was tested using the light fastness tester. The sample fabric size was 1 cm x 5 cm. All the samples were exposed to the UV light for a time period of 53 hours until the standard sample was getting in to the 3rd class of the grey scale.



Finally, the changes in colour were visually assessed under the colour assessment cabinet using the grey scale (ISO 105 AO2: 1993).

3 RESULTS AND DISCUSSIONS

It was observed that different shades can be obtained when dye extraction is done in alkali condition and tints can be obtained under acidic conditions. The highest depth of shade was observed in the samples dyed with dye liquors extracted with NaOH (pH 13-14). The depth of shade improved with the time and temperature; for example, a low depth of shade with 500°C and high depth of shade with 1000°C over the dyeing duration of 60 minutes. However, at 1000°C dyeing the temperature was kept at about 900°C and slowly raised to 1000°C when the duration was reaching 60 minutes to prevent decreasing liquor volume due to vaporization. Different colour depths and shade differences can be obtained by using different mordants and different dyeing conditions. The sample mordanted with FeSO₄ and dyed in neutrally extracted dye liquor and the sample mordanted with FeSO₄ and dyed in acidic extracted dye liquor produced very deep shades. Comparatively light hues were observed in the samples mordanted with alum and *Sepalika*

flowers for all three different dye liquors. Non mordanted samples have exhibited similar hues compared to the mordanted samples. Table 01 shows the results of the optimum dyeing duration and the optimum dye steeping duration. Table 02 shows the effect of pH on dye affinity of different fabrics and table 03 shows the changes in colour after the light fastness and wash fastness tests.

A small influence of dyeing time can be seen when the dyeing is done for 75 minutes. Natural dye extracted from annatto seeds also proved to produce a good colour depth on cotton after around 45 minutes of dyeing time (Prabhavathi *et al.*, 2014). Staining was best when the sample was steeped overnight. Good staining was observed when dyed using de-sized and bleached cotton, and mercerized cotton. The results of wash fastness test show that the least degree of change in colour in the samples was visible in the samples that were dyed in neutrally and alkaline extracted dye liquors mordanted with alum, CuSO₄ and FeSO₄. *Sepalika* mordanted samples also show moderate values for a change in colour. The results of the light fastness test show moderate values in samples dyed with alkaline extracted dye liquor. Samples mordanted with alum and dyed in neutrally and acidic extracted dye liquors have shown changes in colour.

Table 01: Results of the optimum dyeing time and optimum dye steeping time

Steeping time	Staining value	Dyeing duration	Staining values
30 minutes	3	30 minutes	2
6 hours	2-3	45 minutes	2
Overnight	2	60 minutes	2
		75 minutes	1-2

Table 02: Effect of pH on dye affinity of different fabrics

Fabric type	Staining value (pH 13-14)	Staining value (pH 4-5)
De-sized and bleached cotton	2-3	2
Mercerized cotton	2	2



Table 03: Change in colour values due to light and washing of dyed samples

Nature of the dye liquor	Non-mordant sample	alum	FeSO ₄	CuSO ₄	Sepalika
Neutrally extracted liquor	Light 3 Wash 4-5	Light 2-3 Wash 4-5	Light 3 Wash 4-5	Light 3 Wash 4-5	Light 3 Wash 3-4
Alkaline extracted liquor	Light 3-4 Wash 3	Light 3-4 Wash 4-5	Light 3-4 Wash 4-5	Light 3-4 Wash 4-5	Light 3-4 Wash 3-4
Acidic extracted liquor	Light 3 Wash 3	Light 2-3 Wash 3	Light 3 Wash 3-4	Light 3 Wash 3-4	Light 3 Wash 3-4

4 CONCLUSIONS AND RECOMMENDATIONS

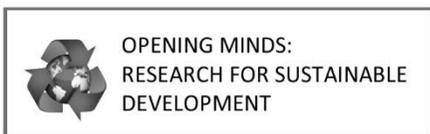
The present study has shown that it is possible to use the bark of *Thespesia populnea* (Gansuriya) to extract natural dyes using aqueous extraction method for colouring 100% cotton fabrics. The depth of shade in extraction can be improved by the addition of an alkali during the extraction of the dye. The results have shown low colour yield for the dye when the extraction was done at the temperatures about 500°C. The colour yield was apparently improved when the extraction was done at temperatures close to 1000°C over 30 minutes. In the case of dyeing, the duration of dyeing did not heavily affect staining. However, the duration of steeping affected staining. According to the results, deep shades can be obtained by steeping the samples for 6 hours or more in the dye bath. The use of mordants has changed the hue of the dyed samples. FeSO₄ and CuSO₄ mordants have contributed to improve the original hue while alum and *Sepalika* flowers (natural mordant) contributed to lighten the original hue. The increased pH has contributed to improving the dye affinity of cotton. Further, the pH difference, whether the dyeing liquor is alkaline or

acidic, allows for the colour changes in the dyed samples. The use of mordant has improved the wash fastness of the dye as the changes in the colour was least apparent in the wash fastness test, but the light fastness properties were not very satisfactory as they gave moderate results. Samples dyed in alkaline extracted dye liquor have shown somewhat good fastness to light. Non-mordanted samples have shown moderate wash and light fastness.

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Producing Claddings and Partition Boards Using Induru Fibre

W. D. C. Chandanie*, M. A. I. Perera

¹*Department of Textile and Apparel Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: chamilachandanie@gmail.com

1 INTRODUCTION

The increase in environmental consciousness and community interest, the new environmental regulations and unsustainable consumption of petroleum, has resulted in the need to use environmentally friendly material. Natural fibres are considered one of the most environmentally friendly materials which have good properties compared to synthetic fibres. Recently, there has been a rapid growth in research and innovation in natural fibre composites for so many products in various industries. On the other hand, natural fibres are renewable, replaceable and have a low environmental impact. These fibres can be produced at a lower cost than synthetic fibres and show low hazard levels in manufacturing. This study focused on the retting methods of fibres, properties of the fibres, bleaching and dyeing of the fibres and the method of developing composite and its properties. The composite was developed using Induru Fibre (*Hanguana malayana*) with unsaturated polyester resin and the fibres were randomly orientated in composites.

2 METHODOLOGY

2.1 Extraction of Fibres

Different fibre retting methods were analysed to identify the most relevant retting method. Chemical retting with

NaOH was identified as the most significant method.

2.2 Testing of Fibre Properties

Tensile strength was tested by using Pressley fibre strength tester under ASTM D1445. The moisture content (MC) and moisture regain (MR) of the fibre were tested according to the standards ASTM D2495-07 and ASTM D1776-15 respectively.

2.3 Development of Composites

The composite was developed by using unsaturated Polyester resin, catalyst and mature vein fibres of Induru plant. Based on the weight of fibres 50%, 55%, 60%, 65%, 70% and 75% were used in this experiment while keeping the length of fibres constant. The fibres were arranged in a random orientation.

2.4 Preparation of the Specimen of Composites

Initially a wooden mould was lubricated and then filled with the mixture of fibre and resin. Then the composite was compressed to remove excess resin. The prepared composite was kept for 24 hours for curing under room temperature and then the composite was de- moulded.



2.5 Testing of Composite Properties

The tensile strength of the composite was tested according to the ASTM D638-03 standard. Six specimens were tested for different fibre loading (Table 2) and the average strength was calculated. The impact strength of the composite was tested according to the standard ASTM D256.

There were five samples tested at room temperature and the other sample was frozen with water below 0°C. Five samples were tested and the average impact strength was calculated. The water absorption of the composite was tested under the ASTM D570-98 standard and the calculations were done according to the standard.

The workability factor of the composite was tested to prove the ability to work with composite.

3 RESULTS AND DISCUSSION

3.1 Results of Fibre Properties

During the study the fibre properties such as tensile strength, moisture content and moisture absorption properties were tested.

3.1.1 Tensile Strength of Induru Fibres

Table 1 shows the test results of tensile strength of the Induru fibres. The Pressley Index (PI) of Induru fibres was calculated using

$$PI = \frac{\text{Bundle strength in lbs}}{\text{Bundle weight in mg}} \quad (1)$$

Then, the tensile strength was calculated based on the following method.

$$\text{Estimated tensile strength (g/tex)} = 5.36 \times PI = 5.36 \times 5.71 = 30.61 \text{ g/tex}$$

Table 1: Tensile strength of Induru fibres

Sample No.	Bundle strength in Lbs	Bundle weight in g	Bundle strength in Lbs/Bundle weight in g	Bundle strength in Lbs/Bundle weight in mg
1	15.2	0.0029	15.2/0.0029	5.24
2	10.6	0.0021	10.6/0.0021	5.05
3	7.9	0.0017	7.9/0.0017	7.65
4	8.9	0.0017	8.9/0.0017	4.88
5	9.7	0.0017	9.7/0.0017	5.71
			Average PI	5.71

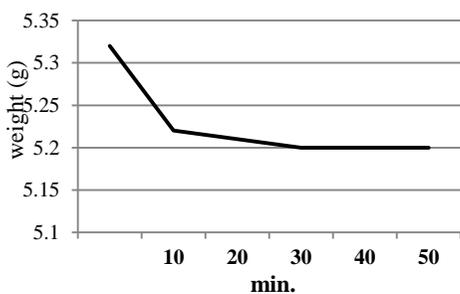


Figure 1: Variation of weight of the fibre sample over the time (minutes)

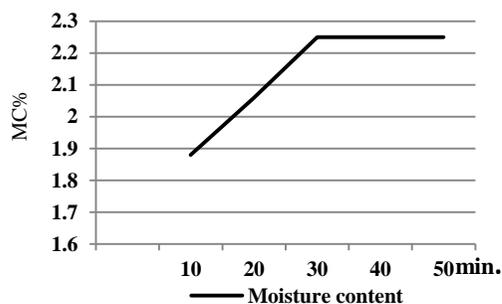


Figure 2: Moisture content of Induru fibre



3.1.2 Moisture Absorption and Moisture Regain of Induru Fibres

Figure 1 shows that the oven dry weight of the sample varies with the drying time in an oven. According to the figure, the oven dry weight comes to a constant level after 30 minutes.

Figure 2 shows the moisture content (MC) of Induru fibre change with time and they reached to constant level after 30 minutes. The study shows the moisture content of Induru fibre as 2.256%.

3.2 Results of Composites

3.2.1 Tensile Strength of Composites

Table 2 shows the breaking loads which represent the tensile strength of composites. According to Table 2 the optimum breaking load can be achieved by adding 60% of fibre proportion, (40% resin + catalyst) because at this percentage the maximum load of 259 N and the maximum elongation of 10% were reported. Elongation was reduced when the fibre weight was increased more than 60% or decreased less than 60%. The breaking load of composite was directly proportional to the weight of fibre percentage of the composite.

Table 2: Breaking load of composites

Sample No	Fibre proportion (%)	Breaking load (N)	Breaking elongation %
1	50	234N	5
2	55	240N	10
3	60	259N	10
4	65	273N	7
5	70	286N	3
6	75	293N	4

3.2.2 Impact strength of composite

Impact strength of the composite was tested using the Charpy Impact strength

tester. Table 3 shows the impact strengths of composites, which were tested under room temperature as well as in temperature below 0°C to check whether the strength difference can be observed. It does not exhibit significant variation. Therefore, it can be recommended that this composite can be used even in cold weather conditions without changing the impact strength.

Table 3: Impact strength of composites

Sample No:	Impact Strength at Room Temperature in (J)
1	0.91J
2	0.80J
3	0.84J
4	1.01J
5	0.90J
Average	0.892J

3.2.3 Water absorption of composites

The percentage increase in weight during immersion was calculated as given below.

$$\begin{aligned} \text{Increase in weight \%} &= \frac{\text{wet weight} - \text{conditioned weight}}{\text{conditioned weight}} \times 100 \\ &= \left(\frac{12.5671 - 12.4013}{12.4013} \right) \times 100 = 1.3369\% \end{aligned}$$

The percentage of soluble matter lost during immersion was calculated as given below.

$$\begin{aligned} \text{Soluble matter lost \%} &= \frac{\text{conditioned weight} - \text{reconditioned weight}}{\text{conditioned weight}} \times 100 \\ &= \left(\frac{12.4013 - 12.4013}{12.401} \right) \times 100 = 0\% \end{aligned}$$

The percentage of water absorbed by composite was calculated as given below.

$$= [\text{Increase in weight \%} + \text{soluble matter loss \%}] = 1.3369\%$$



According to the above calculations given in the standard the percentage increase in weight during immersion in water was 1.3369%, the percentage of soluble matter lost during immersion was 0% and the percentage of water absorbed by composite was 1.3369%. The relative rate of water absorption of this composite is about 1% and according to the above test results it exhibited very poor water absorption.

3.3 Workability factor of the composites

The workability factor of the composite is an important factor to consider. The composite was in better condition and work station tests proved that the composite is able to saw, grind, drill and file without presenting any cracks on the surface.



Figure 2. Tested workability factors of the composites

4 CONCLUSIONS

The estimated tensile strength value of the Induru fibre using Pressley Index tester was 30.61 g/tex and the moisture content of the fibre was 2.25%. The study shows that tensile strength of the composites varied according to the fibre loading and the highest breaking load observed was 293 N and the highest breaking elongation was 10%. The average impact strength of the composite was 0.892J. Water absorption percentage of the composite was 1.3369%. The composite structure was able to saw, grind, drill and file according the work station tests.

Acknowledgment

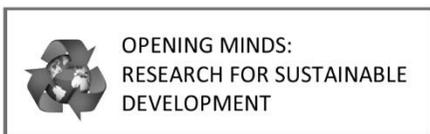
I would like to express my gratitude to The Department of Textile and Apparel Technology and the Department of Mechanical Engineering for their great support throughout the project.

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Health Sciences



Awareness of Cervical Cancer, Attitude and Practice towards Cervical Cancer Screening among Female Undergraduates in University of Peradeniya

Dilumi Jayawickrama* and Anuradha Rathnayake

Department of Nursing, Faculty of Allied Health Sciences, University of Peradeniya, Peradeniya, Sri Lanka

**Corresponding author: Email: dilumijayawickrama@gmail.com*

1 INTRODUCTION

Cervical cancer has become the second most common cancer among females in worldwide (World Health Organization, 2014). It is early detectable premalignant cancer type. The disease has a pre-malignant stage which usually occurs in younger women under the age of 40. Cervical cancers begin in the cells of the transformation zone of uterus which gradually become to pre-cancerous state prior to becoming a cancer.

Cervical cancer is the end result of sexually acquired infection caused by human papilloma virus, HPV type-16(HPV-16) and HPV type-18(HPV-18) (WHO, 2014). Risk for cervical cancer can be identified among females who acquired HPV for chronic and progressive cancer. Colombo *et al.*, (2012) have reported that the relationship between sexual behavior, HPV infection and risk of developing cervical cancer. Avoiding exposure to HPV, Obtaining HPV vaccine, smoking cessation, consuming diet rich in fresh vegetables, fruits and practicing healthy sexual activities leads to minimize occurrence of cervical cancer (American Cancer Society, 2014). National cancer control program of WHO, 2014 has revealed that cervical cancer can be early detectable by performing

Papanicolaou (Pap) test which preferred to the women aged above 30 years. Well Woman Clinic (WWC) services were introduced for Family Health Programme to popularize the cancer screening test. Family Health Bureau in Sri Lanka coordinates Well Women Clinic (WWC) programs in Sri Lanka.

1.1 Background of the research

In Sri Lanka, cervical cancer is the third most common cause for death due to cancer among women aged 15-44 years. Family Health Bureau (2014), states that 1721 new cervical cancer patients are diagnosed annually in Sri Lanka. Almost 50% of patients are diagnosed when cancer is localized, with the survival rate of 92% for remaining five years. It is crucial to improve the quality of remaining years by introducing healthy practices and enhancing their level of knowledge. Percentage of women who had screened for cervical cancer has been increased from 10.6% to 33.9% in last few years during the period of 2009 to 2013(Family Health Bureau, 2014). The lack of nationally representative data related to the extent of cervical cancer and cancer screening among women in Sri Lanka make the area of research relevant. Due to the high incidence of mortality rate and



low coverage of screening, it is essential to identify the level of existing awareness, attitudes and practices related to cervical cancer and cervical cancer screening to further planning of the health care needs of the society. Without obtaining knowledge and awareness related to cervical cancer, it is in vain of program conducted to cancer control.

1.2 Objectives

Objectives were to assess the level of awareness of cervical cancer, attitude, and practices on cervical cancer screening among female undergraduates in 1st and 4th academic year in University of Peradeniya. Undergraduate populations were selected as they are the generation with the power of information carriers to the society and it's critically important to make them aware. They will be benefitted by enhancing their knowledge and correcting their misconception while participating for the research.

2 METHODOLOGY

Study on “Awareness of Cervical cancer and cancer screening among female university undergraduates” was designed as “Descriptive- Cross sectional study”. Female university undergraduates (n=2589) who registered for 1st and 4th academic year, between 20 to 28 years of age, among nine faculties in University of Peradeniya are considered as the study group. Estimated sample size is 335 from the population.

Stratified random sample method based on populations was used to calculate the number of undergraduates to be taken from each faculty in University of Peradeniya. Self-administered questionnaire was designed based on Cervical Cancer Awareness Measure (Cervical CAM) pre validated toolkit version 2.1; 2007-08 adopted for data collection. Translated version of the questionnaire was face validated and

content validated with the panel of experts. Information sheet attached to the questionnaire explained about the purpose of the study and written consent was obtained prior to data collection. Data was tabulated to Microsoft Excel 2010 and analyzed using the Statistical Package for the social Sciences (IBM SPSS) database program version 22. The Chi-square test was used to measure the strength of associations between academic year and level of awareness. P value <0.05 was considered as statistically significant. Modified Blooms cut points were used for measure the level of awareness of cervical cancer. (Nahida *et al.*, 2007). Scale consisted with Good, Satisfactory, and Poor based on the marks obtained. If the 0 to 17 questions were responded correctly participants were given poor grade, if the 18 to 27 questions were responded correctly participants were given satisfactory grade and if 28 to 36 questions responded correctly participants were given good grade. Scale was validated with expert panel and piloted before adapting to the sample. Attitude and practice of cervical cancer screening were obtained as percentage only.

4 RESULTS

4.1 Participant’s Awareness of cervical cancer, and cervical cancer screening among 1st and 4th academic year

Table 01: Distribution of respondents by level of awareness of cervical cancer and cervical cancer screening according to 1st and 4th academic year according to “Modified Bloom’s cut points”

Mark ranges	1 st year n %	4 th year n %
Good 28-36	1 (0.7)	14 (9.9)
Satisfactory 18-27	30 (19.7)	48 (33.8)
Poor 0-17	121 (79.6)	80 (56.3)



Table 01 indicates that 9.9 % of the fourth year students have good level of knowledge while 79.6% of students are having poor levels of knowledge about the cervical cancer and cancer screening

4.2 Participant’s practice about cervical cancer, and cervical cancer screening among 1st and 4th academic year

Figure 01 indicates that 64.5% 1st year undergraduates and 67.6% 4th year

undergraduates are willing to do cervical cancer screening in future

4.3 Participant’s Attitude about cervical cancer, and cervical cancer screening among 1st and 4th academic year

Figure 02 indicates that 86.2% 1st year undergraduates and 93.7% 4th undergraduates are having idea that cervical cancer screening is useful.

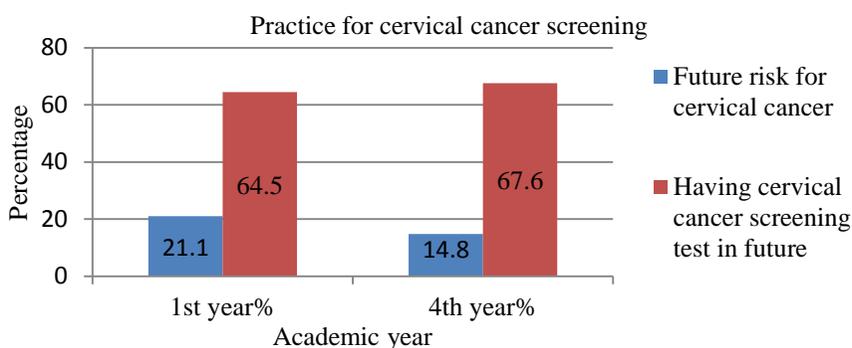


Figure 01: Practice towards cervical cancer screening among 1st and 4th academic years

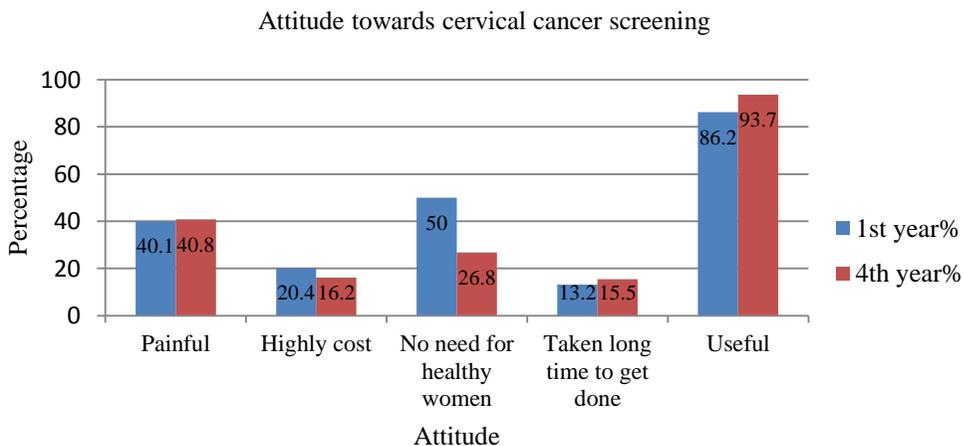


Figure 02: Attitude towards cervical cancer screening among 1st and 4th academic years

5 DISCUSSION

5.1 Awareness of the cervical cancer

In this study, awareness about cervical cancer was 94.6 % in total population which contrast to Joy *et al.*, (2011) which stated as the findings with limited knowledge and awareness among university undergraduates in the city of Kandy, Sri Lanka. Research finding are emphasized the role of media as information providers to society. From half of the participants who had heard of cervical cancer were able to identify vaginal bleeding between periods (58.8%) and persistent vaginal discharge (50.3%) as signs of cervical cancer. Significant association can be identified comparing with the academic year (1st and 4th year). The received p value for both categories are 0.005 which revealed that 4th year undergraduates are more prone than 1st year.

5.2 Awareness of cervical cancer and cervical cancer screening

Only 39% of undergraduates had known about Pap test as the screening test for cervical cancer. Only 25% has marked correctly that Pap test is preferred in 3 times in their life time to women who are above 35 years old. Although Pap test is freely available in Well Women Clinic in Sri Lanka, only few (17%) know about WWC in Sri Lanka. Annual Health Bulletin on Public Health Services (2012) has stated that Well Woman Clinics (WWC) implemented in 1996 to provide reproductive health services to Sri Lankan women. But results conveyed that public should be made aware about the WWC.

5.3 Attitude on cervical cancer and cervical cancer screening

A majority of the undergraduates 45% have identified that the Pap smear is useful for women's health and did not consider as high cost. Less than 20% of undergraduates have stated as the Pap test

is painful and no need to perform for healthy women (19%). With the insufficient awareness of the cervical cancer screening test was difficult to measure the attitudes towards the Pap test. The 98% of the participants have answered that they would be worried (12%) and severely worried (86%) if they found with HPV infection. Osth (2015) has indicated in her research that majority of the study population thought that the Pap smear is important for women's health and did not consider it embarrassing.

5.4 Practice about cervical cancer and cervical cancer screening

Results have proven that more than half of participants believe that they are in a risk of getting cervical cancer in future. But risk factors, signs of cervical cancer and screening test of cervical cancer have not identified by the participants correctly. More than 50% of participants planning to get pap screening test in future. Therefore it emphasized the necessity of improving the awareness of cervical cancer and it's screening among the all women. Related to practice for cervical cancer, it was difficult to obtain more details as most of the undergraduates are below 35 years and they had not experienced cervical cancer screening test.

6 CONCLUSIONS

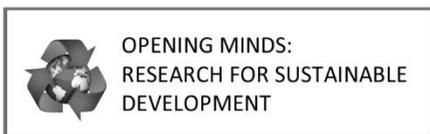
Awareness of cervical cancer correlate with academic year. This study conveyed that awareness of signs; risk factors, treatments, prevention and screening test for cervical cancer were poor even among university undergraduates. Only Less than half of the participants were able to identify the signs and risk factors of cervical cancer. Awareness of cervical cancer and cancer screening was poor among study population. Considering the attitudes and practices towards cancer they are having satisfactory level of



attitudes and practices. As the study participants are not aware about the risk factors for cervical cancer, they have minimum chance to modify their life style. Sri Lankan society is in need of need of increasing adequate information on cervical cancer and preventive methods are desirable.

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Travel Characteristics of Older and Disabled People in the Colombo District, Sri Lanka

Varuni Tennakoon^{1*}, Roshini Peiris-John², Rajitha Wickemasinghe³ and Shanthi Ameratunga²

¹University of Sri Jayewardenepura, Gangodawila, Sri Lanka

²University of Auckland, New Zealand

³University of Kelaniya, Dalugama, Sri Lanka

*Corresponding author: Email: varuni16email@yahoo.com

1 INTRODUCTION

Abundant opportunities for active travel and social participation confer many co-benefits for the health and wellbeing of older people and people living with disability (Saunders *et al.*, 2013). However, barriers to realising these benefits are common in many low-and middle-income countries.

Sri Lanka reports a growing number of road traffic injuries and fatalities with increased motorization and expanding traffic mix particularly in the district of Colombo (Dharmaratne *et al.*, 2015; Toroyan, 2013). The older people and people living with disabilities are at higher risk of road traffic crashes and injuries (Peden, 2004). According to road crash statistics in 2013, over one-fourth of the fatal crashes were among people 60 years or older in Sri Lanka (University of Moratuwa, 2014).

Compared to many lower-middle income countries, the population of older people in Sri Lanka is greater, and increasing relatively quickly (De Silva, 2007). The World Health Survey conducted from 2002 to 2004 reported a disability prevalence of 12.9% in Sri Lanka and a crude prevalence of disability among adults (aged 50 years and above) of 27.2%

(Hosseinpoor *et al.*, 2016). These trends, when considered in concert with current economic burdens in Sri Lanka, create a strong need to better understand the future mobility needs of these vulnerable road user groups in order to provide cost-effective and safe transportation. The current lack of information on transportation details of older and disabled people is a deficiency addressed by this research.

This study aimed to describe travel characteristics (i.e. modes, purpose, distance etc.) and involvement of road traffic crashes among older and disabled people living in the Colombo district, Sri Lanka.

2 METHODOLOGY

2.1 Study design, setting and participants

A household travel survey was conducted in three purposively selected contiguous Divisional Secretary (DS) divisions of Dehiwala, Ratmalana and Kesbewa in the Colombo district. Study participants were disabled people (aged 5 years and older) with physical, sensory, learning or mobility impairment, and older people (60 years and above).



A total of 180 households were randomly selected from lists maintained at the authorities of Divisional Secretariats. Sixty (60) households in each DS division were identified (30 from the elderly list and 30 from the disabled list) such that 30 households have at least one older person and other 30 have at least one disabled person. Thus a total of 180 households were included. A pilot-tested semi-structured interviewer administered questionnaire was completed at the participants' house following informed written consent. Semi-structured questionnaires are widely used to conduct travel surveys and to identify travel characteristics (Delbosch and Currie, 2010). Ethical approval for this study was granted by the Ethics Review Committee, Faculty of Medical Sciences, University of Sri Jayewardenepura, Ref. 48/16.

2.2 Data analysis

Data were entered in to SPSS software files, entries were verified with original data. Frequency distributions were generated.

3 RESULTS AND DISCUSSION

3.1 Demographic distribution of the study population

The 180 participants were categorized in to three groups for statistical analysis: older people with disability (n=95; 52.8%), older people without disability (n=18; 10%) and other (young or middle-aged) people with disability (n=67; 37.2%). Over 94% of participants lived with their spouses or families. This reflects the socio-cultural background in Sri Lanka that supports the extended family concept. The demographic characteristics of the study participants are shown in Table 1.

Of the people above 60 years, 84% had some kind of disability. The ethnic distribution of the study population which was predominated by Sinhalese may

reflect the general population in the selected DS divisions (Department of Census and Statistics, 2012). However, there could be an underrepresentation of Tamils, Muslims and other ethnic groups in the lists that were obtained for sampling in the study. Nearly 60% of the participants had primary education or less. More than 75% of the study sample earned less than Rs 20,000 per month.

Visual impairments were seen in 39% of older people and learning impairments were seen in 73% of persons under 60 years of age. The type of disability may be a deciding factor influencing travel in this population.

3.2 Travel characteristics

A travel trip is defined for this study as an uninterrupted travel to a specific destination. A 52% of the study population used public bus for travel trips and 28% used the three-wheeler as the mode of transport. Travel characteristics of the study population are shown in Table 2.

A 49% of the study sample has travelled the previous day while a cumulative percent of 82 has travelled within the previous week. Analyses of consecutive 48-hour travel details immediately preceding the date of the interview showed that older people with or without disability mostly travel to participate in a social meeting. Travel purposes common for people less than 60 years were to go to shops, hospital and the school. More than 50% of the travel trips among people living with disabilities were within 1km distance. In contrast, nearly 53% of older people without disability travel within a distance of 10 km. Frequent short trips mainly for social meetings is a commendable trend as it enhances the livelihood and well-being of the participants (Hand, 2015). However, the limited travel trips to distant places may reflect transport barriers these groups encounter.



Table 1: Demographic distribution of the study population

Category		Older people without disability (n=18)	Older people with disability (n=95)	Other people with disability (n=67)
		n (%)	n (%)	n (%)
Gender	Male	13 (72.2)	61 (64.2)	26 (38.8)
	Female	5(27.8)	34 (35.8)	41 (61.2)
Ethnicity	Sinhala	18 (100)	94 (98.9)	60 (89.5)
	Tamil	0	0	4 (6)
	Muslim	0	1 (1.1)	3 (4.5)
Education level	No/Primary	5 (27.8)	57 (60)	45 (67.2)
	Secondary	11 (61.1)	33 (34.7)	6 (8.9)
	Tertiary	2 (11.1)	4 (4.2)	1 (1.5)
	Other	0	1 (1.1)	15 (22.4)
Monthly income	Children (<18)			15 (22.4)
	No income	7 (38.9)	26 (27.4)	14 (20.9)
	Rs 1-20000	9 (50)	50 (52.6)	35 (52.2)
	Rs>20000	2 (11.1)	19 (20)	3 (4.5)
Type of disability*	Visual		37 (38.9)	9 (13.4)
	Speech		7 (7.4)	22 (32.8)
	Hearing		17 (17.9)	10 (14.9)
	Walking		12 (12.7)	21 (31.3)
	Learning		6 (6.4)	49 (73.1)
	Other (arthritis, aches/pain etc.)		48 (50.5)	5 (7.5)

*An individual may have had more than one disability

Table 2: Travel characteristics of the study population

Category		Older people without disability	Older people with disability	Other people with disability
		n (%) (n=18)	n (%) (n=95)	n (%) (n=67)
Mode of transport	Public bus	11 (61.1)	53 (55.8)	29 (43.3)
	Taxi	4 (22.2)	18 (18.9)	29 (43.3)
	Walking	1(5.6)	13 (13.7)	3 (4.4)
	Other	2 (11.1)	11 (11.6)	6 (9)
Last day of travel	Previous day	13 (72.2)	50 (52.6)	25 (37.3)
	Within last week	4 (22.2)	33 (34.7)	23 (34.3)
	> a week	1 (5.6)	12 (12.6)	19 (28.4)
Travel purpose**	Social meeting	15 (27.3)	43 (18.6)	1 (0.8)
	Shop	0	17 (7.4)	12 (9.4)
	Hospital	5 (9.1)	11 (4.8)	12 (9.4)
	Work	2 (3.6)	5 (2.2)	7 (5.5)
	School	0	0	9 (7.1)
	Home and other	33 (60)	155 (67.1)	86 (67.7)
Travel distance**	1km or less	18 (32.7)	118 (51.1)	67 (52.8)
	>1km-10km	29 (52.7)	88 (38.1)	54 (42.5)
	>10km	8 (14.5)	25 (10.8)	6 (4.7)

**within a consecutive 48-hour period. An individual may have had one or many travel trips



3.3 Road traffic crashes involved in the previous year

Thirteen (13) participants reported being involved in road traffic crashes in the previous year. Five participants were injured due to falls when getting down or getting on to bus. Others were injured from road traffic crashes involving three wheelers (n=3) or motor bikes (n=2). One crash victim had sustained irreversible injuries and four others reported moderate to severe injuries.

The increased risk for road traffic injury with decline in capabilities that impair cognitive, sensory and psychomotor functions and less resistant to trauma among older and people living with disabilities is well documented (Chang *et al.*, 2016). In this study 7% of the study population had been involved in a road traffic crash and nearly 40% of them sustained major injuries in the 12 months before the survey.

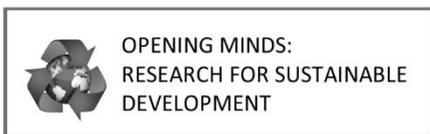
4 CONCLUSIONS

This study identified that older and disabled people in the study sample were generally of poor educational and economic backgrounds. The majority of the older population was afflicted with disabilities. The older and disabled people mainly travel short distances and rely on the public bus for transport. Many participants had sustained major injuries when involved in a road crash. More research is needed to identify the specific barriers for safe transportation of these interested groups. It is also imperative that relevant authorities in Sri Lanka develop strategies to address issues of safe transportation and to accommodate the needs of marginalized groups in future transportation systems. This in-turn will enhance the quality of life and well-being of older people and people living with disabilities.

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Prevalence and Associated Social-Reproductive Determinants of Menopausal Symptoms among Pre and Postmenopausal Women in Galle, Sri Lanka

N. Rathnayake^{1*}, J. Lenora², G. Alwis³ and S. Lekamwasam⁴

¹Allied Health Sciences Degree Programme, Faculty of Medicine, University of Ruhuna, Sri Lanka

²Department of Physiology, Faculty of Medicine, University of Ruhuna, Sri Lanka

³Department of Anatomy, Faculty of Medicine, University of Ruhuna, Sri Lanka

⁴Department of Medicine, Faculty of Medicine, University of Ruhuna, Sri Lanka

*Corresponding author: Email: nirmala.priyanthi@gmail.com

1 INTRODUCTION

Physical, psychological and urogenital symptoms experienced by women before, during and after menopause have a significant impact on their lives. Symptoms experienced at menopause, their nature, frequency and severity (the intensity of the symptoms) of symptoms vary among individual women from mild to very severe stages due to various confounding effects of different factors (Elsabagh and Abd Allah, 2012). To date, few studies have been carried out in Sri Lanka about menopausal symptoms and their severity (Goonaratna *et al.*, 1999; Waidyasekera *et al.*, 2009) and therefore, this study aims to determine the prevalence and severity of menopausal symptoms and to evaluate the associated social and reproductive determinants among pre and postmenopausal women in Galle, Sri Lanka

2 METHODOLOGY

A descriptive cross sectional study was carried out with 184 premenopausal and 166 postmenopausal community dwelling women in Bope- Poddala MOH area,

Galle, aged between 30-60 years who were selected by multi-stage cluster sampling. The lower age limit of 30 years was considered because the bone and muscle maturity of women is completed at this age (at the end of accelerated growth) and also women after 30 years are free of adolescence and pre-adolescence hormonal influences. In the same way, the upper age limit of 60 years was considered to avoid bodily changes that are attributable to advancing age and many diseases that are prevalent in old age. Postmenopausal women younger than 60 years would provide an opportunity to study changes that are mostly attributable to the effects of menopause. Ethical clearance for this study was obtained from Ethical Review Committee, Faculty of Medicine, and University of Ruhuna. Written informed consent was obtained from each participant who wished to take part in the study before administering the questionnaire. A self-administered questionnaire including demographic questionnaire and Menopause Rating Scale (MRS) was applied. MRS evaluate Eleven (11) symptoms under 3 subscales of symptoms as psychological symptoms (PS), somato - vegetative symptoms (SVS), and urogenital symptoms (UGS) in a severity scale as none, mild, moderate, severe and very



severe. MRS score was generated by summing the scores given for 11 symptoms. SPSS 20.0 version was used in the data analysis process. Chi square test, Pearson correlation coefficient, Independent sample t test and one way ANOVA test were applied where necessary. P value <0.05 was considered as statistically significant.

3 RESULTS AND DISCUSSION

Majority of the participants were Sinhalese, non-employed and were married in both pre and postmenopausal groups. The mean (SD) age of pre and postmenopausal women was 42.48 (6.02) years and 55.83 (3.80) years respectively. The prevalence of at least a single menopausal symptoms among pre and postmenopausal women was 90.8% (167) and 96.4% (160) respectively ($\chi^2=4.49$, $p=0.00$). Concordant findings were observed in previous studies carried out in Sri Lankan locality which were about >91% among pre, peri and postmenopausal women and 87.1% (Goonaratna *et al.*, 1999) among perimenopausal women while the different other geographical communities also reported approximately equal prevalence figures (Dennerstein *et al.*, 2000).

Both prevalence and severity of all the symptoms were higher among the postmenopausal women. The most frequently reported menopausal symptoms among premenopausal women were physical and mental exhaustion (49.5%), joint and muscular discomforts (48.4%) and irritability (41.3%) in mild to moderate severity. Physical and mental exhaustion (53.0%), irritability (48.2%), depressive mood (43.4%) and hot flushes/sweating (42.2%) in mild to moderate severity were reported more frequently among postmenopausal women while the 47.5% reported joint and muscular complaints in severe to very severe degree (Table 01).

The frequencies of reporting severe to very severe symptoms among postmenopausal women were higher when compared with the premenopausal women. Presence of hot flushes or sweating, sleep disturbances, anxiety, physical and mental exhaustion, sexual problems, bladder problems, dryness of vagina, joint and muscular discomforts were significantly associated with postmenopausal status ($p<0.001$) (Table 1). High prevalence of joint pain among postmenopausal women (55.8%) have been reported by Goonaratna *et al.*, 1999). Although most of the western women report hot flushes as the most common menopausal symptom (Dennerstein *et al.*, 2000), it was not common in current study sample and other studies reported in Sri Lanka (Goonaratna *et al.*, 1999; Waidyasekera *et al.*, 2009).

Mean(SD) overall and subscales of symptoms scores were significantly higher among postmenopausal women [overall:10.98(6.90), PSV:4.04(3.22), SVS:5.17(3.01), UGS:1.78(2.21)] compared to premenopausal women [Overall:6.90(6.20), PSV:2.79(3.10), PSV:3.15(2.68), SVS:3.15(2.68), UGS:0.97(1.72)] ($p<0.001$).

Among the premenopausal women, PS were significantly correlate with age at menarche ($r=+0.18$, $p=0.01$) and women with high parity (children 4-7)($p=0.01$), SVS were associated with civil status(married)($p=0.04$) and high parity($p<0.001$), UGS were associated with age ($r=+0.16$, $p=0.02$), duration of breast feeding ($r=+0.15$, $p=0.03$), civil status (married)($p<0.001$) and high parity ($p=0.001$) and overall menopausal symptom score only associated with the high parity($p=0.04$). Among the postmenopausal women, PS and SVS were not correlate/associate with any evaluated factor. However, UGS were associated with age at menarche($r=0.16$, $p=0.03$), associated with unemployed status ($p=0.02$) and married status ($p=0.01$). Overall menopausal symptoms



score was associated only with ethnicity (high in non-Sinhala women) (p=0.04). Both similarities and discrepancies with previous studies have been reported. Decreased severity of menopausal symptoms was associated with more time spent in education, an employed status, a history of pregnancy, longer

postmenopausal duration and increased severity of menopausal symptoms was associated with absence of a partner among Korean women (Lee *et al.*, 2010). Low educational level and early age at menarche were associated with presence of menopausal symptoms among Iranian women (Delavar and Hajiahmadi, 2011).

Table 1: Prevalence and severity of menopausal symptoms among pre and postmenopausal women

Menopausal symptom	Premenopausal women (n=184)			Postmenopausal women (n=166)			Chi square test	
	None (%)	M-M (%)	S-VS (%)	None (%)	M-M (%)	S-VS (%)	X ² value	P value
Hot flushes, sweating	113 (61.4)	65 (35.3)	6 (3.3)	75 (45.2)	70 (42.2)	21 (12.7)	15.31	0.00
Heart discomfort	132 (71.7)	47 (25.5)	5 (2.7)	104 (62.1)	53 (15.9)	9 (5.4)	3.91	0.14
Sleep problems	129 (70.1)	46 (25.0)	9 (4.9)	69 (41.6)	65 (39.2)	32 (19.3)	33.49	0.00
Depressive mood	104 (56.5)	69 (37.5)	11 (6.0)	80 (48.2)	72 (43.4)	14 (8.4)	2.63	0.26
Irritability	101 (54.9)	76 (41.3)	7 (3.8)	77 (46.4)	80 (48.2)	9 (5.4)	2.67	0.26
Anxiety	114 (62.0)	61 (33.2)	9 (4.9)	80 (48.2)	74 (44.6)	12 (7.2)	6.73	0.03
Physical and mental exhaustion	82 (44.6)	91 (49.5)	11 (6.0)	45 (27.1)	88 (53.0)	33 (19.9)	20.96	0.00
Sexual problems	149 (42.6)	31 (16.8)	4 (2.2)	115 (32.9)	43 (25.9)	8 (4.8)	6.75	0.03
Bladder problems	151 (82.1)	27 (14.7)	6 (3.3)	97 (58.4)	56 (33.7)	13 (7.8)	23.60	0.00
Dryness of vagina	144 (78.3)	36 (19.6)	4 (2.2)	111 (66.9)	45 (27.1)	10 (6.0)	6.93	0.00
Joint and muscular discomfort	40 (21.7)	89 (48.4)	55 (29.9)	20 (12.0)	67 (40.4)	79 (47.6)	13.17	0.00

(M-M = mild to moderate, S-VS = severe to very severe, X² = chi square value)

4 CONCLUSIONS

This cross sectional survey found high prevalence of menopausal symptoms among both pre and postmenopausal women, while higher prevalence and severity observed in postmenopausal women than premenopausal women. The most frequently reported menopausal symptoms among premenopausal women were physical and mental exhaustion, joint and muscular discomforts and irritability. Among postmenopausal women, physical and mental exhaustion, irritability, depressive mood, hot flushes/sweating and joint and muscular complaints were reported frequently. Among the premenopausal women, PS were affected by age at menarche, parity, SVS were affected by civil status and parity, UGS were affected by age, duration of breast feeding, civil status and parity and overall menopausal symptom score only associated with parity. Among the postmenopausal women, UGS were affected by age at menarche, unemployed status and married status. Overall menopausal symptoms score was associated only with ethnicity. As most of the pre and postmenopausal women reported non-specific symptoms which are not related to the ovarian dysfunction, non-specific therapies such as lifestyle modifications, psychological counseling and usage of approved herbal remedies need to be emphasized among the women for better coping with menopausal symptoms.

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OPENING MINDS:
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DEVELOPMENT

Prevalence of Nosocomial infections and associated factors among patients in the Intensive Care setting of the Colombo North Teaching Hospital, Sri Lanka

K.A.M.S. Pemasinghe¹, V.M.D. Vithanage¹, T.S.N. Fonseka¹, K.A.M.S.P. Kandearachchi¹, U.C.P. Fernando¹ and P.P. Jayasinghe^{2*}

¹Colombo North Teaching Hospital, Ragama, Sri Lanka

²Post Graduate Institute of Medicine, Colombo 7, Sri Lanka

*Corresponding author: Email: akpresearches@gmail.com

1 INTRODUCTION

The term "Nosocomial" comes from two Greek words; "nosus" meaning "disease" and "komeion" meaning "to take care of." Hence, "Nosocomial" is applied to any disease contacted by a patient while under medical care. However, the term hospital-acquired is used synonymous with the word "Nosocomial" (Kouchak and Askarian, 2012). A Nosocomial infection is an infection which was not present or was in the incubation period at the time the patient is admitted to the hospital, but occurs within 72 hours after admitting to the hospital. They are potentially caused by organisms that are resistant to antibiotics (Ducel and Fabry, 2002).

Despite the rapid progress of facilities and hospital care, infections continue to develop in hospitalized patients, and may also affect the hospital staff. Many factors promote spreading infections among hospitalized patients. These will include pathophysiological conditions of the patient and poorly maintained hospital environment which facilitates transmission of infection.

Most frequently identified Nosocomial infections are infections of surgical wounds, urinary tract infections and lower respiratory tract infections. The WHO study and other studies have shown that the highest prevalence of Nosocomial

infections is found in intensive care units and in acute surgical and orthopedic wards.

Hospital-acquired infections add to functional disability and emotional stress of the patient and in some cases may lead to disabling conditions that reduce the quality of life. Nosocomial infections are also one of the leading causes of death. The economic burden is also important at this event. Increased length of stay of the infected patient contributes mainly to increased cost. In 2014, there were 707 deaths and death rate in ICU was 13.5 (IMMR 2012). Cause of death of ICU patients were not among published data. Detail investigations of Nosocomial infections and its causative factors are essential for future planning as well as for resource allocation to minimize the burden of Nosocomial infections to the country. Teaching hospitals have a large turnover of patients as most of the critical patients are transferred to them from peripheries and relatively large number of ICU beds are available at teaching hospitals (Ministry of Health Sri Lanka, 2015).

Objectives of the study were to describe the prevalence of Nosocomial infections and describe the types and distribution of associated factors of nosocomial



infections at the Intensive Care setting of Colombo North Teaching Hospital, Sri Lanka

2 METHODOLOGY

A descriptive Cross sectional study was conducted among patients admitted to Intensive Care Unit of Colombo North Teaching Hospital for one year duration. Patients admitted to the ICU for more than 24 hrs. And patients who did not have fever spikes 48 hrs. Before the admission were included to the study. Patients who developed fever spikes within 48 hrs. of admission were excluded. Sample size was calculated by using Lwanga and Lemeshow equation and it was 101 (Lwanga and Lemeshow, 1991). Systematic random sampling technique was applied for sample selection.

3 RESULTS

Table 1: Characteristics of the study sample

	Mean	SD
Age	51.17 years	17.98 years
Duration of stay	92.5 hours	66.9 hours
	Male	Female
Gender distribution	53(51.6%)	48(47.5%)
Nosocomial Infections	20(38.4%)	22(45.8%)

Prevalence of Nosocomial infections in the study sample was 41.58% (N= 42). There were 51.55 (N=52) of males and 47.5% (N=48) of females in the study sample. Age showed a normal distribution which ranged from 9 years to 83 years (Mean=51.17; SD=17.98). Patients admitted to Intensive Care Unit were treated for 24 hours to 408 hours. (Mean 92.5hrs: SD=66.9hrs) Acquiring Infections did not depend on sex of the patient.

(OR=0.767:95% CI =0.347-1.695).

Table 2: Associated factors for Nosocomial infections

	Odds Ratio (OR)	95% CI	P value
Female Gender	1.145	0.767-1.708	>.05
Ventilator used	1.97	0.847-4.58	>.05
Dedicated Instruments	0.903	0.409-1.994	>.05
Age>50 years	1.947	0.838-4.42	>.05
Duration of stay > 3 days	1.335	0.821-2.173	>.05
Urinary Catheter	1.017	0.984-1.052	>.05
Nasogastric Feeding	2.016	0.872-4.66	>.05
Ambu Ventilation	1.252	0.566-2.769	>.05

Although mechanical ventilation was identified as a risk factor for acquiring Nosocomial infections (OR=1.97), it did not show a significant effect (95 CI%=0.847-4.58).Using dedicated instruments was identified as a protective measure for preventing Nosocomial Infections (OR=0.903). But it did not show significant figures (95% CI=0.409-1.994).Age above 50 years was considered as a risk factor for nosocomial infections (OR=1.947:95% CI=0.838-4.42). A high risk of acquiring nosocomial infections was identified in patients who had an Intensive Care Unit stay for more than three days (OR=1.335:95%CI=0.82-2.173). Urinary catheterization (OR=1.017:95% CI=0.984-1.052), nasogastric feeding (OR=2.016:95%



CI=0.872-4.66), and ambu ventilation (OR=1.252:95% CI=0.566-2.769) were identified as positive contributors for acquiring Nosocomial Infections. Out of all associated factors, nasogastric feeding showed the highest odds ratio (2.016). Except using dedicated instruments all the associated factors considered in the study were identified as risk factors for Nosocomial infections. Using dedicated instruments was recognized as a protective factor for preventing Nosocomial infections.

4 DISCUSSION

Predominant risk factors identified for acquiring Nosocomial infections during an Intensive care unit stay are mechanical ventilation, naso-gastric feeding, central venous line insertion and age above 50years. Although the risk of spreading Nosocomial infections can be minimized by using dedicated instruments for each and every patient, it is not practical to practice such isolation in a very busy Intensive Care setup. But dedicated instruments can be used with minimum expenses when a single set of instruments are used for a single patient until the patient is discharged from the Intensive Care Unit. Several confounding factors such as low immunity, medical comorbidities and nutritional imbalances could affect the increased risk of acquiring Nosocomial Infections among patients with increased age. Exposure to microorganisms is significantly high and immunity status is diminished in prolonged Intensive Care Unit stay. Therefore risk of acquiring infection is increased with increased period of Intensive Care Unit stay, especially the instruments can be easily contaminated with biological secretions. Therefore using dedicated instruments during prolonged Intensive Care Unit stay helps to minimize microorganism transmission.

Possibility of developing Nosocomial infections at critical care setting in developed countries is 30% (Yesilbağ, *et*

al., 2015). But this value is expected to be more than two times higher among the developing countries. Age above 65 years is identified as a risk factor for Nosocomial infections. Nasogastric nutrition, central venous line insertion and urinary catheterization are identified and proven risk factors for Nosocomial infections by several studies. Prolonged Intensive Care Unit stay more than ten days is identified as a risk factor for Nosocomial infections in developed countries (WHO, 2004). But during this present study, Intensive Care Unit stay more than three days was observed as a risk factor for Nosocomial infections.

Association of socio-demographic factors was not studied during the study and ethnic and religious factors and occupational and social status should be considered as well. Reasons for Intensive Care Unit admission and the confounding effects created by comorbidities of the participants were not addressed during the study.

Outcome variable which was used in the study was the incidence of Nosocomial infections and it was defined by recording the fever episodes above normal body temperature. They were not confirmed by culture studies. Raised body temperature could be a result of many other pathologies apart from Nosocomial infections. Reliability of the study becomes questionable due to above reasons and it causes reduction of internal and external validity.

A patient is admitted to an Intensive Care Unit when his life is in a critical stage and the aim is to make necessary treatment methods and minimize the risk and discharge from the Intensive Care Unit as soon as possible. If a patient happens to acquire new infections from an Intensive Care Unit it will prolong his ICU stay and will aggravate his critical situation.

5 CONCLUSIONS AND RECOMMENDATIONS

Anyhow the associated risk factors and protective features identified in this study should be studied in detail, especially with a larger sample size and with a study design that minimizes confounding effects. A well-defined matched case control study design can be recommended for future studies.

It is essential to implement new practical methods to minimize Nosocomial Infections. So practical implementation procedures for using dedicated instruments should be established and their feasibility has to be studied in detail.

Intensive Care Unit admitted patients acquire Nosocomial Infections more frequently. Duration of Intensive Care Unit stay and the treatment procedures done at the Intensive care unit directly affect the spreading of Hospital Acquired Infections. As patients' morbidity and mortality trends are remarkably increased with Nosocomial Infections, it is essential to suppress the associated factors and minimize the spread of Nosocomial Infections. Feasibility of low cost methods in minimizing Nosocomial Infections should be studied in detail.

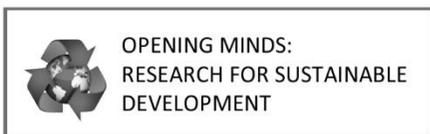
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Third Year Student Nurses' Perceptions Regarding Their Clinical Learning Environment

K.A.S.H. Silva¹, W.A.A.D.S.S. Wimalasena^{1*}, J.P.C.K. Jayalath¹, S.T. Miranda¹ and P.W.G.D.P. Samarasekara²

¹National Hospital of Sri Lanka, Colombo 10, Sri Lanka

²Department of Pharmacy, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: Salannangesandamali@gmail.com

1 INTRODUCTION

Student nurse is a person who is training to be a nurse at a nursing school and works to maintain, promote and restore the health of patients while following the procedures of the hospital where she or he gaining practical experiences (Schater *et al.*, 2011). The clinical learning environment (CLE) is the place where the theoretical components of the curriculum can be integrated with the practical and transformed into professional skills and attitudes within an emotionally safe environment (Steven *et al.*, 2014). Nursing students require a CLE which provides adequate facilities both human and physical resources. The purpose of this study is to examine third year student nurses' perceptions regarding their CLE.

2 METHODOLOGY

This is a quantitative descriptive cross sectional study. Third year student nurses studying in the college of Nursing Colombo was selected using purposive sampling technique because third year nursing students have more experiences with available recourses and barriers to practice in CLE compared to other nursing students. Ethical approval for the study was obtained from the Ethical Review Committee of the National

Hospital of Sri Lanka (NHSL). Permission to conduct the study was taken from the Deputy Director General of NHSL and Principal, College of Nursing Colombo. Participants were informed about the purpose of the study and consent was taken from each voluntary participant. Privacy and confidentiality were assured by maintaining anonymity. A self-administered questionnaire was used as the data collection tool. Third year student nurses' perceptions regarding their CLE assessed based on five point Likert scale. The data transformed in to numerical amount and analyzed using Microsoft Excel work sheet.

3 RESULTS

The response rate of the sample (n=184) was 90.21% (166). Within the total, age distribution was ranged from 23 to 30 years. Majority of participants were between 26 to 28 years. All the participants were Sinhalese and 157 were female students. Most of them were (161) Buddhists.

3.1 Perceptions on human resources

Forty four point three percent (44.3%) participants responded nursing tutors do clinical supervision and return demonstrations occasionally. Only 1.29% agreed that they do clinical supervision



and return demonstration always. Of the sample 7.3%, 22.4% and 54.5% responded staff nurses were willing to support always, frequently and occasionally respectively. The responses related to support from the medical staff were 50.3% occasionally. Among the selected students 42.5% showed that individual instruction by nursing tutors was rare while 24.6% and 11.4% showed it as occasionally and frequently, respectively. The 45.5% students stated that staff nurses have good interactions with student nurses occasionally (Figure 1).

3.2 Perceptions on physical resources

From the participants 45.2% responded that sufficient equipment for procedures were frequently available. Of them 41% agreed that they had adequate time period for practice in special units occasionally. Separate areas to arrange procedures in every ward (38%) and ability to finish the whole procedure within allocated time period (31.9%) occasionally. (Figure 2).

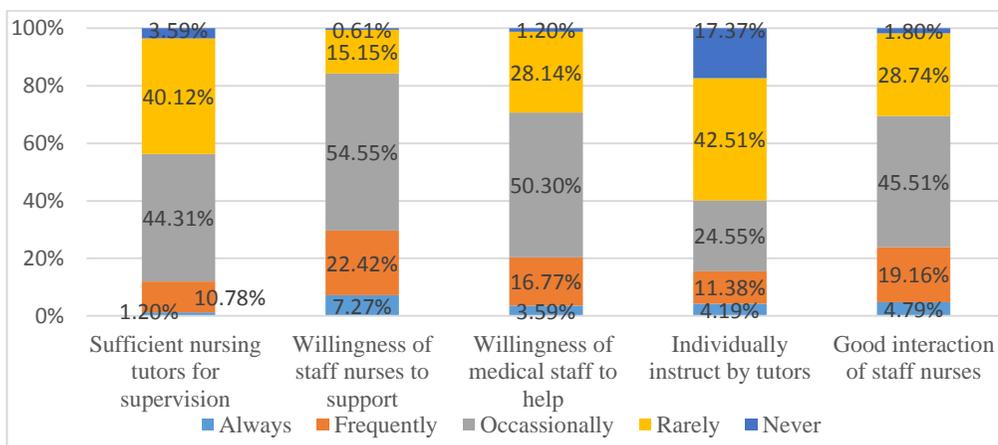


Figure 1: Human Resources

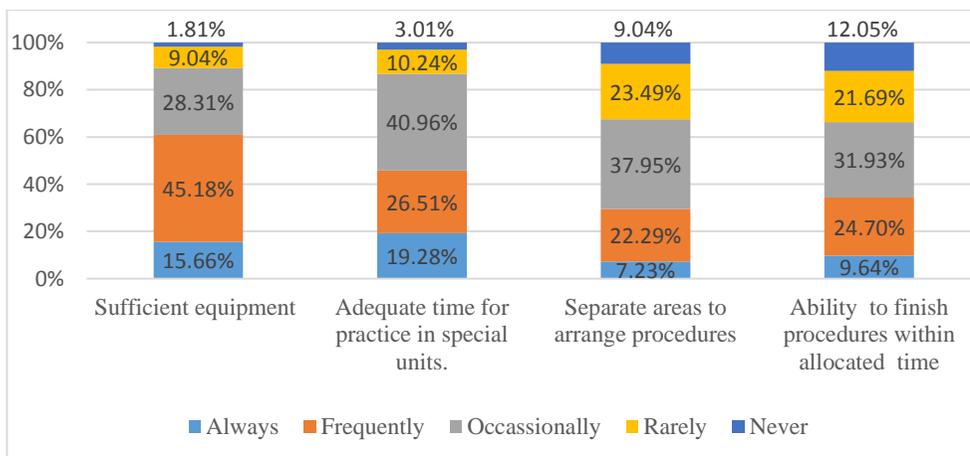


Figure 2: Physical Resource



3.3 Perceptions on learning opportunities

Everyone has opportunities for practice procedures in the ward 31.7% occasionally. Participants responded 33.5% satisfied frequently with ward rotations. The opportunities to operate special instruments in the ward, 36.5% and 38.3% responded rare opportunities to perform procedures in the ward as same as learned in the class room respectively. Of the sample 46.7% agreed that the nursing tutors were too busy. Participants 37.1% responded they have lack of experience to care critically ill patients. Among the sample 44.8% agreed feel stress when doing procedures individually. Students 32.1% were agreed that too many students in the clinical area. (Figure 3)

According to determine expected CLE of the student nurses; 55.4% students were

expected staff nurses should be strict but helpful. Students (61.9%) were agreed that their willingness to do procedures with staff nurses. Students were strongly agreed (39.3%) that there should be a similar time period for both clinical practice and educational environment. Regarding statement of increase the clinical rotation time in gynecology, obstetrics and pediatric wards 41.7% were responded neutral about the effectiveness of it. Students 50.3% were strongly agreed that they wish their tutors always help and evaluate the nursing procedures. Students (54.2%) were agreed that they have chances to assess and practice the patients. Students disagreed (48.9%) with the statement “expect clinical practice should happen in before theoretical knowledge”. Their responded were neutral (43.1%) regarding that they expected to get clinical experiences with all the students in the college at the same time and different time schedules for separate year of nursing batches.

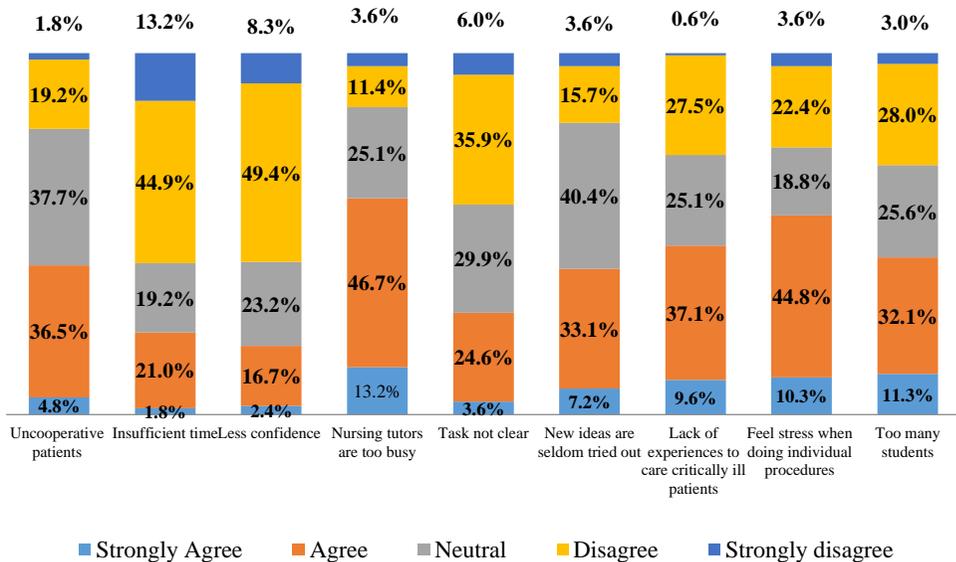


Figure 3: Barriers in CLE



3 DISCUSSION

Findings revealed that student nurses had less satisfaction on available human resources. Insufficient nursing tutors, lack of attention to students' individualization and less staff support were also found as negative perceptions. In this regard Rahmani *et al.* (2011) emphasized, students were not satisfied with their clinical instructors, staff nurses and medical staff support and interaction with each other and also stated lack of attention to student individualization was a major problem.

According to study findings, an overall perception on physical resources was negative. Similarly Mohammadi *et al.* (2004) stated lack of necessary educational aids and lack of adequate facilities were affect negatively to the CLE. Majority of students responded that they were unable to finish whole procedure within the allocated time due to short stays in clinical setting. In contrast Serena *et al.* (2009) stated that students were satisfied with activities done in the ward.

Students have negative perceptions on learning opportunities in the CLE. Majorities were responded that they were not satisfied with ward rotations and opportunities in the ward for practice, opportunities to perform procedures as same as they learned and operate special instruments. McCarthy *et al.* (2008) concluded that short clinical rotations limited the chance to learn and reduced learning opportunities. Furthermore they stated that students have negative perceptions regarding the opportunities to perform procedures in CLE.

Uncooperative patients and overcrowding of students in CLE were identified barriers in CLE. Similarly, Truong (2015) also emphasized this matter. Fewer students rated their perceptions more positively. Findings show students have sufficient

time for practice. In contrast, Brammer (2006) stated time is a major barrier. According to the study that student tasks were clear in the setting. In contrast, Zaighami *et al.* (2004) reported unspecified task orientation was the main problem in CLE.

Findings revealed majority of student nurses expected, staff nurses should be strict, cooperative, knowledgeable and experienced. But different studies show different aspects on it. Truong (2015) stated staff nurses were less of helpfulness, openness, reluctant to teach students. Findings show maximum amount of students were expected to do procedures with staff nurses. Ghodsbin and Shafakha (2008) showed that non-cooperation of nursing staff was the main preventing factor in clinical education. Always help and evaluate the nursing procedures by the nursing tutors was another important expectation in majority of students. This expectation represented in another way by Bigdeli *et al.* (2015) spend a limited time and interact with different instructors in the ward rotation lead a good interaction with instructors.

Majority of students expected to have chances to assess and practice the patients. Bigdeli *et al.* (2015) emphasized, facilitate cooperation in ward activities affect the clients' health and students' safe practice. Majority of students expected that would be increased clinical time in special wards. Gallagher *et al.* (1999) reported increase in clinical performance with more steady clinical allocation as opposed to recurrent rotations. There were discrepancies between theory taught at the college and the actual practice in the setting. Taylor (2000) stated that students undergo ambiguities when they go to new CLE, therefore they need support.



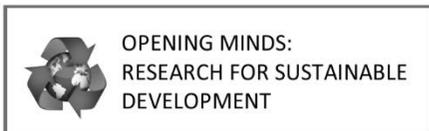
4 CONCLUSIONS AND RECOMMENDATIONS

Study shows that support, guidance, supervision and caring are essential components that student nurses expect from the staff nurses and nursing tutors. It is necessary to facilitate adequate time for practice in special units, facilitate areas to arrange procedures and improve ability to finish the procedures within the allocated time period. The identified barriers are insufficient time, less confidence, stress, uncooperative patients, overcrowded and tight schedules of the nursing tutors.

It is recommended to improve collaboration between the College and hospital by holding annual meetings that address issues relevant to clinical practice for students. Enhance scheduling, create clinical coordinator positions, improve planning and negotiating of placements are also recommended. Continuous studies on CLE evaluation and their results are important. Also staffs nurses must encourage being mentors for student nurses

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Government Pharmacists' Perceptions on Continuing Education

K.D.S.V. Karunanayaka, R.A.N. Dilsha, R.W.N. Tanuja, R.B.J. Buddhika, and P.W.G.D.P. Samarasekara*

Department of Pharmacy, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: pwsam@ou.ac.lk

1 INTRODUCTION

International Pharmaceutical Federation (FIP) of Professional Standards on Continuing Professional Development (CPD) explains that "Pharmacists are health care professionals whose professional responsibilities include seeking to ensure that people derive maximum therapeutic benefit from their treatments with medicines." This requires them to keep abreast of developments in pharmacy practice and the pharmaceutical sciences, professional standards requirements, the laws governing pharmacy and medicines and advances in knowledge and technology relating to use of medicines" (International Pharmaceutical Federation, 2002).

Pharmacists are employed in regulatory control and drug management, community pharmacy, hospital pharmacy, pharmaceutical industry, academic institutions, training institutes of other health workers, and research (World Health Organization, 1988). Hospital Pharmacists commit substantially to the overall advancement of pharmacy practice worldwide to upgrade the entire profession (Doloresco and Vermeulen, 2009).

Continuing education (CE) is defined by the Accreditation Council for Pharmacy

Education as "structured educational activity designed or intended to support

the continuing development of Pharmacists and/or pharmacy technicians to maintain and enhance their competence" (ACPE, 2007). Although recent studies show the need of CE for the professional development of Pharmacists, there is a lack of systematic CE in Sri Lanka. Therefore, preference towards CE should be assessed in order to develop the pharmacy profession. This study focused on Sri Lankan government Pharmacists' perceptions on CE. Government Pharmacists' current engagement with CE, their expectations in relation to CE and the barriers related to their continuous education were identified.

2 METHODOLOGY

A quantitative approach and a descriptive cross-sectional design were utilized. The study was carried out in Teaching Hospitals in the Western Province, Sri Lanka.

Government Pharmacists working in Teaching Hospitals, holding the Diploma in Pharmacy offered by the Ministry of Health were included in this study. Expected sample size (Total = 279) included all government Pharmacists



working in Teaching Hospitals in the Western Province. Hundred and sixty-six (n=166) government Pharmacists consented and participated in the study. A self-administered questionnaire was used as the data collection tool. The questionnaire was validated by an expert panel. Data was analysed using Microsoft excel.

Ethical approval for the study was obtained from the Ethics Review Committee, National Hospital of Sri Lanka as well as the Lady Ridgeway Hospital for Children, Colombo 08. Informed written consent was obtained from all participants prior to the study. The results were kept strictly confidential by the investigators and each participant was identified only by a number allocated at the beginning of the study.

3 RESULTS

The response rate of this study was 60%. Among those who responded the majority of the study participants (40%) were in the age group of 31-40 years and a majority of the participants were female (66%), and 78% were married.

Fifty one percent (51%) of government Pharmacists worked in outdoor pharmacy and only 7% were in managerial positions as superintend Pharmacists and chief Pharmacists. Majority of the participants (73 %) had more than 6 years of working experience as Pharmacists.

Seventy percent (70%) of the participants had the Certificate of Proficiency as the highest educational qualification and 85% were not currently involved in any kind of educational activities. Eighty four percent (84%) of the participants were registered for the B. Pharm Degree offered by The Open University of Sri Lanka and 8% were registered for the same Degree offered by other government universities. Only 4% of the participants were engaged in postgraduate education.

3.1 Present engagement in continuing education

Based on responses of the participants, salary increment (50%) was the main reason for motivation to engage in CE (Figure 01). Promotions (47%), funding by the government (44%), employer encouragement (46%), family/ friends' encouragement (47%) and behaviours of role models (43%) were considered other significant reasons for motivation.

3.2 Expectations on continuing education

Pharmacists expected that CE in pharmacy should be made mandatory for practicing as a Pharmacist (52%), the institution should support CE financially (46%) and the institution should support CE by granting duty leave (84%).

Pharmacists recognized that there were a variety of reasons for the importance in CE. Majority of them (94%) accepted that updating knowledge and improving skills was one of major reasons. Acquiring additional qualifications (63%) and developing leadership capacities (65%) were the second most important causes according to the respondents.

Following are the other reasons for engaging in CE: (59%), obtain salary increments (57%), obtain promotions (54%), network with the other Pharmacists in the field (58%), practice confidently (49%), self-satisfaction (55%), be a mentor for junior Pharmacists and students (55%) and enhance status of the profession (59%) were also identified as importance in CE.

Majority of the respondents were expected to follow B. Pharm Degree (73%) and M.Sc. in pharmacy (6%). Most have accepted that the preferred mode for CE as part time (45%) and preferred duration for CE as more than one year (54%).



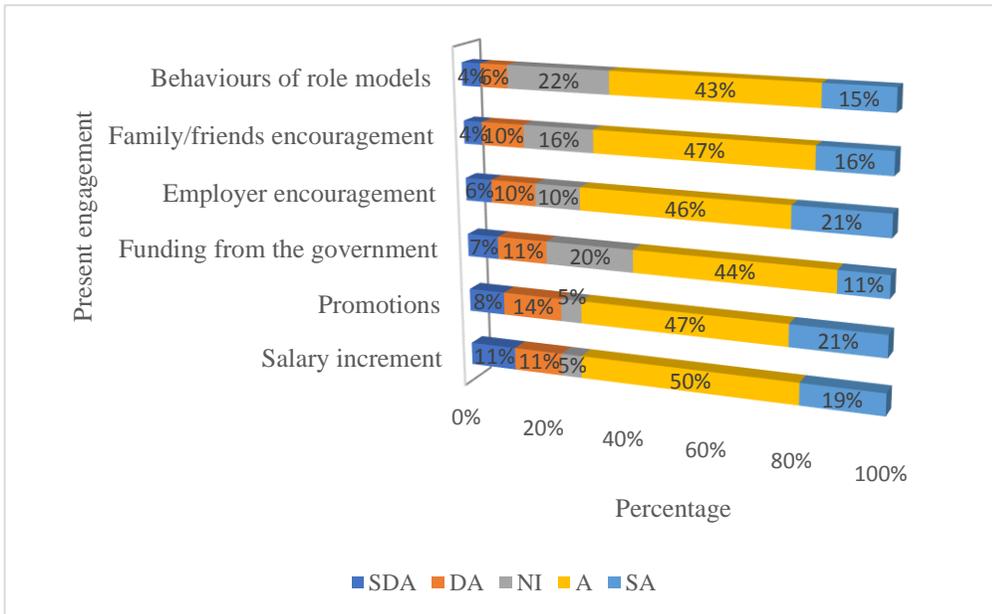


Figure 1: Present engagement in continuing education

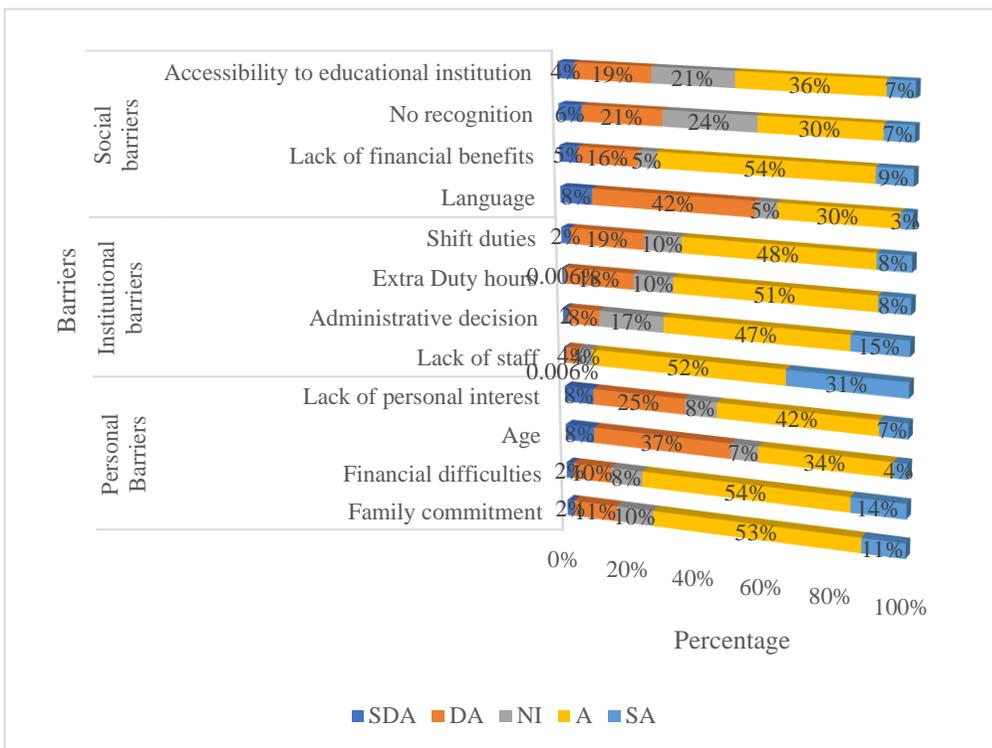


Figure 2: Barriers in continuing education



3.3 Barriers in continuing education

Based on this study, most of the Pharmacists perceived the following barriers (Figure 02) to CE: family commitments (53%), financial difficulties (54%), age (34%), lack of personal interest (42%), lack of staff (83%), administrative decisions (47%), extra duty hours (51%), shift duties (48%), language (30%), lack of financial benefits (54%) and no recognition (30%).

4 DISCUSSION

This study reveals that most of Pharmacists identify that the major reason for engaging in CE is to update their knowledge and improve skills, even though they are presently not engaged in CE. An American study on the perceived benefits of CPD was more than 90% (Christine, 2012), which is similar to the findings of this study. The same study also indicated that all respondents agreed that CPD improved and updated their professional knowledge and thus helped improve performance in their current role.

According to this study, the institutional barrier (lack of staff) was the main limitation in CE rather than personal and social barriers. Financial difficulty and family commitments were the major personal barriers while lack of financial benefits was the major social barrier. International Pharmaceutical Federation (FIP) has stated that Surveys of Flemish, Egyptian, and Qatari Pharmacists cited time considerations and excessive workload or job constraints as barriers to CE participation. Other barriers identified from Pharmacist surveys included cost, lack of program accreditation, and uninteresting subjects.

In this study Pharmacists were expecting that CE in pharmacy should be made mandatory for practicing as a Pharmacist and there should be institutional support by providing financial benefits and duty

leave. A study carried out in Australia revealed that some Pharmacists believed that making CE mandatory for registration was important, but the level of CE required should be achievable (Marriott et al, 2007). They believed mandatory CE should be made a requirement but with flexibility to allow for some Pharmacists' difficulty in accessing relevant CE because of age or geography.

5 CONCLUSIONS AND RECOMMENDATIONS

This quantitative study investigated the present engagement, expectations and barriers CE for Sri Lankan Government Pharmacists. It was found that present engagement in CE was low. Pharmacists' major expectations was to follow the B. Pharm Degree as a CE course on a part time basis. Thus, the distance learning mode needs to be enhanced and promoted and the provision of administrative support is essential to motivate Pharmacists to engage in CE in Sri Lanka.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Culture Specific Mental Imagery in the Treatment of Anxiety

Tina Solomons*

*Department of Secondary and Tertiary Education Department of Psychiatry, Faculty of
Medicine, General Sir John Kothalwawala Defense University, Sri Lanka*

**Corresponding author: Email: thsolomons@gmail.com*

1 INTRODUCTION

K, a 55 year old Sri Lankan male was referred by a psychiatrist for psychotherapy. At presentation the patient was being treated with an SSRI (Selective Serotonin Reuptake Inhibitor) for Panic disorder, with a secondary depression which was at mild to moderate level. K's complains were, inexplicable sudden feeling of fear with panic attacks. According to him he had several other worries which had lessened with the pharmacological treatment.

As Sri Lanka still does not possess government cadre for psychologists, there are no psychologists in government hospitals. Further as psychology is a newly emerging profession, there are only few clinical psychologists working in the capital city of the country who provide private consultancy services at major private hospitals in the Colombo metropolitan area. The patient described in this article was treated through consultations at an accredited private hospital.

K is in his third marriage and had a daughter of 22 from his first marriage. He is resident outside Sri Lanka and whenever he visited Sri Lanka made unsuccessful attempts to reactivate the broken relationship with his daughter. He has lot of latent anger and resentment towards his first wife for "destroying his relationship with his daughter" But this

concern was not prominent at the presentation. He was more concerned of the abuse, both physical and psychological which he faced as a child from his elder brother. He came from a chaotic family background where he experienced the influence of a step father as a result of an extra - marital affair of his mother's. He also had siblings from his father's first marriage. What was most prominent was his feelings of distress at his mother's neglect which occurred according to him because of his close resemblance to his father, who separated from them and with whom he was never able to have a relationship until very late in his father's life. His father had already passed away by the time of presentation. The most prominent emotion was a deep resentment and anger towards the mother for not protecting him and the severe physical assaults of his elder brother.

He re-experiences the constant fear of his childhood where he frequently thought he would be assaulted to death by his brother. What was interesting was for each violent incident with his brother aggression and resentment was directed to the mother who failed to protect him rather than the brother.

After re- examining these thoughts and when the patient was sufficiently calm we embarked on CBT. It should be emphasized that as psychology is still in its infancy in Sri Lanka, there are not



much CBT related measurements validated for the Sri Lankan population. Further, Sri Lankan patients prefer to write less and therefore most writing exercises are done verbally where possible. (Solomons, 2016) K was very compliant in writing exercises more than the average client.

With progression on to therapy K was compliant in homework assignments and was able to identify the loop of thoughts, feelings and physical reactions which lead to his repeated panic attacks.

Yet, his symptoms were not reducing sufficiently. I sensed a feeling of some sort of superficiality in his identification of thoughts. As the therapy was not helping him make progress I thought of helping him by incorporating a few mindfulness techniques. I helped him practice mindful breathing within the sessions and encouraged him to identify his thoughts. Further, as the thoughts were not matched with emotional reactions I urged him to look at the presence of mental images.

When he examined images in his mind, he could relate his emotional intensity with the content of the images. After some time he made a wonderful discovery. He discovered that his constant fear response and panic attacks were linked to a picture of a semi human form. When we explored this during the sessions, he was experiencing all the symptoms of panic. Gradually K became capable of describing and further exploring this picture with mindful breathing. (Didonna, 2009)

Though the physical assault by K's brother and other chaotic incidents in childhood appeared to be the obvious reasons for K's fear, the discussion on these aspects did not evoke severe panic attacks within therapy or outside therapy. Thus the severity of the panic attacks could not be matched to these incidents. Yet, the attention to the green figure evoked severe panic attacks both within

the therapy and outside, making it clear that the severe panic attacks were related to his history with an abusive brother.

He described the picture as green in color. Also he described the first time he encountered the image. As a child he had gone near a small wood in the evening. Usually Sri Lankan, Buddhist cultural beliefs says that if you walk alone in solitary places in the dusk, you can be the victim of the influences of evil supernatural forces such as "Bhootaya", "Yaka" etc, which are evil superhuman forms. According to K, he was gazing at the woods and this semi-human form emerged from the woods and was green in color. First he thought it was a part of the woods but the semi-human form came closer and closer, at which point he had run away in great fear.

What was interesting was his description of the super human form had a very close resemblance to the Sri Lankan *Wamana rupa* and the *Bhairava* images. These are supposed be supernatural forces guarding ancient places.

Yet, as a clinical psychologist trained in the Western model by westerners mostly I was not ready for it. Especially in a globalized culture like Sri Lanka, these images are largely confined to the study rooms of history and archaeology and not a matter of daily consumption. This made it even more difficult for me to understand this client.



Figure 1: Wamana Figures of Sri Lanka- (Wamana Figures in Pollonnaru Architecture, 2015)





Figure 02: *Bhairava* figures of Sri Lanka- (*Wamana* figures in Polonnaruwa Architecture, 2015)

The *Wamana* picture shown above has a long history. *Wamana* sculptures and images are a cultural tradition which has travelled to Sri Lanka from India. It is believed to be the 6th avatar of God Vishnu. Though Indian *Wamana* figures and SL *Wamana* figures resemble closely, the concept of *Wamana* figures in the two countries differ a lot. In Sri Lanka it's more or less an ornamental supernatural force expected to be guarding ancient buildings. There is a wide variation of these figures. (*Wamana* Figures in Polonnaru Architecture, 2015)

These sculptures can be seen on entrances to ancient buildings and around stairways as a means of decoration. They also appear as guardian stones. These sculptures can be seen as depicting different emotions such as anger, smile, joy, dancing etc. Some look non-human.

Bairava rupa

Bairava's are considered ghost-like beings who protect a particular assigned area of a treasure. The concept of *bairava* is associated with fear of these supernatural beings in the Sri Lankan cultural context. In short *vamana* and *bairava* figures can be recognized as Sri Lankan cultural representations of fear.

Though small, Sri Lanka is a country rich in cultural diversity. The above details are mostly about the beliefs in the Sinhalese

tradition. There are common concepts like these among the Tamil communities as well.

As K explored these images most symptoms improved. His therapy terminated gradually and he was able to go back to the country where he had obtained citizenship. The follow-up plan was supposed to be to visit the therapist when he returned in one month which he did and the next follow-up session was scheduled for three months' time.

2. OBJECTIVES AND IMPLICATIONS FOR CLINICIANS

With globalization and migration, people with different cultural roots live in different parts of the world. The above example can be suggestive of the fact that emotions may be stored in the form of cultural images. Yet, further research is necessary to investigate this in more detail. If, as implied in this case, emotions are stored/registered in the form of cultural representations, it could be quite clear that any practitioner in psychology would have to have a thorough grip of the client's culture. This would emphasize the current interest in culturally sensitive therapies. Emphasizing these requirements in the practicing of psychotherapy is the main objective of this paper.

If the therapist is unable to grasp the cultural images of the client's culture, the therapist may fail at the treatment of client's symptoms.

Further, it would be of interest to research on possible cultural representations associated with different human emotions. Carl Jung's archetypes could be a good starting point for this. This type of research would definitely be of immense value for the therapist practicing in a culturally diverse world. Further, till those researches come into existence, it would make good sense for the therapists

to find out from their own clients if there are any cultural representations attached to their client's emotions.

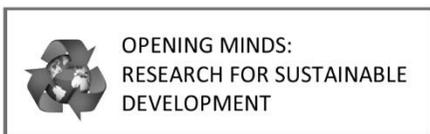
In this case, the client had sufficient reasons in his childhood history to provoke fear, which at first appeared to be the reason for the severe panic attacks. Yet, as the green figure was the reason for the panic attacks it could also imply that when there are fear provoking stimuli, people internalize these in the form of cultural images related to the emotion. In this case it could be that the fear in K's life was internalized in the form of the green figure, which is a cultural image related to fear.

It is a well-known fact that mental imagery acts as precipitating events in anxiety disorders. A clinician would be able to anticipate the common anxiety provoking mental images a patient would normally have. Yet as per this case, if the mental imagery of the patients could also be very much culture specific, it could highlight the importance of cultural sensitivity, particularly knowledge of visual cultural symbols of fear on the part of the clinician. At least the clinician will have to be sensitive enough to inquire of such mental imagery from the client in the case of a client from a cultural background not familiar to the clinician.

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Prevalence and Factors Related to Non-use of Modern Family Planning Methods among 15-49 Years Aged Married Women in the Medical Officer of Health Area Horana

S.S. Thilakahetti¹, W.M.P. Wanniarachchi², H.W.K. Kanthi³, M.D.I. Perera⁴
L.I. Malwenna⁵, and P.W.G.D.P. Samarasekara^{6*}

¹*District Hospital Bandaragama, Sri Lanka*

²*District Hospital Ingiriya, Sri Lanka*

³*District Hospital Galpatha, Sri Lanka, Sri Lanka*

⁴*District Hospital Dambulla, Sri Lanka*

⁵*National Institute of Health Sciences, Kalutara, Sri Lanka*

⁶*Department of Pharmacy, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: pwsam@ou.ac.lk

1 INTRODUCTION

Family Planning (FP) refers to the constellation of activities, in particular, fertility regulation-timed contraception and planned conception, undertaken by a heterosexual couple of child bearing years to achieve the desired birth spacing and family size (Westoff, 1978). Contraceptive Prevalence is the percentage of women who are practicing or whose sexual partners are practicing any form of contraception and usually measured for married women aged 15-49 years (WHO, 2016).

FP helps individuals or couples to avoid unwanted pregnancies, bring about wanted births and regulate the intervals between pregnancies, control the time at which births occur in relation to the ages of the parents and to determine the number of children in the family. Non-use of effective FP methods by sexually active couples resulted in unplanned pregnancies which could be ended up with an induced abortion which is unsafe most often, especially in the developing world leading

to high rates of maternal mortality (WHO, 2016). Even the pregnancy is continued, the pregnancy and the born child will be given less care and attention leading to many adverse outcomes including infant deaths and infanticides. Apart from that, having too close, too many pregnancies will lead to have many adverse outcomes like maternal malnutrition including anaemia, pre term births, intra uterine growth retardation leading to intra uterine death and low birth weight (Westoff, 1978). Purpose of the study was to examine the prevalence and factors related to non-use of modern family planning methods among 15-49 aged married women in the Medical Officer of Health (MOH) area Horana.

2 METHODOLOGY

The study was community based descriptive cross sectional study conducted among 15-49 aged married



women in MOH area Horana in Kalutara District, Western Province, Sri Lanka, excluding those who are not at risk of pregnancy named; women who have undergone hysterectomy, bilateral oophorectomy which were verified based on diagnosis cards or clinic records and those who attained menopause (No menstruation for last six months and not pregnant and not on hormonal therapy), those had minor or moderate auditory and visual disturbances which interfered participation and mental impairment thus cannot give the consent.

The required sample size was calculated using the prevalence of modern FP use in the Demographic and Health Survey (DHS) 2006/7; the latest available at the time of study, considering the critical value of specified confidence as 90%. Final sample size was 200 with added 10% to counteract the non-response rate as it was a community based survey. Cluster sampling was adopted considering the Public Health Midwife (PHM) area as a cluster; selected based on probability proportion to size of each (PHM) division. Cluster size was limited to 10 participants considering the feasibility as revealed by pre-test. One eligible female from one household was selected with informed consent.

The study instrument was an investigator Administered Questionnaire (IAQ), pre tested in MOH area Bandaragama to ensure reliability, acceptability, wording and flow of words, comprehensiveness and ease of administration. Data was collected by members of the research team. The survey was conducted at participants' residences with minimal possibility to miss them within a period of 12 weeks during months of February to April 2017. Contraceptive prevalence and future preferences were expressed as percentages of the study participants. The

statistical associations between different categories and the nonuse of a modern family planning methods were assessed by the chi-square test and p value for significance. The study was conducted under ethical approval from the Ethical Committee of the National Institute of Health Sciences, Kalutara, Sri Lanka.

3 RESULTS

The response rate was 99.5%. Among the participants, 55.3% (n=199) of women were in age range of 30-39 years. Most of women (97.8%) of the study, were Sinhalese. Among non-users, 81.9% of women were more than 35 years and all were Sinhalese. Majority of the study participants (62.5%) completed General Certificate Examination (Ordinary Level) and 44.4% were employed.

3.1 Prevalence of non-use of modern family planning methods

The prevalence of non-use of modern methods in MOH area Horana was 36.2% (n=72). Among the 199 respondents who participated the study, 127(63.8%) was using a modern method and 10 (5%) was using traditional and natural family planning methods at the time of survey.

When consider the individual family planning methods, 43 (21.60%) were using Intra Uterine Devices, 20 (10.05%) were using condoms, 20 (10.05%) were using sub dermal implant, 18 (9.04%) were using oral pills, 15 (7.35%) of the participants have undergone female sterilization, 11 (5.52%) were using Depo-Provera injection. There were no participants whose husbands have got vasectomy done in the study sample at the time of survey.



Table 1: Distribution by socio-demographic characteristics of modern FP non-users

Characteristics	Frequency	Percentage
Marital Status		
Married	68	94.44%
Divorced	2	2.77%
Separated	0	0.00%
Widowed	2	2.77%
Living together	0	00.0%
Level of education		
No schooling	2	1.00%
Grade 1- 5	3	4.16%
Grade 6 – 11	12	16.66%
GCE O/L	45	62.5%
GCE A/L	10	13.88%
other	2	2.77%
Employment		
Employed	32	44.44%
Not employed	40	55.55%

Characteristics	Frequency	Percentage
Age(Years)		
15 – 19	0	00.0%
20 – 24	0	00.0%
25 – 29	5	6.94%
30 – 34	8	11.11%
35 – 39	22	30.55%
40 – 44	17	23.611%
45 – 49	20	27.7%
Ethnicity		
Sinhalese	72	100%
Tamil	00	00.0%
Moor	00	00.0%
Others	00	00.0%
Religion		
Buddhist	68	94.44%
Catholic/ Christian	4	5.55%
Hindu	00	00.0%
Islam	00	0.00%

3.2 Factors related to non-use of modern family planning methods

Among 72 non users of modern methods, majority (45.83%) has stated the fear of side effects of modern methods as their

reason for not using while 31.94% have no faith on methods. 20.83% stated infrequent sex only one woman gave the reason of not having enough privacy in the family planning clinics.

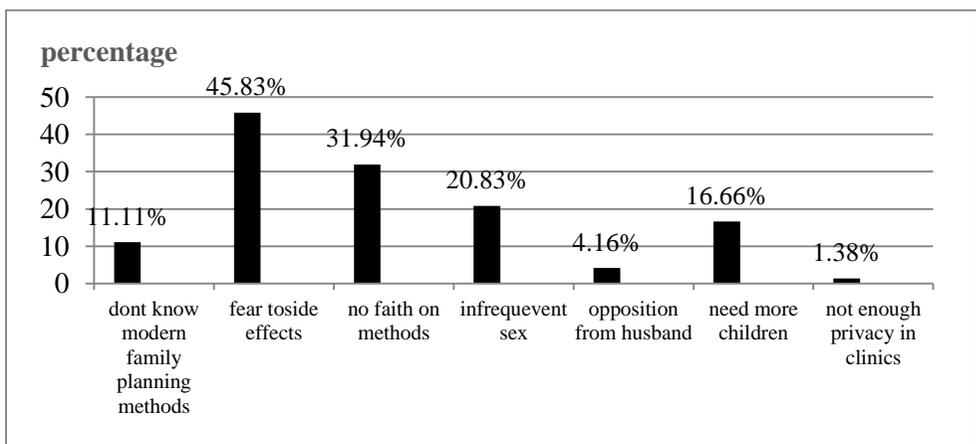


Figure 1: factors related to non-use of modern family planning methods

4 DISCUSSION

Prevalence of non-use of modern FP methods was much lower (36.2%) than that of national level (43.8%) which could be attributed to the better service provision as well as higher socio economic status in women living in MOH area Horana (DHS, 2006/7). Compared to district levels assessed in 2010, it is further lower reflecting the change of socio economic status of the country with time (Malwenna, 2010). It is much lower (43%) than the estimates of some countries (United Nations, 2015). According to that survey, female sterilization and the IUD are the two most common methods all over the world. In the current study IUD was the most popular method being 21.6%.

When considering the reasons for not using a modern family planning method, 45.8% were expressed their fear of side effects of FP methods. This factor has been identified in the study done in Kalutara District as the mostly stated (28.9%) reason (Malwenna 2010). Although most of the respondents were getting information from the PHM and still the fear of side effects remains as the main reason for non-use. Compared to nationally available data in Demographic and Health Survey (DHS) in 2006/7, the reasons for non-use have been assessed for the whole group who were not practicing modern methods of FP. The reasons described in the DHS 2006/7 for non-use included, 37.5% for menopausal / sub fecund states, 20.5% for health concerns and side effects, 8.1% for opposition to use and 21% for infrequent sex (DHS, 2006/7).

Usually in eastern culture, women tend to have less use of FP methods when they have more children, usually in older age groups thinking that their risk of conceptions are low because they are old. This is much dangerous because until

women reach menopause the risk of conception exists leading to unwanted pregnancies which are more prone to be terminated.

5 CONCLUSIONS AND RECOMMENDATIONS

The trend of using modern methods was IUD and implants in the MOH area Horana. Identified reasons warrant the need of clear information coupled with good counselling services to the public to increase the use of modern methods of family planning in the community. Continuous professional development is a pre requisite to improving counselling services by health care workers.

Recommendations to reduce the non-use of modern family planning in the MOH area Horana based on the findings of the study are improve the community awareness on modern family planning methods, make available all types of FP services demanded by the clients, train the field staff to update their knowledge and skills to provide accurate information and provide counseling services to the community and involve all health care providers including hospital staff the medical officers nursing officers in providing accurate information and service on modern FP to the community.

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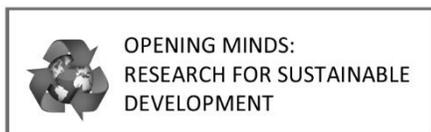
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Socio-demographic Characteristics of Families, with a Child Less Than 5 Years of Age having a Congenital Heart Disease and the Out of Pocket Expenditure of Those Families

P.P. Jayasinghe^{1*}, V.L. Iddamalgoda², K.M.D.S. Kulathunga², W.A.A. Kumara³, W.G.W.P.K. Waldeniya³ and S.D. Darmarathne¹

¹*Faculty of Medicine, University of Peradeniya, Peradeniya, Sri Lanka*

²*Sirimavo Bandaranayake Specialized Children's Hospital, Peradeniya, Sri Lanka*

³*Teaching Hospital, Peradeniya, Sri Lanka*

**Corresponding author: Email: pasan978@gmail.com*

1 INTRODUCTION

Congenital Heart Diseases (CHD) are the commonest congenital abnormality found in the world and in Sri Lanka (Christianson *et al.*, 2006). There are several types of Congenital Heart Diseases and they are distributed in many countries in different geographical areas among different social groups. This distribution may associate with many factors, which are worth studying mainly to evaluate the disease burden to a country. The direct cause for CHD is unknown although there are related factors such as genetic disorders, consanguinity, maternal infections (Lissauer, 2017). But, risk factors or causes are not identified for a considerable amount of patients. So, the associated factors such as sociodemographic, economic, environmental and cultural exposures should be investigated in detail and should be shared in several settings. This can be used to understand multiple associations in order to develop a hypothesis to establish the causative

factors. Sri Lanka, as a country which provides free health care facilities for the whole population, bears the health care expenses of children with congenital heart defects as well. But as the services are not at the door step level, people have to reach certain specialized institutions to get services. Visiting these institutions from faraway places in a regular frequent manner to get the essential and required treatment, obviously causes a great burden to the whole family.

In Sri Lanka, estimated number of live births with a congenital heart defect for a single year is 3024 (Framework, 2013). Although they are scattered all over the country, there are very limited number of paediatric cardiology clinics functioning at present. Patients face unlimited number of difficulties while attending these clinics and the clinic at Sirimavo Bandaranaike Specialized Children's Hospital Peradeniya gives services to patients from several provinces of the country. Although all the treatment expenses of a congenital



heart disease patient are spent by the government via hospital clinic, there can be many opportunities for additional expenses during clinic visits and many other associated events. These expenses are called out of pocket expenses and studying and analyzing these expenses with sociodemographic characteristics of families, were the aims of this study.

2 METHODOLOGY

A descriptive cross sectional hospital based study was conducted at Sirimavo Bandaranaike Specialized Children's Hospital Peradeniya. Study was conducted for a period of six months from November 2014 to April 2015, after obtaining ethical clearance from the Ethical Review Committee Faculty of Medicine, Colombo. Children under 5 years attending the Pediatric Cardiology Clinic at the SBSCH Peradeniya during the study period, were considered as the study population. Children diagnosed with a congenital heart disease, presented with a diagnosis card and children less than five years of age were included to the study. Children with co-existing other congenital abnormalities, children attending the cardiology clinic due to any other reason other than the routine clinic visit, children who have undergone cardiac surgeries and children presenting with any other illness on the visiting day such as Respiratory tract infections and Urinary Tract Infections were excluded. Sample size was calculated by using the Lwanga and Lemeshow equation (Lwanga and Lemeshow, 1991) and it was 335. Systematic sampling required sample size. An interviewer administered structured questionnaire was used for data collection. The technique was applied to obtain th Questionnaire was prepared in English

and was translated to Sinhala and Tamil. Questions consisted of both open and close ended questions. The questionnaire consisted of three parts; socio demographic characteristics of the child, information regarding the congenital heart disease and information required to calculate the out of pocket expenditure for a clinic visit. Questionnaire was developed after extensive literature review and with the contribution of many expert ideas of several specialties in the subject stream. Data sheet was not validated, but was pretested one month prior to proper data collection. Collected data were entered into an Excel 2010 data sheet. After data had been cleaned, they were analyzed by using SPSS version 23 statistical software. Initially a univariate analysis was conducted and on selected variables a bivariate analysis was conducted. The total cost of a clinic visit was estimated by using the following variables; travelling, lodging and incidentals.

3 RESULTS

This study employed a Sample size was 335 and response rate was 100%. The sample consisted of children from seven districts of Sri Lanka, both gender/sex, and main ethnic and religious groups. Out of the 335 children who participated in the study, 47.2% were male (N=158) and 52.8% were female (N=177). There was no statistically significant difference between two genders of participated children ($P>0.05$). Ages of the children varied between 13 months to 60 months with a mean age of 37.1 months and SD was 14.5. Majority were in 37 months to 48 months age group (N=93:27.8%). Majority of the children were Sinhalese (N=270: 80.6%). There were five types of congenital heart diseases found in the study sample. They were; Atrial Septal



Defect (ASD), Ventricular Septal Defects (VSD), Tetralogy of Fallots (TOF), Patent Ductus Arteriosis (PDA), Mitral Valve Prolapse (MVP). Among them the most common (40.3%) congenital heart disease was MVP (N=135).

Total income of the families varied from Rs.12, 000/= to Rs.80, 000/= (Mean=Rs.23759.7: SD=Rs.9026.6). Majority (29.9%) of the families was included to the total income range between Rs.20, 000/= to Rs.24, 999/= (N=100). 23% of participants had taken support from outside people to attend the clinic but no one had to pay for them. 80.9% of employed parents could not attend to work on the clinic day, due to the

clinic visit. 23% of participants lost their daily income due to the clinic visit. None of the patients were given prescriptions to buy drugs from private pharmacies and none of them had to do investigations from private laboratories. All the health care services were provided by the cardiology clinic of Sirimavo Bandaranaike Specialized Children's Hospital. None of the participants had an insurance cover to reimburse the expenses of the clinic visit. 23% of children had withdrawn their savings to cover the expenses and 11 families had borrowed money from friends and relations.

Table 1: Sociodemographic Characteristics of Participants

Gender	Number	Percentage (%)
Male	158	47.2
Female	177	52.8
Age		
13-24	94	38
25-36	61	18.2
37-48	93	27.8
49-60	86	26
Ethnicity		
Sinhala	270	80.6
Tamil	32	9.6
Muslim	31	9.3
Other	2	0.2
Type of CHD		
VSD ¹	102	30.4
ASD ²	76	22.7
PDA ³	11	3.3
TOF ⁴	11	3.3
MVP ⁵	135	40.3
Total	335	100

¹Ventricular Septal Defect; ² Atrial Septal Defect; ³Patent Ductus Arteriosis; ⁴Tetralogy of Fallots; ⁵Mitral Valve Prolapse.

Table 2. Total Family income and Out of pocket expenditure for clinic visits

Family income (Rs.)	Number	Percentage (%)
<15,000	23	6.9
15,000-19,999	93	27.8
20,000-24,999	100	29.9
25,000-29,999	42	12.5
30,000-34,999	28	8.4
>35,000	49	14.6
Out of pocket expenditure		
<500	13	3.9
501-1000	118	35.2
1001-1500	137	40.9
1501-2000	42	12.5
>2001/=	25	7.5
Total	335	100

5 DISCUSSION

The study sample consisted of children from seven districts. Majority was from the central province. Although there was a female predominance in the study sample, according to the statistics the Male: Female ratio of the population of Sri Lanka was 47.1: 52.9 in 2012/13 (Central Bank of Sri Lanka, 2016). Data mentioned in the study sample approximately overlap with this information. According to the population statistics there was a Sinhala Buddhist predominance identified in the districts which were included to the study. There were 80.6% of Sinhalese and 81.8% of Buddhists in the study sample (Statistics, 2012).

According to the study done by Marelli, *et al.* (2007), 52% of congenital heart disease children were females. Majority of the Congenial Heart Disease children had Ventricular septal Defects and the second commonest disease was Atrial Septal Defect. Mitral Valve prolapse was not considered in most of the studies but patients born with Mitral valve prolapse had abnormal heart sounds and therefore they were followed up at clinics for 2-3 years. At the end they were reassured and discharged from the clinic after

prescribing prophylactic antibiotics only for necessary situations. During this period of clinic visits, many opportunities for expenses were generated. Therefore significant attention was paid on mitral valve prolapse during this study, although clinically not serious.

According to the mean income of a family, four main social classes were identified by the Senses and Statistics Department of Sri Lanka. They are very poor, poor, middle and rich (Department of Censes and Statistics, 2009). Mean income of the poor social class was Rs.15, 760/= and the mean of the middle class income was Rs.32, 590/=. According to the present study mean of the monthly income was Rs. 27,759/=. So the mean income of this study falls between the mean income of poor and middle social classes. And in the present study, most of the mothers were educated up to GCE O/L. In the present study, there were no children representing the rich social class. This observation generates two hypotheses; either CHD is not present in this social class or they are not attending the government health care institutions for services.

According to the study done in 2015 in India, majority of the Congenital Heart



Disease patients are from the upper middle class (43%) and lower middle class (37.5%) families (Raj *et al.*, 2015). Majority of patients of the present study also represented middle and poor social classes. At the Indian context, family expenses due to hospitalization for surgeries to correct Congenital Heart Disease were studied and it was calculated as 0.93% of their annual family income. A median of 15 working days was missed annually due to hospitalization. In the present study 80.9 % of participants had missed working days due to clinic visits. Majority had managed their expenses within their monthly income. But in India, Majority (96.1%) had to depend on other external sources to cover up their expenses

There is an opportunity of calculating the non-medical out of pocket expenses of patients who had undergone corrective cardiac surgeries. Calculating the non-medical expenses during the period of preparing for surgeries and during the period of hospital stay can be done by using the 'Review diary method' practiced in USA (DiFazio and Vessey, 2013). Generally there are limitations for leading a normal life after undergoing a cardiac surgery. The impact of those conditions should be evaluated by using a validated technique.

4 CONCLUSIONS AND RECOMMENDATIONS

Majority were Sinhala Buddhists from the central province and they showed a slight female predominance. Among congenital heart diseases Mitral Valve Prolapse showed the highest prevalence. Average out of pocket expenditure for a single clinic visit was Rs.1246.80 (SD=Rs.650.80) Expenses for transport and food were highest among out of pocket expenses.

People should be directed to do necessary behavioral changes to minimize the out of

pocket expenses. Reducing the period of stay at the clinic by allocating a time and providing an efficient service during that time can be used to minimize the expenses for food, lodging and transport. This study can be expanded to calculate the non-medical out of pocket expenses when undergoing a corrective surgery. The psychological effects generated on a congenital heart disease child when living with the limitations of life should be studied in detail.

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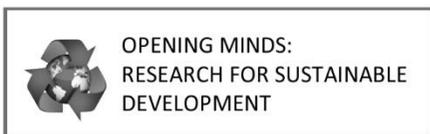
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Factors Related to Theory Practice Gap among Student Nurses

V.G.A.A. Aththiligoda, H.T.R. Kumara, W.A.N.M. Wijesinghe, A.D. Chamari, A.S.P.L. Senadheera and B.S.S. De Silva*

¹*Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

**Corresponding author: Email: bssil@ou.ac.lk*

1 INTRODUCTION

Nursing is the protection, promotion and optimization of health, prevention of illness and injury, and alleviation from suffering through the diagnosis and treatment of human response, for the individuals, families, and communities (American Nurses Association, 2012). Hence, the main goal of every institute of nursing education is to improve health field of the country by providing high quality and standard patient care through upgrading knowledge, attitudes and practice of the students. Students are taught both the theories and practice of Nursing. Theory is defined as the content that student nurses learn in the classroom. Practice is the experience which is obtained at the clinical settings through application of the theories (Jones *et al.*, 1997). “Matching of the textbook descriptions of clinical situations with the reality of practice is an ongoing problem faced by members of the nursing profession and it is commonly referred to as the theory practice gap” (Scully, 2011, p. 93). It means there is a big gap between ongoing practice and desired practice. This theory practice gap has reduced the quality of patient care and decreased patient satisfaction and this also damages the image of nursing. Lack of knowledge and skills, insufficient equipment, inadequate time to perform procedures, inadequate clinical supervision and poor

supervisory relationship are identified factors for the theory practice gap in other parts of the world. However, limited literature is available in the Sri Lankan context. Therefore it is important to find the factors for the theory practice gap. The main purpose of this study is to identify the factors associated with the theory practice gap among the student nurses in the College of Nursing Colombo, which is one of main institutes in nursing education in Sri Lanka. The specific objectives were to identify student nurses’ knowledge and attitudes on clinical education; hospital environmental factors contributing to the student nurse’s clinical education; identifying the associated factors in student nurses curriculum that contribute to the theory practice gap.

2 METHODOLOGY

A quantitative descriptive design was utilized in this study (Burns and Grove, 2007). A convenient sample of 182 student nurses of the third year in the College of Nursing, Colombo was utilized. Data was collected using a self-administered questionnaire which assessed individualized factors, environmental and nursing curriculum related factors which contribute to theory practice gap according to student



perceptions. Prior research findings and opinions of experts were sought to achieve content validity of the questionnaire. Reliability and understandability was assured by performing pre-test reliability with 10 participants. Ethical approval was obtained from the ethical review committee at National Hospital of Sri Lanka (NHSL). Written Informed consent was taken from each voluntary participant, and anonymity and confidentiality were assured by securing the information within their search team. The data was analysed using the Statistical Package for Social Sciences (SPSS) 22 version.

3 RESULTS AND DISCUSSION

A total 182 of nursing students enrolled to the study of whom 94% (n=158) were female. Among the participating students, 76% (n=128) had clinical experience mainly from NHSL. Of the sample, 94% had experiences in variety of special wards including medical and surgical ward

3.1 Individualized factors

As individualized factors which caused the theory practice gap, 82% of students believed it is anxiety whereas 86% thought it is due to lack of knowledge and attitudes. In Iran, Jamshidi *et al.* (2016) revealed that students' lack of knowledge and skills is associated with the theory practice gap. Only 42% of participants believed inadequate self-confidence as the cause. Faezeh *et al.* (2016) revealed the student nurses' self-confidence is one of the other factor associated with theory practice gap.

3.2 Environmental Factors

Knowledge on healthcare settings outside the hospital is required during placements in community including home care and nursing homes, and mental health care

(Bjork, 2014). As hospital environmental factors which negatively impact clinical education, 52% of students thought it is as insufficient equipment. This finding supports the result of a study conducted by Chuan and Barnett (2012), where sufficient equipment was shown to enhance student learning. When considering other environmental factors, only 49% believed in less adjustable hospital environmental facilities while 50% less opportunities due to students being treated as workers, and only 33% thought it as busy ward/ unit. These findings are in agreement with the results of a study conducted by Chuan and Barnett (2012) that factors which inhibit student learning were inadequate time to perform procedures, in the clinical unit, busy wards and students being treated as workers. Seventeen percent of students believed poor interpersonal relationship and communication with hospital staff and students and poor nurses' attitudes towards impacted student learning negatively. The study conducted by Kaphagwani and Useh (2013) revealed that effective learning takes place in a clinical environment with good interpersonal relationship and communication. This finding further emphasises the study findings of Chuan and Barnett (2012) which found that staff nurses' attitudes towards student learning enhances student learning. Of the sample, 47% indicated inadequate clinical supervision, and 54% indicated supervisory relationship and feedback and leadership style of the ward sister. Few studies revealed that clinical supervision, supervisory relationship and feedback as important factors in the clinical environment (Kaphagawani and Ushesh, 2013; Papastavrou *et al.*, 2016). Comparatively, Lawal *et al.*, (2016) identified that maintaining positive interpersonal relationships directly influenced learning in clinical setting. Further they found that practicing with demonstration and return demonstration also influencing factors on clinical learning. Moreover, Mabuda *et al.*, (2008),



revealed that there is a negative impact of poor teaching - learning support, less opportunities for learning, inadequate theory-practice integration, and poor interpersonal relationships among nursing staff, nursing tutors and the students on student learning.

3.3 Factors related to Nursing Curriculum

Identified factors in the nursing curriculum contributing to the theory practice gap vary. Among students, 81% of students have no idea about their curriculum. According to the study findings 85% of participants were not satisfied with the content which is not updated to current medical issues. In 2011, Ajani and Moez found that, it is necessary to update the nurse with new knowledge and practice of the field for maintenance of a proper balance between theory and practice. This is also compatible with the study implemented by, Tiwaken *et al.*, (2015), to examine the live experience of student nurses during their clinical practice. Seventeen percent of students stated the theoretical content is not helpful to them to integrate with practice and 36% suggested for changes and updating the standard procedures to match the real and actual clinical setup. As the same finding in Sharif and Masoumi (2005) students stated that the theoretical content, which they have been learning in nursing schools did not help them to integrate theory and practice. However, according to Jayasekara and Schultz (2006), when introducing a new curriculum to a country it is essential to adapt it culturally to the particular country.

3.4 Causes for not practicing standard nursing care

Surprisingly only 6% implemented standard nursing procedures while a majority (94%) were not performing at the ward setup. According to the students' points of view, the following were the

reasons for not practicing standard nursing care: 85% responded that they didn't receive clear practical knowledge through the procedure demonstration, 28% of them stated the ward staff expect to fulfil their routine, 11% of students stated it takes long time, 9% expressed that support from the ward is inadequate, 11% said inadequate clinical supervision, while 18% of participants stated the reason as due to heavy routines.

3.5 Practice related factors

When looking at the reasons for not receiving clear practical knowledge through the procedure demonstration, y some reasons can be identified (Figure 1). Of this sample, 37% (n=61) of students stated that the demonstration does not give solutions or suggestions for the actual practical setup. But only 1% of students expressed that the procedure book does not explain the content in a clear and accurate manner and, they had did not have sufficient opportunity to perform a repeat demonstration as the reason. Compatible with these findings are the findings of Sharghi *et al.* (2015): there is no application of theoretical aspects of the nursing (85.6%), usage of traditional routine-oriented methods in general practice at the wards (81.1%) insufficient time for performance based on knowledge in relation to the nurses' workload (86.5%), weakness and usefulness of scientific function encouragements systems in clinics (85.2%) whereas learnt theoretical subjects are not been practiced in clinical fields after graduation.).

3.6 Suggestions to reduce theory practical gap in providing patient care

The students suggested a few things to reduce the theory practice gap. The majority (36%) suggested for updating the standard procedures with the current



actual clinical setup, whereas 24% proposed that tutoring should done at the clinical teaching at ward rather than

demonstrations at the skill lab. Of the sample, 18% suggested that tutors should be actively involved to solve the theory problems while applying it to a practical setup.

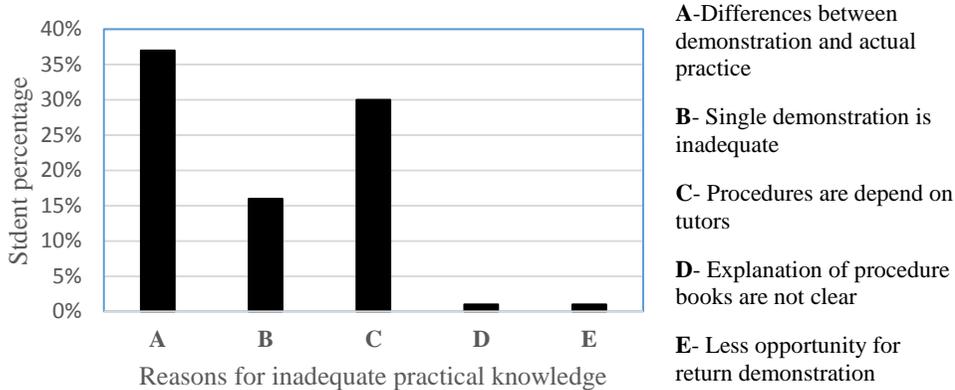


Figure 1: Reasons for not receiving clear practical knowledge through the procedure demonstration

4 CONCLUSIONS AND RECOMMENDATIONS

This study concludes that individual factors such as anxiety, insufficient knowledge and inadequate self-confidence affect clinical education negatively. Insufficient equipment, students being treated as workers, inadequate time to perform procedure, poor interpersonal relationship and communication with hospital staff, poor staff attitudes towards student learning, insufficient clinical supervision, and leadership style of the ward sister are environmental factors which influence clinical learning. Moreover the findings concluded that the nursing curriculum’s theoretical content is not enough to have a good knowledge, and inadequately supports developing confidence in the clinical set up, and does not integrate theory and practice, and the differences between the actual ward situation and demonstration room and that there is variability in the procedures depending on tutors.

It is highly recommended to enhance collaborative work in the clinical environment within the nursing school; increase facilities; treat students as adult learners; implement modern teaching methodologies; conduct continuous revision and upgrading of the curriculum so that it is suited for current medical education needs; and further studies are recommended to identify problematic areas and overcome the theory practice gap in nursing education. Promoting distance learning programmes among nurses to improve their knowledge, attitudes and practices is another recommendation.

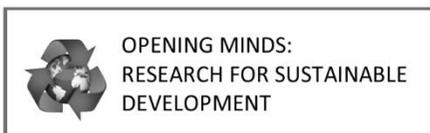
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Mothers' Experiences of Having a Child with Autism Spectrum Disorder in a Tertiary Care Hospital, Sri Lanka

K. Monika, H.G.I. Wijayarathne, G.A.M.I.L. Gunarathne, G.G.W.C. Wijesekara* and A.V. Pramuditha Madhavi

¹*Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: ggwij@ou.ac.lk

1 INTRODUCTION

Autism Spectrum Disorders (ASDs) is a growing problem worldwide and it was estimated that the global prevalence of ASDs to be one child in 160, which accounts 0.3% of the global burden of disease (World Health Organization-WHO, 2013). The children with ASDs encounter number of problems including restricted social, communicative and emotional competencies, uneven cognitive development and maladaptive behaviours and therefore, parents of these children have to face a unique set of challenges which in turn affects their psychological and emotional well-being (Meirsschaut *et al.*, 2010). Mothers appear to carry the large burden of care and may feel a need to be with their child always and experience stress related to coping with the heavy load of care giving (Davis and Carter, 2008; Meirsschaut *et al.*, 2010). Moreover, mothers were challenged with multiple reasons and therefore having suffered from deferent unpleasant experiences which are mostly remain unrevealed. Further, lack of published research studies were found in exploring mothers' experiences having a child with ASD within the Sri Lankan context. Hence, this study was conducted to explore the mothers' experience in parenting a child with ASD. The findings of this study will be helpful to aware relevant authorities, health care workers and the general public about the physical

and psychosocial problems the mothers of autistic children are facing and thereby to take necessary actions and facilitate them to overcome such problems.

2 METHODOLOGY

The qualitative exploratory research design was used for this study and the data analysis was done by the researcher using qualitative content analysis method described by Graneheim and Lundman (2004). Convenience sampling method was used to select participants of this study and sample size was determined as data saturation point is reached. Hence, for the study, a sample of 15 mothers a) who were able to understand and speak Sinhala or English languages and b) who were having a child aged between 3 years and 12 years with ASD were included from the Child Guidance Clinic (CGC) in the Lady Ridgway Hospital (LRH) of Sri Lanka.

Ethical approval for this study was obtained from Ethics Review Committee of LRH and the permission to conduct this study was taken from Director, Special Grade Nursing Officers and Nursing Officers In-Charge of LRH.

All the participants were provided with both written and verbal information about the purpose and the nature of the study. Voluntary participation to the study was



encouraged and from among those demonstrated the interest in participation, a written informed consent was taken prior to the data collection. All participants were informed about the right to withdraw from the study at any point of time without any sort of penalty. Researchers ensured the privacy and confidentiality of the participants prior, during and after the study and gathered data with tape recorders were protected with a password in a computer.

Data was collected using semi-structured interviews which usually lasted between 20-30 minutes. The interview guide for this study included demographic question about the participants and their children as well as 10 open-ended questions related to participant's experiences of having a child with ASDs in areas of a) the time of diagnosis of ADS, b) maintaining social and family relationships and c) own physical and mental well-being. Follow-up questions were included if clarity was needed in a particular area. All interviews were conducted in a confidential room at LRH by the research team members. The time duration of the individual interviews was ranged between 20-30 minutes.

All the interviews were tape recorded and transcribed in to verbatim. Then, the data were coded according to individual questions and patterns in order to make meaning of the participants' experiences. Coding continued until all possible option for themes had been derived and the interviews appeared to have been fully explored. The data was then organized thematically.

3 RESULTS AND DISCUSSION

3.1 Demographic Characteristics of the Participants

Mean age of the participants was 35 years the age was ranged between 28 to 41 years. Majority of the participants were Sinhalese (80%; n=12) and Buddhists (67%; n=10). Most of the participants had

studied up to O/L (67%; n=10) and many were unemployed (73%; n=11).

3.2 Mothers' Experiences of having a Child with ASD

According to the results, the major themes derived from this study were, a) Negative emotional reactions, b) physical exhaustion, c) financial problems, d) social withdrawal and e) coping with the autistic child.

a) Negative Emotional Reactions

Most mothers had negative emotional reactions when they first time heard that their children have ASDs. Feeling of sad: *"I have never heard the word autism here before. Once I heard that my child is having autism, I felt very sad"*; frustration: *"I got frustrated once my child was diagnosed with Autism.... and it took time to me to believe it and therefore, it was delayed to start treatments"*; and difficulty to tolerate: *"I felt a deep pain as I heard my child is having Autism. Actually I couldn't tolerate it"* were more common among participants. Similar to this finding, in a qualitative study done in UK found that parents had experienced distress and frustration when they were disclosed the diagnosis of their child's ASD (Abbott *et al.*, 2013). Also, the participants expressed uncertainty over their child's future: *"Anyone can't look after my child and they are not accepting my child. I think when I die; we both need to die together"*. In their study, Davis and Carter (2008) reported that parents undergo high level of stress and depressive symptoms when raising a child with ASD.

b) Physical Exhaustion

The participants' normal day today activities were drastically affected by having a child with ASD and caused them physical exhaustion. The participants reported that there is a heavy work load for them: *"I get up early in the morning and do everything for my family"*, *"I have to do lot of work due to my child's*



condition". On the other hand, they had missed their leisure time since they had to devote much more time and attention for their autistic child: *"Now I haven't freedom like earlier, it is zero"*. Supporting this result, another study also revealed that mothers reported difficulties in engaging with normal family activities such as going to a playground with the children, going on vacation, visiting friends, etc. (Meirsschaut *et al.*, 2010).

c) Financial Problems

Most mothers of this study expressed that they had to give up their career to give full time attention for their autistic child. Many mothers stayed at home and looked after the child thus father being the only breadwinner for the family: *"I had a dress making shop. Now I can't run it with this situation"*. Therefore, these families had to face financial difficulties since they had to spend considerable amount of money on expensive treatments of ASDs: *"We spent much money for the child's treatment. We can't save money. We are in rental house"*. In their study, Meirsschaut, *et al.*, (2010) also reported that it was impossible for mothers with autistic children to engage in full-time jobs due to their child's condition.

d) Social Withdrawal

In this study, mothers had to face many difficulties with their child's difficult behaviours. Some participants reported that their child demonstrated aggressive or violence behaviours towards parents, siblings or friends: *"he throws house hold items away and hit those on the floor"*; *"he always quarrels with friends at pre-school"*. In align with this result, other studies found that dealing with challenging behaviours (temper tantrums, repetitive behaviours and aggressive behavior) of children with ASD as stressful for parents (Ludlow *et al.*, 2011). Also, the participants experienced isolated feelings due to social stigma: *"I will be laughed at by others when they get to know my child's condition"*, *"we don't like to go to weddings, parties or restaurants*

because he (autistic child) runs here and there", *"I never go out of the home with this child alone"* and similar findings were reported by Nicholas, *et al.* (2016) and Hsu, *et al.* (2017).

e) Coping with the Autistic Child

Though initially mothers got delayed in accepting their child's condition, later they have accepted it: *"I made my mind to bare it...."* and turned to further improve their knowledge on ASDs by searching internet, watching television or reading newspaper articles (knowledge seeking behavior): *"I searched the internet and watched several videos regarding Autism and attended for a speech therapy class"*. A study done in Netherland found that parents of children with ASD showed high levels of acceptance and active adaptation to their child's recent diagnosis of ASD (Poslawsky *et al.*, 2014). This study found that most of mothers received help from their family members in looking after this child as well as the other children. Mothers had positive experience with paternal care and had support from their husbands. Also, the extended family become more helpful for those mothers: *"My younger sister looks after my child as she finished her school life...."* Mothers valued this support as a thing that helped them to cope with the situation. However, different results revealed by Meirsschaut *et al.*, (2010) since they found lack of understanding about ASD among relatives impacted on their relationships with the extended family members. Further, most of mothers got social support to care of their child, especially from health professionals like doctors, nurses and other therapists. Some mother got help from neighbors, head of the working place etc. However, lack of external support with lack of friendship and peer connection was reported in the study of Nicholas *et al.* (2016).



4 CONCLUSIONS AND RECOMMENDATIONS

This study explored mothers' experiences with their child diagnosed with Autism Spectrum Disorder and the major themes derived were negative emotional reactions, physical exhaustion, financial problems, social withdrawal and coping with the autistic child. Mothers had significant emotional challenges when it disclosed the news of the diagnosis. Mothers carried out intervention at home in the role of a full time therapist for their autistic child. It caused to increased level of stress and impacted upon their daily lives. Although a little number of mothers adjusted and were able to cope with daily activities with the diseased child, others were not fully adjusted. By revealing the challenges that the mothers faced of having a child with ASD, the authorities need to take actions to facilitate these mothers and strengthen their capacity to cope with and adjust with the condition. Further, awareness of the public regarding this disease is crucial since it helps to minimize social stigma that facilitates mothers to receive appropriate emotional and psychological support from the society at large.

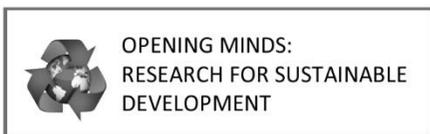
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Reasons for Recurrent Admission of Patients with Asthma in District General Hospital Embilipitiya

W.A.U. Perera¹, H.V.R. Jeewanthi¹, K.P.D.N.S. Jayawardana¹,
M.H.T.D. Krishanthi¹, R.A.N. Dilsha² and P.W.G.D.P. Samarasekara^{2*}

¹District General Hospital Embilipitiya, Sri Lanka

²Department of Pharmacy, Faculty of Health Sciences, The Open University of Sri Lanka, Nugegoda, Sri Lanka .

*Corresponding author: Email: pwsam@ou.ac.lk

1 INTRODUCTION

Asthma is a chronic inflammatory disease of the airways associated with bronchial hyper responsiveness and reversible airflow obstruction (Turner *et al.*, 2011) characterized by recurrent attacks of breathlessness and wheezing, which vary in severity and frequency from person to person (Bousquet *et al.*, 2010). It is considered to be one of the world's commonest non-communicable diseases (Bousquet *et al.*, 2010). The fundamental causes of asthma are not completely understood. The strongest risk factors for developing asthma are a combination of genetic predisposition with environmental exposure to inhaled substances and particles that may provoke allergic reactions or irritate the airways (Akdis *et al.*, 2006).

The incidence and prevalence of asthma have increased during the past twenty years, affecting 5-10% of global population (Guptha and Weiss, 2007). World Health Organization (WHO) in 2007 estimates 235 million people suffered and recurrently admitted to the hospital due to asthma recurrent attacks. According to the Global Asthma Report in 2014, most people (80%) affected are in low-an-middle-income countries, and its prevalence is estimated to be increasing fastest in those countries compared to the

developed countries. Poor asthma control remains a frequent cause of emergency department (ED) presentation and hospital admission (Adams *et al.*, 2000) though the patient on the medication for particular clinical incidence. Improper use of inhaled devices in the management of bronchial asthma (Adams *et al.*, 2000) and factors such as variation in exposure to tobacco smoke and other allergens affect to the recurrent hospital admission of asthmatic patients (Woolcock, and Peat, 1997) in most of the countries.

Asthma is burden disease condition which has to be allocated high cost for conducting control programme and as well as treatment due to re admission to hospitals. The Sri Lankan Government is reported to have allocated Rs. 140 million for asthma treatment in the year 2015 alone. The GAN (Global Asthma Network) has marked Sri Lanka as one of the high prevalence countries of asthma and Sri Lanka was also listed as one of the countries with no national strategy plan for managing asthma in 2014. Therefore it is very important to identify the factors related to recurrent admissions of asthma patients in Sri Lanka for an effective control of asthma. There are no significant amount of researches done to identify the factors related to recurrent hospital admissions in asthmatic patients and even



the available research also focused on pediatric population which is not evaluate the adults perception. Therefore this study was aimed to examine reasons for recurrent admission of patients with asthma in District General Hospital Embilipitiya.

2 METHODOLOGY

Quantitative, descriptive and cross-sectional study design was utilized in this study. The study was carried out in medical wards in District General Hospital Embilipitiya, Sri Lanka.

Sample size was calculated using online sample size calculator, Raosoft® considering 95% confident interval and 5% margin of error. Convenience sampling method was carried out and 150 asthmatic patients between 18 to 80 years with more than two times admission within a period of six months, solely due to exacerbation of asthmatic condition were selected. Asthmatic patients who were admitted only once and exacerbation of asthma due to other medical conditions were excluded. Self-administered questionnaire and participant demonstration on inhalation technique were used to collect data. Questionnaire was prepared by reviewing literature and with self-experiences of the investigators. Questionnaire was validated by expert panel. Inhalation technique was evaluated according to the check list developed by referring standard checklist of use of inhalation devices in National Asthma Council Australia and American Pharmacists Association - Academy of Pharmacy Practice and Management (APhA-APPM). Evaluation was done by the investigators. Data was analysed descriptively by using the Microsoft excel software.

Ethical approval was obtained from the Ethics Review Committee of National Hospital of Sri Lanka and permission was obtained from the Medical

Superintendent, District General Hospital Embilipitiya. Informed written consent was obtained from all the participants prior to study. The results were kept strictly confidential by the investigators and each participant was identified only by a random number allocated at the beginning of the study.

3 RESULTS AND DISCUSSION

Respond rate of this study is 96% as 144 usable study instruments were returned from the expected value of 150. According to the socio-demographic background, most of the study participants (60%) were in the age group of 61-80 years. There were more female (67%) than males (33%) and 65% were married. All the participants are Sinhalese and only 23% of the participants have undergone the secondary education (Table 1).

Table 1: Demographic Characters

Description	Quantity	Percentage
Gender		
Male	50	33%
Female	100	67%
Age		
18-40yrs	25	17%
41-60yrs	35	23%
61-80yrs	90	60%
Ethnicity		
Sinhala	150	100%
Religion		
Buddhist	145	97%
Christian	5	3%
Marital status		
Single	30	20%
Married	98	65%
Divorced	6	4%
Widow	16	11%
Education Level		
No formal education	12	13%
Up to Grade 5	7	30%
Grade 6- GCE O/L	34	10%
UP TO GCE A/L	36	13%
Marital status		
Single	30	20%
Married	98	65%
Divorced	6	4%
Widow	16	11%



3.1 Practices of asthmatic patients

According to the results, the majority of the study participants (80%) were unaware of the inhalation device that they use. The majority (60%) were unable to distinguish and identify the difference between Metered Dose Device (MDI) and Dry Powder Inhaler (DPI). Further Majority of the participants (90%) were unable to identify the colour codes of the MDI which were separated for symptom relievers and for symptom preventers. This would affect to effective delivery of the inhalation therapy due to the scare in knowledge regarding the inhalation devices.

Eighty five percent of asthmatic patients had errors in inhalation technique, especially in the use of MDI (Figure 1). The most frequent errors observed in the inhalation technique were poor coordination between actuating the medication and inhalation where observed in 91% of the participants. Further 86% of participants were not hold the breath after inspiration and only 2% holed breathe for 5-10 seconds. The majority (93%) did not used proper positioning for effective inhalation technique. These factors directly contribute to the ineffective drug delivery through the inhalation route where patient on the under dose and which trigger the recurrent hospital presentation in the case of environmental change or exposure to an allergen. Similar results was found in the research conducted in Saudi Arabia where improper use of inhaler devices, lack of education about asthma disease or a lack of regular clinic follow up were led to recurrent admissions (Hamdan *et al.*, 2013).

The majority (90%) were using the MDI with spacer device. Of 40% participants not considered the cleaning of the spacer device and 45% were not clean the spacer device since started using the device. Most of the inhaler users (71%) unaware of the

proper cleaning of the spacer device where they were using dry cloths. This can result in electrostatic charge on the inside of the spacer, which make the medication and dust stick to the sides which result in unwanted side effects and inadequate drug delivery due to blockage in device. Not only the spacer devices, 90% of the participants were not cleaned the MDI while using and also showed inappropriate technique.

Unawareness of the spacer device technique lead to withdrawal of the use of spacer device combination with MDI in 25% of the asthmatic patient though they have recommended to use spacer device. This made difficulty and complication in use of inhalation device among those patients. These results emphasized the importance of advance education for patients regarding proper usage of inhaler and correct inhalation technique prior to use. Further timely evaluation of the proper usage of inhalation device by the health professionals would help to minimize the recurrent admission of the asthmatic patients to the hospital.

Apart from the inhalation technique errors, practice of smoking also contribute to the recurrent hospital admission in the study participants (Figure 1). There were 44% cigarette smokers among the participated male patients. 72% of cigarette smokers had increased their disease condition and reported hospital admission as similar with the study by Sama *et al.*, 2015.

In addition to above major factors, some of the personal practices also affected to the exacerbation of the asthmatic condition and hospital admission. There were 60% of participants had practicing of bathing at night, 65% of the participants consumed cooled foods and beverages and 75% had pets (Figure 2). These caused to recurrent admission to the hospital as the unawareness of the risk factors of the asthma.

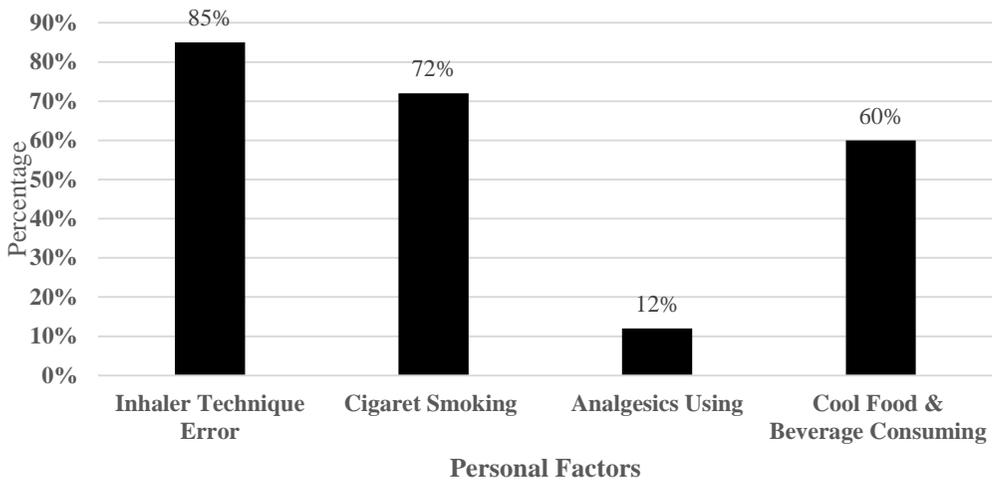


Figure 1- Practices of the asthmatic patients

3.2 Environmental factors

Environmental factors like climate changes also caused to the hospital admission due to the asthma as the season changes may increase cold humidity. And also dust and particle generated due to the agricultural environment (65%) and pest

handling (75%) also contributed to the recurrent hospital admission due the exacerbation of asthma (Figure 2). Similar reasons has been showed in the study conducted by D'Amato, 2011.

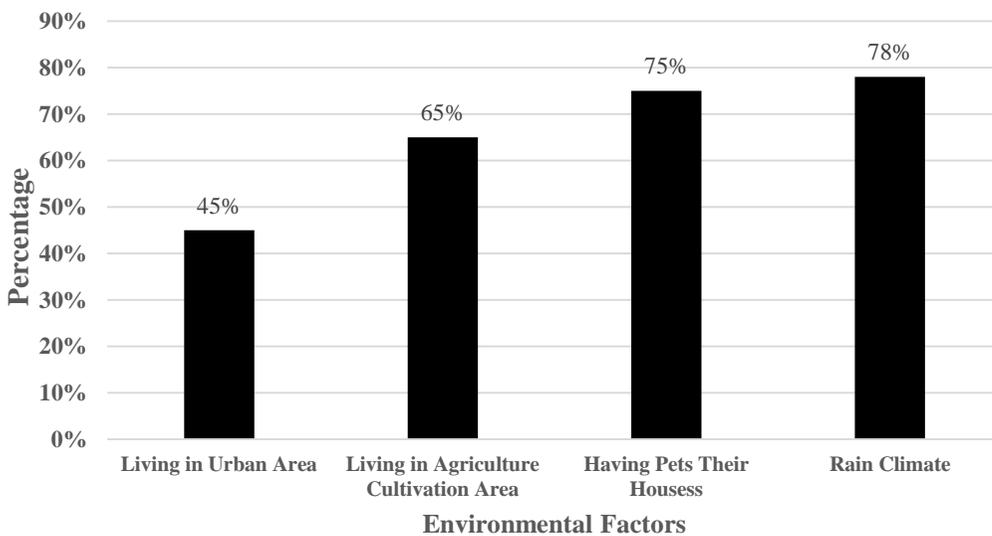


Figure 2- Environmental factors of the asthmatic patients



4 CONCLUSIONS AND RECOMMENDATIONS

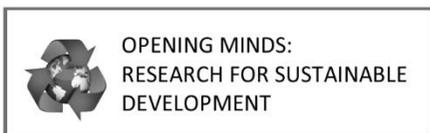
An inhalation technique error is the main factor that affect to the recurrent hospital admissions of patients with asthma in District General Hospital Embilipitiya. The most frequent errors observed in the inhalation technique were poor coordination between actuating the medication and inhalation. In adequate knowledge regarding the correct practice of using inhalation devices (use and cleaning) also affect as a barrier for optimum drugs delivery to lungs which enhance the hospital presentation. Personal factors like smoking and inappropriate habits (Evening bathing, having pets and consumption of cooled foods and beverages) also affects to the recurrent hospital admission due to the asthma as the genetical or physiological stimulation of the asthmatic condition. Further environmental factors like climatic changes also caused to the hospital admission of the asthmatic patient where uncontrolled by the asthmatic patients.

Minimizing the effect of above factors can control the recurrent hospital admission due to the asthma in asthmatic patient. Specially providing knowledge regarding risk factors of the disease, knowledge of the inhalation devices and proper demonstration on inhalation devices will have greater influence.

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Mothers' Knowledge, Believes and Practices Regarding Febrile Convulsions and Home Management

M.S.S.K. Abeysekara¹, M.P.N.P. Weerasekara², B.V.T.N. Wijesena¹, R.A.C.N. Perera², K.A. Sriyani^{3*} and N.R. Kuruppu³

¹Teaching Hospital, Kandy, Sri Lanka, Sri Lanka

²Base Hospital, Warakapola, Sri Lanka

³Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: kasri@ou.ac.lk

1 INTRODUCTION

Febrile convulsions are the most common seizure disorders in childhood. Usually it occurs in children who are at six months to five years of age (Zyoud *et al.*, 2013). There are two types of febrile convulsions; simple and complex. Majority of the children get simple febrile convulsions and they have minor risk of getting recurrent afebrile seizures, but who had complex febrile convulsions are at greater risk of developing recurrent afebrile seizures.

Children who are having febrile seizures end up with lot of complications including cognitive impairment, psychological effects, social impact, prolonged hospitalization and increased health costs in the country (Najimi *et al.*, 2013). After getting the first febrile convulsion, parents are unknowingly become shocked and many think that child may die (Parmer, Sahu, and Bavdekar, 2001). It can cause severe anxiety among mothers due to the simultaneous occurrence of two major phenomena at once; fever and seizure. Suffering their child from febrile convulsion is a very stressful experience for parents and it can significantly influence their emotions and family life (Sajadi and Khosravi, 2017). The

outcomes of febrile convulsions are known to be poor in developing countries due to various inaccurate information, and traditional beliefs and harmful practices (Iloeje, 1989).

2 METHODOLOGY

Quantitative research approach and descriptive research design was utilized. Study was conducted among 150 mothers who were having children under five years of age admitted to the pediatric wards of the Teaching Hospital Kandy. Convenience sampling technique was used to recruit the sample.

Self-administered questionnaire was used to collect data. It consists of four parts: demographic characteristics of the mother, mothers' knowledge regarding febrile convulsion, mothers' believes and their practices of febrile convulsion at home environment. Participants' level of knowledge was assessed by 10 multiple choice questions. When scoring, each correct answer was given "1" and incorrect answers and unattempted questions were given zero. The total score was



ranged from zero to 10 and the level of knowledge was categorized in to three as poor (<5 marks), fair (5-7 marks) and good (8-10 marks). The content validity of the questionnaire was ensured through literature review and subject experts. It was pretested among ten mothers who did not participate in the real study. Data were analyzed by using Microsoft Excel 2010 using frequencies and percentages.

Ethical approval was obtained from the Ethics Review Committee of Teaching Hospital, Kandy and permission for data collection was taken relevant hospital authorities. Voluntary participation was encouraged and participants were informed about purpose of the study, risks and benefits and their rights to withdraw from the study at any time. Written informed consent was signed by all participants prior completion of questionnaires.

3 RESULTS AND DISCUSSION

Table 1: Demographic characteristics of participants

Variable	Frequency	%
Age (in years)		
18- 22	25	16.67
23 – 28	57	38.00
29- 35	38	25.33
Above 35	30	20.00
Religion		
Buddhism	101	67.33
Islam	27	18.00
Hindu	17	3.30
Education level		
No Schooling	8	5.33
Upto Grade 8	34	22.67
Up to O/L	71	47.33
Up to A/L	35	23.33
Higher Education	2	1.33
Employment status		
Yes	53	35.33
No	97	64.67

3.1 Mothers’ knowledge regarding febrile convulsion

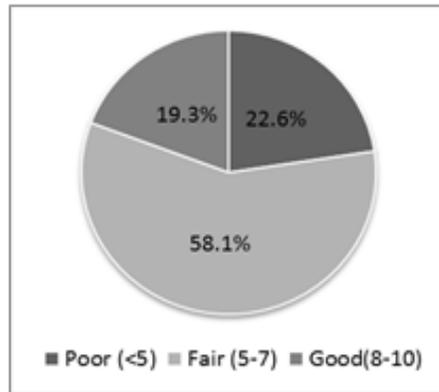


Figure 1: Mothers’ knowledge on febrile convulsion

The summative knowledge score revealed that majority (77.4%) of the participants had adequate knowledge regarding febrile convulsion (Figure 1). Similar results were found in studies done in Ghana and Turkey (Nyaledzigbor *et al.*, 2016; Kayserili *et al.*, 2008). But it is contrasting with the findings of Wassmer and Hanlon (1999) as the general knowledge of febrile convulsions among parents of young children found to be low in UK. Furthermore, 88% of mothers of the present sample were able to mention various signs and symptoms of the febrile convulsion such as stiffness of the body parts (hand legs) eye rolling up and loss of consciousness and 65.3% of mothers understand that it is associated with high body temperature (Figure 2). These findings were similar to a recent study conducted in Taiwan (Huang, Huang and Thomas, 2006). 47.3% of mothers were able to identify 98.4° F as the normal body temperature which is contrasting with the findings of the study done in may be due to nature of the knowledge area assessed. Ghana as majority of the mothers could not be able to specify the number of degrees of Fahrenheit.



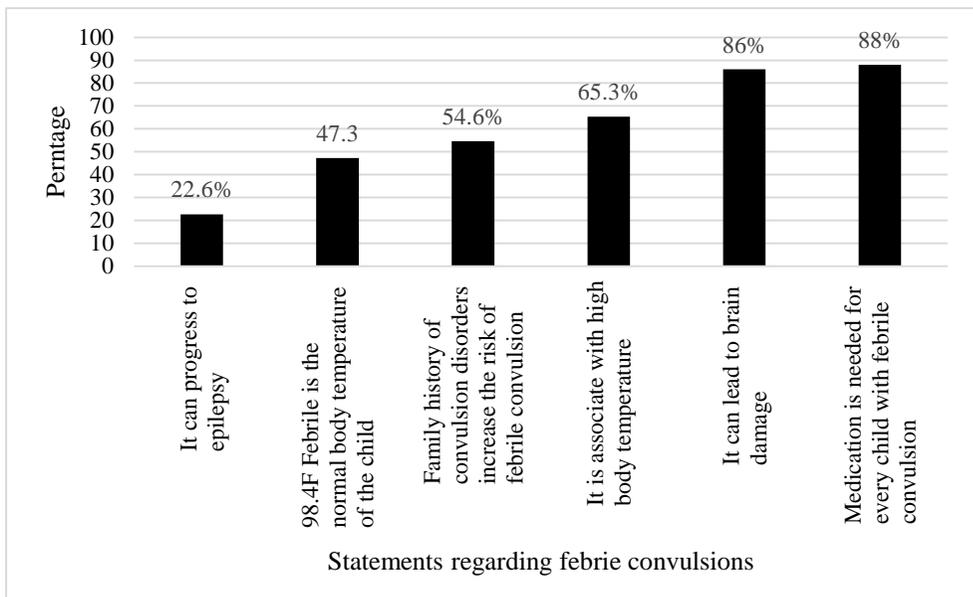


Figure 2: Mothers’ knowledge on febrile convulsion

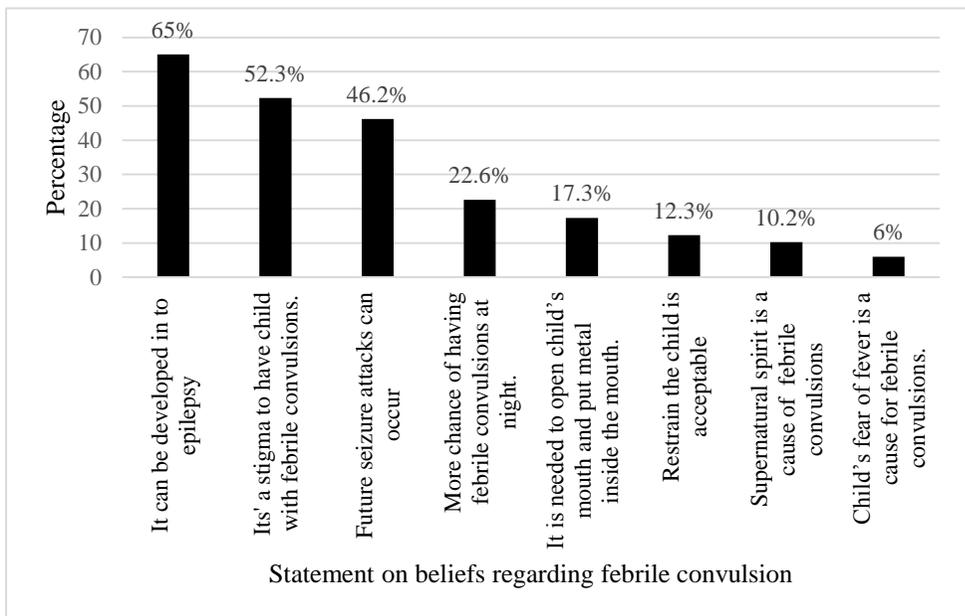


Figure 3: Mothers’ belief on febrile convulsion

3.2 Mothers’ beliefs regarding febrile convulsion

Regarding the beliefs of mothers on febrile convulsion, 65% of mothers

thought that it can be developed into epilepsy in the later age of their children and 62% of mothers believe that if one child have febrile convulsions, his or her siblings will also have a chance of getting febrile convulsions.



Furthermore, less number of mothers believed that supernatural spirit (10.2%) and child's fear (6%) are the causes for febrile convulsion (Figure 3). Same results were given by Deng *et al.* (1996) indicating that "ghosts" and "spirits" as the cause of the seizure. According to the Nyaledzigbor et al African countries greatly influence their health seeking behaviour for sick children, as they described febrile convulsion as a sickness in children which is caused by

enchantment, evil spirits and sore in the abdomen of the child and abnormal functioning of tbrain. Similar results were found in Nigeria by Anigilaje and Anigilaje (2013). More than half of the mothers believed that having a child with febrile convulsion is a stigma. Also previous studies have shown that incidence of febrile convulsion has much impact on families, parental behaviours and relationship with parents and children (Najimi *et al.*, 2013; Sajadi and Khosravi, 2017 and Wassmer and Hanlon, 1999).

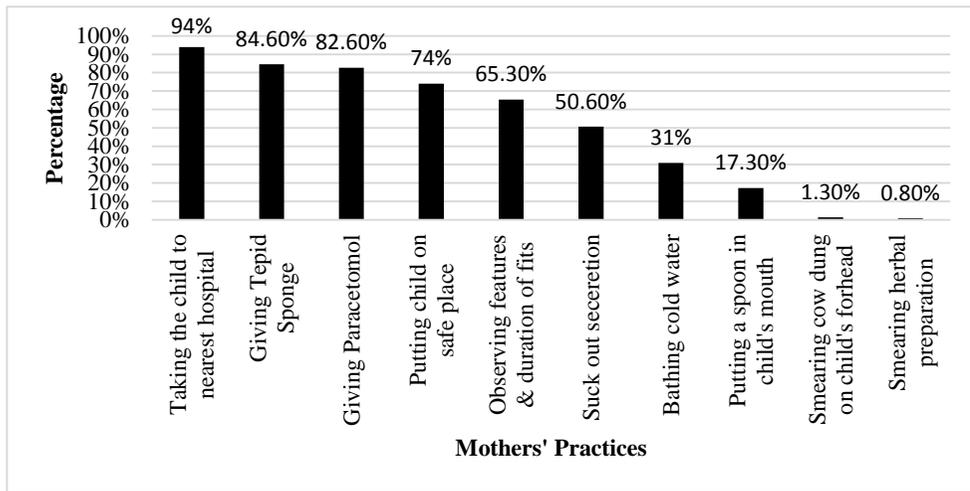


Figure 3: Mothers' practices to manage febrile convulsion at home

3.3 Mothers practices regarding febrile convulsion

When the mothers were asked about practices taken at home to manage febrile convulsions, more than 94% of mothers immediately took their child to the nearest hospital, about 74% of mothers kept their child on safe and smooth place and 50.6% of mothers sucked out secretions and kept the child in lateral position when the child is drooling. These findings were very similar to the studies done in Indonesia and Malayasia as they brought their children to hospital or emergency department (Gunawan, *et al.*, 2008; Deng *et al.*, 1996). The other forms of pre-

hospital interventions given were tepid sponge bathing (84.6%), giving paracetamol (82.6%) and bathing with cold water (31%). Nyaledzigbor *et al.* (2016) highlighted that herbal preparation was the most common form of pre-hospital treatment, given in 15 (10.2%) of the cases in Ghana which is totally contrasting with the findings of this study as smeared herbal preparation are used by only 8% of mothers in the case of febrile convulsion. The findings further revealed, few of others (1.3%) used smeared cow dung on the child's forehead when their children had febrile convulsion at home.



4 CONCLUSIONS

According to the findings of this study, it was concluded that mothers who have children under five years of age, have adequate knowledge regarding causes, signs and symptoms of febrile convulsion, but still some areas needed to be improved. Tepid sponge bathing, bathing with cold water and giving paracetamol found to be most common practices of mothers in the case of febrile convulsion. Furthermore, negative beliefs are still persist among mothers regarding febrile convulsion and those misconceptions can lead to take inappropriate or even harmful actions in an attempt to control the convulsions.

5 RECOMMENDATIONS

Mothers require further education on alarming signs and symptoms of febrile convulsion rather than absolute temperature rises. Also it is required a reliable evidence based information about the care of a child with febrile convulsion and it will increase the self-confidence and reduce anxiety of mothers. Spending more time for educating and training parents on home management of febrile convulsion and conducting public awareness programs are timely needed.

Acknowledgments

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Back Pain among Emergency and Orthopaedic Nurses: Prevalence and Perceived Risk Factors

Kavindra Masakorala^{1*}, Gayani Iddawala¹, K.H.P. Abeyratna¹, Priyanga Munidasa²

¹*The National Hospital of Sri Lanka, Colombo 10, Sri Lanka*

²*Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: kavindramasakorala@gmail.com

1 INTRODUCTION

Back Pain is a common health problem among variety of occupational groups as well as general population. Many epidemiological studies have been carried out to specify the role of individual and occupational factors as possible causes. Studies across the globe have published with proven evidences that their higher prevalence among nurses.

The operational definition for back pain used in this study is “pain or annoyance in upper or lower back sustained for more than three days”. Occurrence of back pain among nurses is multi-factorial phenomenon. It can cause by bio-mechanical, organizational, psycho-social, and individual factors (Anap *et al.*, 2013). While bio-mechanical demands increase the risk of back pain, psycho-social and individual factors can amplify the effects of physical exertion. Most of nursing activities require lifting heavy loads, physically demanding postures, transferring patients and operating hazardous equipment which exceeds body tolerance. These physical and psychological job demands put them at high risk for acute and cumulative back injuries.

Nursing is inherently a female dominant occupation. This gender base identity has been found as an important determinant for back pain in many studies (Lorusso, *et al.*, 2007; Nur-Azma, *et al.*, 2016).

Furthermore, shift duty, lack of ability to control on and off time of duty, working on off days, unplanned extended schedules, and mandatory overtimes makes nurses physically and psychologically stressful. According to many studies nurse’s work environment is highly stressful and filled with pre-disposing factors for developing a back pain. (Smeldley *et al.*, 1997). Female nurses with additional responsibilities at home as a working woman are more vulnerable to get a back pain.

The type and amount of workload is partly determined by the type of unit or specialty which nurses are working (Ex. ICU vs. Clinics). In clinical settings with heavy work load such as Emergency Treatment Units, Orthopaedic Wards, nurses compelled to working on longer hours with few to no breaks and often little time for recovery between shifts. Therefore, nurses working in Emergency departments and orthopaedic sections are more vulnerable to developing back pain.

The annual incidents rate back pain among nurses in developed as well as developing countries are in same level. Sri Lankan nurses had reported 44% of highest incidence rate for back pain among other musculoskeletal disorders (Warnakulasooriya *et al.*, 2013). Further he reported that job dissatisfaction and time pressure was significantly associated with low back pain of Sri Lankan nurses.



This pattern of prevalence globally and locally evidence the need of a study among Sri Lankan nurses working in emergency departments. Accident and orthopedic section in the National Hospital of Sri Lanka (NHSL) is one of the busiest places in Sri Lankan health care system. Nurses provide around the clock duty in this unit and handling critical patients in large numbers.

The purpose of this study is to determine the prevalence and perceived risk factors for back pain among nurses working in Accident and Orthopedic Section in National Hospital of Sri Lanka and to identify whether there are associations in between prevalence of back pain and perceived risk factors.

2 METHODOLOGY

This was a quantitative study in descriptive cross sectional design. Study population was registered nurses working in Accident and Orthopedic Section in NHSL. Two hundred registered nurses were recruited into the study using systematic random sampling technique. Attendance registries of this section were used to draw this sample of nurses by selecting every other name from pre-prepared name list. Age and sex was not concerned and the Ward/Unit managers and student nurses were excluded from the sample. A self-administered questionnaire consisting four sections based on objectives was used as the data collection tool. Content validity and face validity was established consulting supervisor of the study. Questionnaire was sent to the subject experts and their inputs and suggestion were incorporated into the final version. It was pre-tested among ten nurses other than who recruited to this study. Ethical approval granted by Ethics Review Committee of NHSL. A written informed consent was taken from every participant prior to the collection of data. The data was collected within two-week duration in April 2016.

Data analysis was done using Statistical Package for Social Sciences (SPSS) - Version 20. Pearson Chi-squared Test was applied to find associations between categorical variables. Level of significance was assessed by setting probability level at 0.05 ($p < 0.05$).

3 RESULTS AND DISCUSSION

3.1 Demographic Characteristics

The study sample consisted 87.5% female and 12.5% male nurses. Majority was Sinhalese, 99.5% while, 0.5% are Tamil. From them 72% of subjects was married while 28 % were unmarried. Highest proportion of them (75.5%) are nursing diplomate while 0.5 % having specialty training relevant to working place.

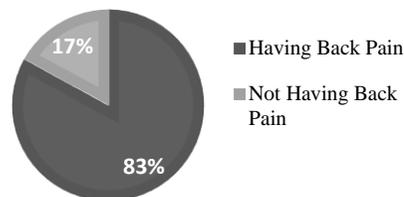


Figure 1: Prevalence of back pain among study participants

Results shows 83% prevalence of back pain among the population while 17 % reporting for not experiencing back pain (Figure 1). From the low back pain prevalence point of view, nurses are placed in 3rd place among employed people globally (Yip, 2004). Sri Lankan studies confirmed this high prevalence of back pain among nurses (Warnakulasuriya *et al.*, 2012; Munidasa, *et al.*, 2015). Working place is a significant factor for occurrence of back pain among Sri Lankan nurses; working in ICU, time presser to complete tasks and poor perception of general physical health are among other factors.



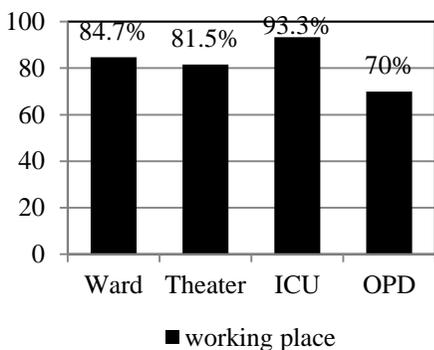


Figure 2: Prevalence of back pain in relevance to working place

3.2 Prevalence of Back Pain with relevance to Tenure of Service

Results showed increasing the tenure of service positively associated with occurrence of back pain among this population. It says 99% of subjects having more than 15-year service suffered with back pain. This result is consistent with the global trend of research findings of back pain (Wong *et al.*, 2010; Yassi and Lockhart, 2013).

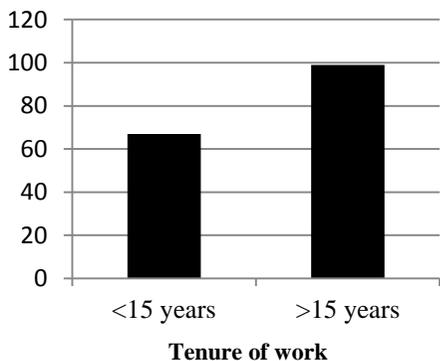


Figure 3: Prevalence of back pain relevant to tenure of work

3.3 Factors Associated with High Prevalence of Back-Pain

Besides individual risk factors which is commonly identified, common nursing works involving joint burden, extreme flexion of the trunk, frequent heavy

lifting, maintaining an awkward or static posture, bending, twisting, hard physical work and psychological stress are reported as causal factors for back injuries in several studies (Smeldly *et al.* 1997; Yip, 2004). Heavy physical activities like transferring and lifting patients play an important role in nurses' Low Back Pain (Yip, 2004). But most of the researchers believe that the physical factors justify only a portion of LBP. The relationship between the psycho-social activities and LBP has been mentioned as an important finding in many recent studies (Anap *et al.*, 2013; Nur-Azma *et al.*, 2016)

Table 1: Factors associated with high prevalence of back pain.

Description of the factor	Prevalence
Work place stress	80%
Working on Off days	73.50%
Lifting Patients >10times/6 hour shift	55.40%
Bending >10 times/6 hour shift	66.30%
Walking > 4 hours / 6 hour shift	16.30%
History of having Back Pain	96.60%

Table 2: Significantly Associated Perceived Risk Factors with Back Pain among Participants.

Perceived Risk Factors	P value
Marital status (Married)	0.04
History of previous back pain	0
Frequent Bending at patient handling	0.04

4 CONCLUSIONS

Back Pain is a common health issue among Emergency and Orthopaedic nurses working in National Hospital of Sri Lanka showing 83% prevalence among the study population. Perceived associated factors for occurrence of back pain which identified in the study were work place stress, working on off days, lifting patients, bending > 10 times per shift, walking > 4 hour per shift, marital status, and history of having back pain.

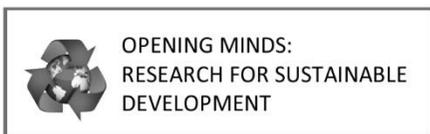
5 RECOMMENDATIONS

Recommend using safety techniques (lift team) and devices (back plate) for handling and transferring patients. Training and workshops for nurses to introduce lift-team concept will be beneficial to most at-risk department such as ICU, Theatres. Rotation and equally distribution of nurses within hospital departments considering requirement is an urgent need to prevent working on off days and reduce occupational stress.

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Physical, Social, and Psychological Impacts of Psoriasis

B.M.M. Rukshani¹, G.R.N.D. Samarakoon², W.S.N Maduka¹, K.A. Sriyani^{3*} and A.S.P.L. Senadheera³

¹*The National Hospital of Sri Lanka, Colombo 10, Sri Lanka*

²*Base Hospital, Kegalle, Sri Lanka*

³*Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

**Corresponding author: Email: kasri@ou.ac.lk*

1 INTRODUCTION

Psoriasis is an immune-mediated inflammatory disease of the skin (Balaji and Devaraj, 2016). It is a chronic disease and impacts to patient's lives physically, mentally and socially. Around 100 million of patients are affected from psoriasis worldwide (National Psoriasis Foundation, 2006). Various studies have revealed the impact of psoriasis on patient's lives. Emotional, social, family, sexual intimacy, physical functioning, professional, and educational life are mostly affected areas and psoriasis also had a moderate or above impact on overall quality of life (Vettuparambil and Asokan, 2015).

Psoriasis is found to be associated with stress related disorders, low self-esteem and depression. Depression can lead to social isolation, while it makes stigma and rejection from the society. Despite of that, high rate of suicidal thoughts are more common among individuals with psoriasis (National Psoriasis Foundation, 2006). Hence, psoriasis is a not simply a problem for the individuals affected from the disease, but it also a social issue. In comparison with other countries, limited literature is available on psoriasis in Asian countries including Sri Lanka. Thus, it is high time to explore how psoriasis can impact on patients' life in a Sri Lankan

context in order to improve the quality of care provided for these patients. Hence, the main purpose of this study was to explore physical, social and psychological impacts on patients having psoriasis in dermatology unit of the National Hospital of Sri Lanka (NHSL), Colombo.

2 METHODOLOGY

A qualitative phenomenological approach was used for this study to explore the experiences and feelings of the patients. A total of 20 adult patients with ages 18 years or above and who have been diagnosed for psoriasis and taking treatment minimum for six months were purposively recruited for the study. Those having a history of mental disorders and acute physical illnesses were excluded.

Ethical approval was obtained from the Ethics Review Committee of NHSL and prior permission to access the setting was taken from the relevant authorities. Written informed consent was obtained from each voluntary participant. Privacy and confidentiality were maintained throughout the study. Data was collected through face to face in-depth interviews that were lasts for 30-40 minutes period. Open ended questions which were assessed physical, social and



psychological impact of psoriasis were used to direct the interview. All interviews were tape recorded and transcribed to verbatim. Each transcript was read multiple times by the researchers to understand the meanings. Content analysis method was used for data analysis. Primary data was coded, and then the codes were clustered to derive themes.

3 RESULTS AND DISCUSSION

3.1 Physical impact on psoriasis patients

In identifying the physical impact, the findings of the study revealed that most of the participants (n=12) had pain, itching, burning sensation, flakes and deformity. The themes were derived as pain and discomfort; the alteration of body image; and the activity impairment. These are mostly evident by following views and ideas of the participants.

"Itching is affected me so much. Sometimes I itch my skin thoroughly and at that time I can see blood and discharges come out" (Patient A).

The alteration of body image of patients was clearly evident.

"I don't like to see my face and body by the mirror. The less colour patches and scaly skin make me nervous" (Patient B).

The activity impairment was evident with participant's statement of;

"I am a tailor, I am very hard to do my job with this disfigured fingers. But I have to continue it because my family is depending on it" (Patient C).

Similarly, Fortune (2005) has shown that patients can experience distressing itching, bleeding, noticeable flakes and attention drawing physical appearance on

their skin. In addition, it has shown that approximately, 5% of patients have joint involvement also. In accordance with findings of Ramsay (1988), the patients considered physical appearance of their skin as the worst aspect of having psoriasis. According to National Psoriasis Foundation (2006), almost 75% of patients believed that psoriasis had moderate to large negative impact on their quality of life with alteration in their daily activities. Current study findings have shown that altered body image was the most affected aspect for patient's lives, whereas pain was the most recent cause for the activity impairments among them. Findings of the present study further emphasized that physical discomfort and disappearance caused to develop negative social and psychological impact on patients.

3.2 Social impact on psoriasis patients

As revealed from the study findings, social impact were merged under four themes as the alteration of family, sexual and social relationships; negative financial impacts; rejection; and the alteration of life pattern. Most of the participants (n=11) had experienced that their relationships had been changed. Patients stated as;

"I live with my wife. Sometimes she is not bothering me. She doesn't care of me. I am fed up about my life" (Patient C).

This finding was supported by the findings of Krueger *et al.*, (2001) as psoriasis can have major effects on disrupting family, and social life; and relationships also.

With regard to negative financial impacts on their lives, one participant mentioned that;

"I had to pay lot of money for my treatments, when I was taking treatments from private sector. I couldn't bear it. Those medications are very expensive."



That's why I came to the government hospital" (Patient D).

In addition to, finally (1995) also has indicated that, psoriasis patients have a higher financial burden due to absenteeism in addition to the cost of caring for their disease. Other than that participants had daily experiences of neglecting them at public places and in social activities. One patient mentioned regarding rejection.

"When I sit on a seat the person in my next get up and go away. I experience it number of times in the day at the bus or train" (Patient B).

Contributing to feelings of shame and isolation, psoriasis patient experienced social discrimination and humiliation as refusal from society (National Psoriasis Foundation, 2006). A young woman said regarding the changing of life patterns as;

"I like to wear clothes with different styles and colours, but disease is a barrier for that. I have to even cover my head with scarf to hide my scalp" (Patient E).

Forty percent of patients surveyed by the American National Psoriasis Foundation (2006) and said that choosing comfortable clothing was the most difficult daily task that was influenced by psoriasis.

3.3 Psychological impact on psoriasis patients

When considering the psychological impacts on the patients, two themes were derived as the negative self-perception and emotional impairment. Statements of some of the patients (n=5) are shown below.

"I always try to hide my patches from the public. Because, when patches appear on my skin, I lose my self-esteem" (Patient E).

A patient with disease of the visible areas of the body (hands/ face) may have greater

psychological symptoms compared with a patient with disease of the same area on a less utilized area of the body (Choi and Koo, 2003). One participant mentioned regarding his experiences

"When my disease gets worse I feel it is better if I have to be alone" (Patient F).

Depression was most significant psychological impact and ultimately most of the patients tend to get suicide and it was evident with these statements of;

"I can't understand how my wife will get it when I am with peeling and scaling skin. At the time my disease was worst I thought to terminate my life. I couldn't tolerate that physical and psychological effect" (Patient G).

Present findings are comparable with previous studies and one study has shown that psoriasis is associated with a variety of psychological difficulties, including poor self-esteem, sexual dysfunction, anxiety, depression and suicidal ideation (Basavaraj, 2011). Hrehorow *et al.*, (2011) found visible lesions cause feelings of stigmatization which can lead to psychological stress and social withdrawal. In a study of 127 patients with psoriasis 9.7% reported a wish to be dead and 5.5% reported active suicidal ideations at the time of study (Gupta *et al.*, 1993).

4 CONCLUSIONS AND RECOMMENDATIONS

Present findings could reveal uncovered areas of impacts of psoriasis on patients' life in physical, social and psychological aspects in Sri Lankan context. Physically psoriasis patients were found to be suffered from moderate to severe pain, discomfort, altered appearance and activity impairment. Socially, psoriasis has impact on patients' sexual, family and social relationships and poor financial



status. Changing of appearance was lead to experience

Rejection and social isolation mostly due to people's misunderstanding about the disease. Psychologically every patient has developed negative self-perception. Emotional influence of psoriasis was great and depression and suicidal thoughts were highest among them.

It is highly recommended to improve public awareness about psoriasis by providing information with using mass media and it will help to reduce social impact for psoriasis patients. Organizing counselling sessions will be helped to reduce the rate of psychological morbidity and expand the general psychological support for patients who are severely depressed. Empowering social support services also recommended to improve patient's overall quality of life.

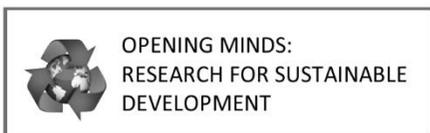
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Comparison of Oral and Depot Antipsychotic Medications in Perspective of Relapse Rates in Patients with Schizophrenia

K.H.D. Mahesh^{1*}, Rajeev Weerasundera², Patrick Ball³, Hana Morrissey³ and H. W. A. S. Subasinghe⁴

¹ Base Hospital, Tangalle, Sri Lanka

² Top End Mental Health Service, Darwin, Northern Territory, Australia

³ School of Pharmacy, University of Wolverhampton, United Kingdom

⁴ Faculty of Medicine, University of Ruhuna, Sri Lanka

*Corresponding author: Email: dhanuja76@gmail.com

1 INTRODUCTION

Schizophrenia is a chronic and disabling mental illness with a major impact on social and occupational functioning of a person. Approximately 1% of the global population is affected by the disease (Tiihonen *et al.*, 2011). Relapses and remissions of the illness are commonly observed. A relapse is described as the exacerbation or re-emergence of symptoms which may or may not result in hospitalization (Olivares *et al.*, 2013). The majority of patients reported experiencing multiple relapses during the course of their illness (Emsley *et al.*, 2013). Unfortunately, nearly 40% of all patients suffer their first relapse within the first year of diagnosis (Hogarty and Ulrich, 1998). Most patients (81.9%) would have experienced a relapse within five years of the initial episode (Robinson *et al.*, 1999).

Relapse prevention is the most important aspect of managing schizophrenia once the diagnosis is established. Improving medication adherence is a key factor in relapse prevention (Kane, 2007). Further, it is the best known predictor for decreasing the chance of relapse in schizophrenia (Ahmadkhaniha *et al.*, 2014) which is known to be 2–6 times

higher without medication (Robinson *et al.*, 1999).

In order to improve adherence to psychotropic medication, it is essential to choose an effective and safe antipsychotic agent and optimize treatment according to the response and tolerability of the individual (Lamberti, 2001). However, the choice of medication is usually complicated due to variety of available pharmaceuticals, specific considerations for unique differences in patient's individualized response to the same medication and side effects (Tavcar *et al.*, 2000). Once an antipsychotic medication is selected the challenge is the mode of delivery and effective dose for this individual patient. There are two main routes of administering antipsychotic medications namely oral (tablets) and intramuscular (depot/ long acting injectable preparations).

Though results of previous research suggest that depot antipsychotics are more effective in reducing relapses in schizophrenia (Rauch and Fleischhacker, 2013) some meta-analysis of Randomized Controlled Trials showed no significance between the two treatment formulations



in reducing relapse (Kishimoto *et al.*, 2013). The aim of this study is to assess the effectiveness of oral and depot antipsychotic medications in reducing relapse rates of patients with schizophrenia.

2 METHODOLOGY

2.1 Experimental design

This is a retrospective comparative study carried out at the two mental health clinics coming under the purview of Top End Mental Health Service, Darwin in the Northern Territory of Australia. All patients diagnosed with schizophrenia during the period of 2010.01.01-2014.12.31(5 years) and on a particular oral or depot medication continuously at least for 3 months while remaining under the care of the service for a minimum period of one year were included in this study. Patients who dropped the treatment in less than 12 months, whom the diagnosis was subsequently changed from schizophrenia to other psychotic disorders, patients who received combination therapy (i.e. both oral and depot medication simultaneously) and patients who changed the treatment modality from oral to depot of a particular medication or vice versa in less than 3 months were excluded.

Patients' past medical records in the electronic record system were reviewed and data were collected according to a data record sheet. In the instances where patients have been treated with more than one drug during the study period with no overlap of medication, each medication trial was considered as a separate 'case' in data analysis.

Ethical approval was obtained from the Ethics Review Committee of the Menzies School of Health Research, Darwin, Australia. All patient records in the sample were de-identified before enrolling into the study.

2.2 Calculation of MRM index

The mean relapse per month (MRM) index was calculated as below (Ahmadkhaniha *et al.*, 2014). The lowest numerical value that could be obtained for MRM is 0 and it is assigned when there is no relapse recorded. A lower MRM value implies low relapse rates and vice versa.

$$\text{MRM index} = \frac{\text{Number of relapses}}{\text{Follow up time (month)}}$$

2.2 Statistical analysis

Data were analyzed by using SPSS version 23. Descriptive statistics including frequencies, means and standard deviations (SD) were studied in variables. Associations of oral and depot antipsychotics with the relapse rate were evaluated by an independent t-test. $P < 0.05$ was considered as statistically significant.

3 RESULTS AND DISCUSSION

The study sample represented participants between 19 and 69 years of age. Among 193 patients 137 were males. Alcohol and substance consumption were respectively 56.48% and 27.46%.

Eight Second Generation antipsychotics (SGAs) and five First Generation Antipsychotics (FGAs) have been used to treat patients with schizophrenia. The SGAs used were Aripiprazole, Paliperidone, Risperidone, Olanzapine, Quetiapine, Ziprasidone, Amisulpride and Clozapine. Of these, Aripiprazole, Paliperidone and Risperidone had been used in both oral and depot preparations. The FGAs used were Chlorpromazine, Haloperidol, Fluphenazine, Flupenthixol and Zuclopenthixol. Haloperidol was used in both oral and depot preparations. Fluphenazine, Flupenthixol and Zuclopenthixol were used only as depot preparations.

The mean MRM of total oral medications was significantly higher ($p = 4.0577 \times 10^{-19}$) compared to total depot medications



(Table 1). It reveals that overall oral antipsychotics are less effective than

depot antipsychotics in controlling relapses in patients with schizophrenia.

Table 1: Descriptive statistics of oral and depot antipsychotic medications

Medication type	Frequency	Mean MRM	SD
Oral	188	0.1003	0.0495
Depot	237	0.0557	0.048
Oral FGA	10	0.0542	0.0519
Depot FGA	94	0.057	0.0506
Oral SGA	178	0.1029	0.0482
Depot SGA	143	0.0549	0.0464

There were a total of 321 cases reported for second generation antipsychotic therapy and among them, 178 were for oral medications while 143 were for depot preparations. The effectiveness of SGA oral and depot antipsychotic drugs was assessed by independent sample t-test. Results indicate that depot SGA medications significantly reduced ($p=1.8507E-17$) MRM compared to oral SGA medications in patients with schizophrenia (table 1). Though depot FGAs are used widely ($n=94$), the use of oral FGAs were very limited and only ten cases were reported. This is mainly due to side effects caused by oral FGA antipsychotics.

Further, the sample contained 114 patients who have been treated with both oral and depot medications at different times during the study period. The MRM of these patients were compared using the paired sample t-test. The mean MRM of depot antipsychotic medications (0.0441 ± 0.0366) was significantly lower than oral antipsychotic medications (0.1048 ± 0.0459 , $p=3.1777E-20$). This further reveals the effectiveness of depot antipsychotics over orals.

Patient adherence in taking prescribed medications is extremely important in obtaining a maximum therapeutic outcome. Side effects and lack of insight are the two main factors contributing to medication non-compliance in patients

with schizophrenia. Depot formulations are considered the most successful pharmacological intervention that addresses the non-adherence problems in schizophrenia. The reason is that depot preparations are administered by a health care professional (doctor or a nurse) and therefore, missing an appointment for their injection is easily noticeable.

In contrast, compliance with oral medication is erratic because they are usually taken at home and not well monitored. Furthermore, parenteral preparations are not influenced by first-pass metabolism, and efficient in maintaining optimum plasma levels.

4 CONCLUSIONS AND RECOMMENDATIONS

Depot antipsychotics are superior to oral antipsychotics in reducing relapses in patients with schizophrenia. Further, the second generation depot preparations are more effective than the second generation orals. The use of depot antipsychotic medications could be considered as a more reliable and effective tool to ensure patient compliance with treatment. This in turn could prove cost effective by preventing relapses and potential hospital admissions.



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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Factors Related to Attempted Suicide among Young Adults Admitted at the General Hospital, Matara

T.G.C. Tharanga¹, V.D.C. Premawardana¹, M.C.T. Wickramasinghe¹, V.A.S. Fernando² and B.S.S. De Silva^{1*}

¹Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Department of Medical Laboratory Sciences, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: bssil@ou.ac.lk

1 INTRODUCTION

An attempted suicide is referred to as an act in which the individual deliberately puts himself at the risk of death (De Leo *et al.*, 2006). Attempted suicide is an enormous public health problem in young adults within the age range from 15 to 34. It is the most common cause of hospital admissions among this age group and the most common cause of death. In Denmark, the suicide rate for the young adults has decreased during the last 20 years from 12 to 6 per 100,000 persons. But at the same time the annual rate of attempted suicides has increased from 200 to 300 per 100,000 persons (Christoffersen, 2009). The World Health Organization South-East Asia Region has revealed that 7% of young adults in Sri Lanka have attempted suicide one or more times in 2009.

The international literature yields a generally consistent account of the risk factors that lead to suicidal attempts in young adults. They are social and educational disadvantages, family adversity, psychopathology, personal vulnerabilities, exposure to stressful life circumstances, social, cultural and contextual factors (Beautrais, 2000). The western literature associated with suicidal

attempts includes young age, female gender, low educational attainment, unemployment, living alone, and history of socioeconomic deprivation (Schmidtke *et al.*, 1996). A study done in India proved that the young adults who were unmarried and had emotionally unstable and/or histrionic personality traits have high risk for suicidal attempts (Radhakrishnan and Andrade, 2012). Most of the descriptive studies in Sri Lanka have only concentrated on the methods of suicide and demographic features of the victims (Silva *et al.*, 2015). Large caseloads of self-harm patients have overburdened the country's limited medical resources as well as it negatively affects the quality of life (Marecek, 2006). Therefore, examining the factors related to attempted suicide in Sri Lanka is crucially important in order to take necessary preventive actions. Accordingly, the current study was planned to investigate the predominant psychological, socio economic factors of attempted suicide among young adults, in 15 -34 age group who were admitted to the General Hospital, Matara. Further, in this study the mode of suicidal attempts was also observed.



2 METHODOLOGY

A quantitative descriptive design was employed in this study. A purposive sample of 125 hospital attendees after suicidal attempts within the age 15 – 34 years were recruited. The data was collected from the participants using a self-administered questionnaire consisting structured questions related to demographic, psychological, socio-economical details and mode of suicide attempts. Details related to medical history, diagnosis were recorded from the bed head ticket of the participant by the investigators. Study was conducted at the General Hospital, Matara with admitted patients during the period of November 2015 to January 2016. Ethical approval was obtained from Ethics Review Committee in Faculty of Medicine at University of Ruhuna and permission was obtained from the director of General Hospital, Matara. Informed consent was obtained from each participant prior to the study. Descriptive analysis was performed using Statistical Package for the Social Sciences (SPSS) 24.

3 RESULTS AND DISCUSSION

The response rate of the study was 84.8%. Among them 60.4% were males. A large number of participants were from the Sinhala ethnic community (83%); Tamil 9.4%; and Muslim participants were considerably low in number (7.6%). The unmarried participants (62.26%) were higher than married participants (22.64%). The separated (11.32%) and living together (3.77%) participants were considerably low. The data has been presented under the mode of suicide attempts, socio-economical and psychological factors.

3.1 Mode of suicidal attempt

The frequent mode of attempting suicides was drug overdose (50%). Paracetamol

over dose was the commonest method among schooling group. Patients with psychological diseases have taken high doses of their own drugs. Poison was the second common mode of attempting suicide among participants (36.9%), followed by hanging (7.5%), and cut injuries (5.6 %). Weedicide, insecticide and some plants found in Sri Lanka such as 'kaneru', 'niyagala' were included among the poisons. Ingestion of toxins (40%) and hanging (25%) were the most common methods in India between 2008 and 2012 (Kumar *et al.*, 2013).

3.2 Socio- economical factors

Males show higher suicidal attempted rate (60.4%) in Sri Lanka. A study done in India also showed the similar findings with a male predominance; male--female ratio ranging from 1.13:1 to 1.63:1 (Radhakrishnan and Andrade, 2012). Unemployment has accounted for 47.16% of cases. The percentage of self-employees was 25.47%. The association between unemployment and suicidal attempt was also more significant for young adults in India (Radhakrishnan and Andrade, 2012). Similarly, non-income group constituted the majority-- about 42.45 % -- of the total suicidal attempters. A similar study done in India proved that lower socio-economic groups such as agriculturists, housewives and unskilled workers represented 75% of the total subjects of suicidal attempters (Gouda and Rao, 2008). Interestingly, the lowest attempted suicidal rate was found among those who earn less than Rs.10, 000 as given in in the study (Table 1).

Considering the education level, suicidal attempts were more prominent in those who were educated only up to Ordinary Level (O/L--44.33%. Among those who possessed tertiary education qualifications it was significantly low (5.65%). The similar findings were discovered in Denmark (Christiansen *et al.*, 2015).



Table 1. Socio economical factors of the study

Socio economical factors		Percentage (%)
Civil status	Unmarried	62.26% (66)
	Married	22.64% (24)
	Living together	3.77% (04)
	Separated	11.32% (12)
Education level	Grade 1-5	9.43% (10)
	Still schooling	26.41% (28)
	Up to Ordinary Level	44.33% (47)
	Up to Advanced Level	14.15% (15)
	Diploma	4.71% (05)
	Degree	0.94% (01)
Type of employment	Government	11.32% (12)
	Private sector	16.03% (17)
	Self-employee	25.47% (27)
	Unemployed	47.16% (50)
Income level	Non income	42.45% (45)
	Below Rs.10000	8.49% (09)
	Rs.10000- Rs.15000	15.09% (16)
	Rs.15000- Rs.20000	17.92% (19)
	Over Rs.20000	16.03% (17)

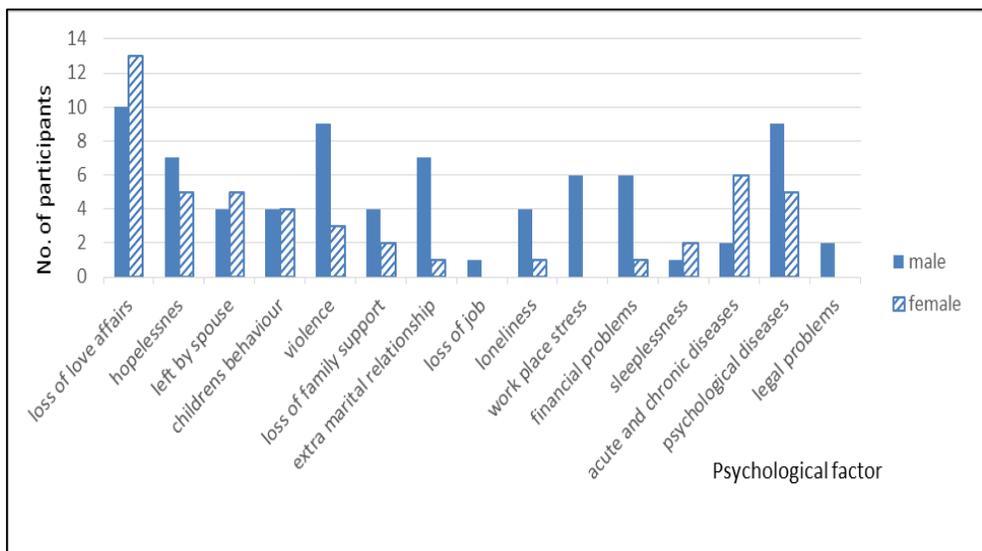


Figure 1: Distribution of psychological factors for attempted suicide among the participants

4 CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the findings of the study reflect variations in suicide attempts with socio economic and psychological factors. Among the suicide attempters, low education, unemployment and non-income are more prominent socio economical factors which persuade suicidal attempts. The majority of suicidal attempters have only completed their secondary education. They may not be still mature enough to control the suicidal ideation which arises in their mind. The poor income and unemployment are other stressful factors which are directly related to suicidal attempts. The unmarried group showed higher propensity for suicide while those married, living together and have separated less. Some psychological factors associated with suicidal attempts are loss of love affairs, left by spouse, violence, hopelessness, suffering from acute and chronic diseases and psychological diseases. Loss of love affairs has accounted for majority of the reported cases. Drug overdose, poison, hanging, cut injuries are the common methods of suicidal attempts. The frequent mode of attempting suicides was drug overdose. Findings of the present research will be helpful for health care workers as well as the community to increase attention and concern regarding suicide attempters to reduce the rate of suicidal attempts in Sri Lanka.

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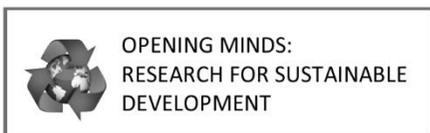
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Risk Factors for Acute Lower Respiratory Tract Infections in Children: Mothers' Perspective

J.M. Palihakkara¹, E.V.P. Kumari¹, A.D. Dilshani¹, E.A.G. Thushari¹,
H.M.S.P. Herath² and B.S.S. De Silva^{1*}

¹*Department of Nursing, Faculty of Health Sciences, The Open University of Sri Lanka, Nugegoda, Sri Lanka.*

²*Department of Medical Laboratory Sciences, Faculty of Health Sciences, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

*Corresponding author: Email: bssil@ou.ac.lk

1 INTRODUCTION

Acute Lower Respiratory Tract Infections (ALRTIs) are leading causes for morbidity and mortality among children worldwide (Martins *et al.*, 2016). According to the literature, in low and middle-income countries, 6.9 million children have died in 2011 and about one fifth of these deaths were caused by ALRTIs (UNICEF, 2012). Furthermore, ALRTIs are the main cause of utilization of health services by children under five years in developing countries.

Therefore, identify the risk factors related to ALRTIs play a major role in the reduction of morbidity and mortality associated with the disease. Several studies done in many countries in the world have found that socio economic factors (low family income, high number of persons in household), low birth weight, poor parental education, malnutrition, seasonality, crowding, air pollution, household pollution, and smoking were major risk factors for acquiring ALRTIs among children play a critical role in this condition. (Prietsch *et al.*, 2008; Savitha *et al.*, 2007). A study conducted by Martins *et al.* (2016) have found that maternal characteristics (such as gestational and childbirth conditions),

use of preventive health services like vaccination and nutritional variables (birth weight, breastfeeding, and maternal nutritional status) have triggered the acquiring ALRTIs to children.

In Sri Lanka, ALRTIs are the leading causes of childhood mortality and morbidity (World Health Organization, 2008). Further, these are responsible for 37% neonatal deaths and 17% post-neonatal deaths in the country (World Health Organization, 2008). However, in Sri Lanka studies carried out to identify the risk factors associated with ALRTIs were limited. Accordingly, the purpose of this study is to identify the risk factors related to ALRTIs among children under 5 years as inscribed in the perspectives of the mothers in the Matara District. The mother is the major close caregiver and the primary diagnostic person of children. The specific objectives of the study were to assess the factors leading to ALRTIs in relation to the socio-demographical, practices, economic and environmental aspects.

2 METHODOLOGY

A quantitative, descriptive design was utilized in this study. The study was conducted in the Paediatric unit at the Teaching Hospital, Matara, during the



period January to March 2017. Mothers of children under five years of age with ALRTIs admitted to Paediatric unit at the Teaching Hospital in Matara were recruited for this study. Children with critical illnesses were excluded from the study. Data were collected from purposively selected sample of 213 mothers whose children suffered from ALRTIs. Written informed consent was obtained from every participant. Pre-tested, self-administrated questionnaire was used to collect data. It contained the demographic factors, practices, environmental factors and economic factors related to ALRTIs in children. Content validity and reliability were assured. Privacy and confidentiality of participants were secured throughout the study.

Ethical approval was granted by the ethical review committee, Faculty of Medicine, University of Ruhuna, Sri Lanka. Data analysis was done with descriptive statistics using Microsoft Excel software.

3 RESULTS AND DISCUSSION

Two hundred and two mothers who have children with ALRTIs were studied. The response rate was 94.8%. Collected data were presented under four main categories: demographic factors, practices, environmental factors and socio-economic factors.

Table 1: Socio demographic factors related to Lower Respiratory Tract Infections

Socio demographic factors		Frequency (n=202)	Percentage (%)
Gender	Male	120	59.4
	Female	82	40.6
Age	1 months - 1 years	28	13.9
	1 - 3 years	98	48.5
	3 - 5 years	76	37.6
Attend pre-school/not	Pre schooling	121	59.9
	No pre schooling	81	40.1
Age of mother	Below 18 years	40	19.8
	18 - 25 years	30	14.9
	26 - 40 years	113	55.9
	Over 41 years	19	9.4
Education level of mother	No formal education	2	1.0
	Up to grade 5	9	4.5
	Up to grade 8	25	12.4
	Up to G.C.E O/L	91	45.1
	Up to G.C.E A/L	37	18.3
	Higher education	38	18.8



3.1 Demographic factors

The mean age of all participants was 2.7 ± 1.6 years. The majority (n=98, 48.5%) of children were being between one to three years age group, showing that they may be at highest risk to ALRTIs. This was evidenced by the contemporary study carried out by Chen *et al.*, (2014). They highlighted that children were more susceptible for infections than adults due to immature immunity.

When considering the gender of the children, 59.4% (n=120) were male. Further, 59.9% children with ALRTIs attended pre-school. In view of the mothers' aspects, the majority of mothers were between 26-40 years and about half of them (n=91, 45.1%) were educated only up to General Certificate of Education (Ordinary Level) (Figure 1).

3.2 Practices of mothers regarding children with ALRTIs

In view of the practices of mothers in relation to ALRTIs, more than 75% of the mothers have discontinued medicines for their children after the reduction of the symptoms of ALRTIs. Sommer (2011) also revealed that high mobility and mortality associated with ALRTIs among children in Indonesia were mainly due to discontinuation of medical management. Therefore, the findings of the present study emphasized that discontinuation of medicine may be one of the risk factor for ALRTIs. Furthermore, 21% of mothers had given Paracetamol to their children without medical advice; only 3% of mothers had increased daily fluid intake of the child while majority of them had given steam inhalations and boiled filtered hot water to their children during the period of ALRTIs.

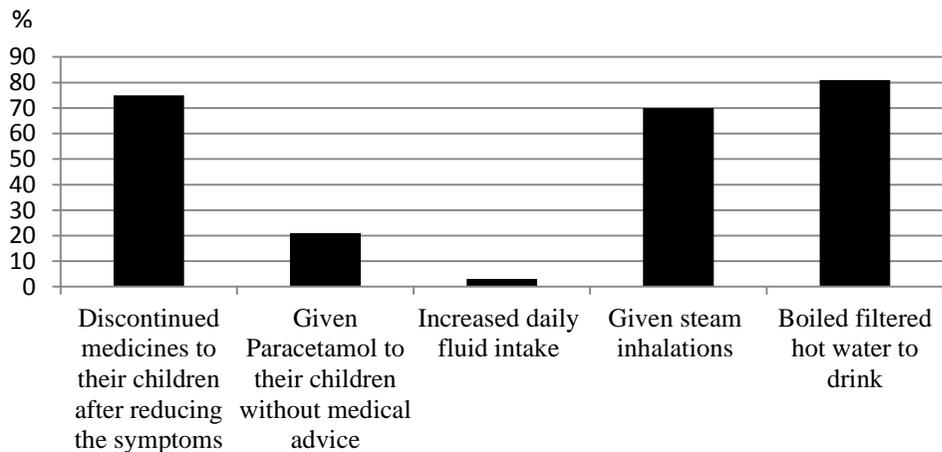


Figure 1: Practices of mothers regarding children with ALRTIs

3.3 Economic factors

In identifying financial barriers, 56.5% of mothers were unemployed while the majority of them had monthly family income less than 15,000 Sri Lankan rupees. In fact a similar study carried out in Brazil has found that poor financial status was a significant risk factor for acquiring ALRTIs among children

(Prietsch *et al.*, 2008). Because, it leads to poor living facilities, poor nutrition and poor mental health which cause reduction of immunity in children (Prietsch *et al.*, 2008). Therefore, present study highlights that children from low income families are more susceptible for ALRTIs.

3.4 Environmental factors

According to the study findings, more than half the children lived in houses where there were only 2 bed rooms with poor ventilation and sanitation. Comparable results have been obtained by a contemporary study done by Prietsch *et al.* (2008). They revealed that poor sanitation and housing conditions acted as risk factors for ALRTIs. Therefore, the present study further emphasizes that poor living conditions and lack of proper ventilation may be a risk factor for ALRTIs among children. Besides, living in houses with Asbestose roof was another risk factor for ALRTI cases. More than half of the mothers revealed that their children had close relationship with pets: 53.4% with cats, 40.8% dogs (Figure 1). A similar study done in Sri Lanka has (Dharmage *et al.*, 1996) pointed out that having a close relationship with pets such as cats and

dogs was a significant risk factor for acquisition of ALRTIs. Hence, present study further suggested that close relationship with pets as also a key factor for ALRTIs among children. Moreover, the respondents of the present study further reasoned out that use of wooden fire for cooking and passive smoking as risk factors which increase the chance of ALRTIs acquisition. Comparable results have been obtained by the contemporary studies carried out by Smith (2000) and Kar *et al.*, (2013). They showed that use of wood stoves had 80% increased occurrence of respiratory illness such as chronic cough, bronchitis, chest illness, wheeze or asthma.

The majority of mothers perceived that they believed polluted air as a significant risk factor for ALRTIs cases. For instance, polluted air causes the asthma condition and it leads to ALRTIs.

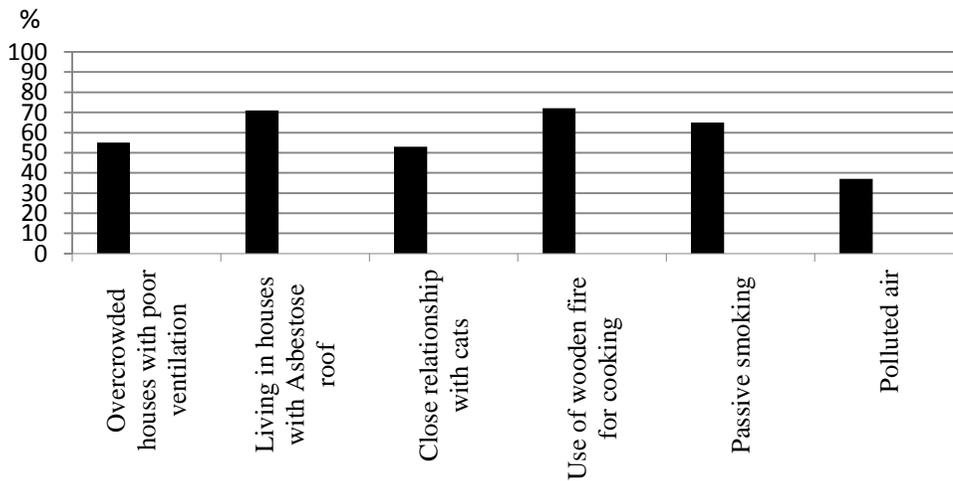


Figure 2: Environmental factors related to LRTIs



4 CONCLUSIONS

According to the present study findings, socio-demographic factors, such as age between 1 to 3 years, male gender, and lower level of education among mothers were common risk factors for ALRTIs among children. The study further pointed out that discontinuation of medicine as one of the major factor which increases the susceptibility of children to ALRTIs. Moreover, environmental factors such as domestic gasses, passive smoking, close relationship with pets, polluted environment e also increased the risk of ALRTIs acquisition. Furthermore, poor socio economic conditions were the main factor which influenced the acquisition of ALRTIs among children in the Matara District. Health intervention programs, widespread immunization against causative agents (virus/bacteria), and proper home care management of children should be recommended to control and prevention of ALRTIs.

Acknowledgments

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Effects of Parental Migration on Educational Developments and Mental Wellbeing of Left-Behind School Children in the Kurunegala District: A Case Study in the Mawathagama Educational Zone

U.M. Dissanayake* and M.B. Sakalasooriya

The Open University of Sri Lanka. Nugegoda, Sri Lanka.

**Corresponding author: Email: mail2madusha@gmail.com*

1 INTRODUCTION

Foreign employment, mainly the unskilled labour market, is the main source of income in South Asian countries and in Sri Lanka it is the largest income earning source in the last decade (Central Bank of Sri Lanka, Various years). Middle East constituents remain the largest source of remittance to Sri Lanka, with 60 percent remittance (Kelegama, 2011). Approximately, 1.8 million people, which is equal to 24 percent of countries' labour force, are presently employed abroad (SLFEB, 2015). Female migrants represent nearly 52 percent of the total migrant workers (Senaratna, 2011), and 89 percent of female migrants work as housemaids (IPS, 2013).

Reports of the Sri Lanka Foreign Employment Bureau (2013-2015) reveal that 80 percent of the migrant women are married and 90 percent of them have children. The need to migrate is usually a function of the complex interaction of economic, social, familial and political factors. Its economic implications, especially on rural communities who are less advantageous are clearly identified (World Bank, 2006). There is a trend among the young mothers with small children to go abroad to overcome their

family economic problems (Ghosh, 2006). The magnitude of maternal migration appears to be increasing, and labour migration has become of age and sex selective (Perera and Rathnayake, 2013). The migration profiles developed by the Institute of Policy Studies suggested that around 30 percent of the woman migrants are not with their children for the period when they are 2-6 years which is considered as the critical developing period of the child's propounding personality, physical and educational developments (IPS, 2013). A limited numbers of surveys were conducted related to the impact on children left behind by migrant mothers because of methodological challenges. Most of them are quantitative investigations based on household surveys (UNICEF, 2011). Perera and Rathnayake (2013) reveal that children of migrant mothers show several deviations from their peers in schools especially when it comes to emotional outbursts. According to the BMC Psychiatry Report (2015), two in every five left-behind children were likely to have mental disorders (95%) and there is a significant connection between such disorders and the parents' absence.



However, Sanderathne (2011) indicated that Sri Lankan economy as a 'remittance-dependent economy' where its huge trade deficit of US 5.2 million was almost entirely offset by these remittances. Not only at the national level, household level income and easing liquidity capital constrain the investments significant for rural economies in Sri Lanka. As a nation, Sri Lanka faces these two dilemmas where remittance is a key economic dependency and the consequent social challenges the nation undergo as a result of sending childbearing mothers for overseas employments. The relative magnitude of the effect is confusing in literature especially in a situation where the remittances of household income is significant while the relationship between remittances and child educational and psychological effects are affected by such remittances. This is very important policy area for researchers.

The Kurunegala District in the North Western Province of Sri Lanka once recognized as the nation's agrarian stronghold as the largest paddy producing district. But presently, Kurunegala shows the highest female departures (Bulletin of International Migration Statistics of Sri Lanka 2010-2016) with average 13, 000 migrant workers annually leaving their families for economic gains. It is further revealed that 85 percent of the woman left children with either the farther or a grandparent; approximately over fifty thousand children in the district live without their mothers during their period of childhood. National Survey on Emerging Issues among Adolescents in Sri Lanka conducted by UNICEF Sri Lanka (2004) shows that, the deviant behavior of the adolescent school children, such as smoking, alcoholism, is the highest in Kurunegala. Mawathagama is the key electoral of the Kurunegala district and has the second highest number

of school children with deviant behavior. Further, educational data reveals that Kurunegala district records the third highest number of student population in Sri Lanka, with 336,609 in the year 2016, while Colombo and Gampaha districts record 379,840 and 361,008 numbers respectively. The Kurunegala district remains as the single district which has the highest number of schools with 890, while the Colombo district records 405 which is almost half in number. Therefore, it illustrates the need to conduct comprehensiveness research in the Kurunegala district.

This paper is based on a case study of left-behind children in families of parents, who have migrated for remittance earning purposes, in selected schools in the Mawathagama educational zone in the Kurunegala district. The purpose of this study is to analyze the comparative association between parental migration and educational status and mental wellbeing of mid-teenage school children by studying both children of migrants and non-migrant families. It heightened the risk of psychological effects for early childhood developments which is seemingly offset by the economic benefits of the labour migration at the rural level.

The problem of this study is the analysis of whether significant disparities exist in the educational performances and emotional characteristics among the children in migratory and non-migratory families where maternal migration, gender and age of the children would be considered as the key factors of the cognitive developments of children.

2 METHODOLOGY

A stratified random sample was used to survey 200 children as a cohort to represent two government schools for the



study which involved one national school and one rural school, with both having over 2000 students and consisting of the Advanced Level classes. Self-designed structured interviews were conducted with each individual child and cohort divided in four age groups; two gender classes and four types of parental migrant status i.e. both parent migrated, maternal migration, paternal migration and non-migrant family situations are included in the survey. Likert scales were used to obtain psychological characteristics while class teachers were consulted to obtain educational achievements of each child.

Associations were studied on descriptive analysis followed by chi-square tests in quantitative procedure. Analysis was done using Statistical Package for Social Sciences (SPSS) version 18. Simple descriptive statistics were calculated to understand the prevalence and profile of each factor inducing the vulnerability of the children in the study. Same methodology was used previously to link children's education (MaKenzie and Rapoport, 2006; Kandel and Kao, 2001) and psychological behaviors (Parreñas, 2005; Yang, Li Ping, Jean and Congdon, 2010) and this mixed approach was used by (Kwaku, 2015) in Ghana and (Perera and Rathnayake, 2013) in Sri Lanka.

3 RESULTS AND DISCUSSION

The research profile is shown in Table 1. As per the data obtained in the survey, both the mother and father migrated abroad in 9.5 percent of students, while among 44.5 percent students, the mother migrated; among 6.5 percent of them, the father migrated and 39.5 percent children were selected from families of non-migrated parents. Father is the main caregiver for the children who live without their mothers and when considering the

family situation, 68.5 percentage of the children in the study lived without one or both the parents.

Results show that maternal migration negatively impact on the educational achievements as per the Figure 1. Where educational performances of children who live with their mothers have shown 43 percent higher than migrant family children and average marks are less than 25 for the for the all subjects, the study further shows that the educational targets of early age teenagers are significantly low in migrant families (Table 2) . However, paternal migration does not clearly affect educational achievements, while general educational performances of children in families who's both parents have migrated is significantly poor. The educational aspirations of the migrant family children are significantly lower than non-migrants.

Results show that children without their mothers have shown less educational outcomes than the children who live with their mothers (Figure 1). Whereas the educational performances of children who live with their mothers have shown 43 percent higher than children who do not, and the average marks are less than 25 for all subjects. The study further shows that the educational targets of early age teenagers are significantly low in migrant families (Table 2).

However, paternal migration does not clearly explained the educational achievements, while general educational performances of children in the absent parent families are significantly poor. The educational aspirations of the migrant family children are significantly lower than non-migrant family children and motivation for higher education is less in migrant families.



Table 1: Profile of students' survey

	Both Parents Migrated		Mother migrated		Farther migrated		Non-migration		Total
	Number	%	number	%	number	%	number	%	
Gender									
Male	10	5.0	46	23	6	3	35	17.5	97
Female	9	4.5	43	21.5	7	3.5	44	22	103
Age of Students									
12 Years	3	1.5	20	10	4	2	4	2	31
13 Years	4	2.0	17	8.5	17	8.5	18	9	56
14 years	4	2.0	17	8.5	3	1.5	6	3	30
15 years	4	2.0	18	9	19	9.5	15	7.5	56
16 Years	4	2.0	17	8.5	0	0	11	5.5	32
Family situation									
Live without parent	19	9.5	19	9.5	0	0	5	2.5	43
Live with one parent	0	0.0	70	35	13	6.5	11	5.5	94
Live with both parents	0	0.0	0	0	0	0	63	31.5	63
Primary care giver									
Both mother and Farther	0	0.0	0	0	0	0	61	30.5	61
Mother	0	0.0	0	0	10	5	8	4	18
Farther	0	0.0	54	27	0	0	4	2	58
Grandmother/ G. Farther	8	4.0	24	12	2	1	3	1.5	37
Any other	11	5.5	11	5.5	1	0.5	3	1.5	26

Table 2: Educational target of children

Migratory pattern	Average number of days absent from school					Educational aspirations		
	Not absentees	Absent 1-3 days	Absent 4-6 days	Absent for more than 7 days	I have no idea	My aim is to pass O/L	My aim is to pass AL	I wish to go to University
Both parents' migrated	2	5	6	6	5	5	7	2
Mother migrated	11	35	18	25	25	32	15	17
Farther migrated	2	10	0	1	1	2	6	4
Non-migrant parent	13	55	4	7	1	13	40	25
Pearson Chi-Square	35.29a				46.63a			
Df	9				9			
P value	.000				.000			



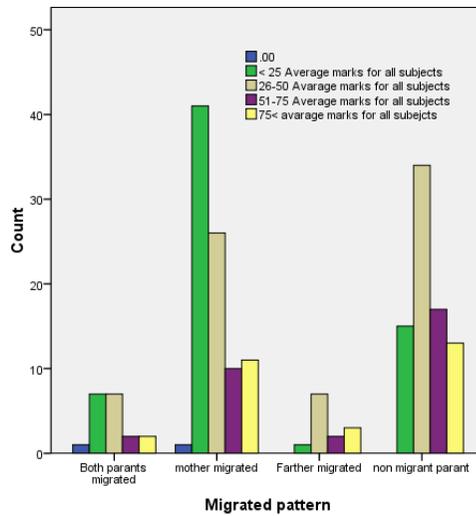


Figure 1: Comparative illustration on the educational performance of children with parents who have migrated

Table 3. Cross tabulation of parental migration situation with sensitivity analysis of children

	Feeling sad while studying		Difficulty in Concentration		Angry with friends		Quarreling with friends	
	Yes	No	Yes	No	Yes	No	Yes	No
Migrate situation								
Both	18	1	15	4	13	6	9	10
Mother	71	18	82	7	46	44	59	30
Farther	11	2	13	0	1	12	5	8
None- migrants	30	46	36	43	19	60	18	61
Total responses	130	67	146	54	79	122	91	109
Significance test								
Chi- Square	37.4		51.8		24.6		32.241	
Df	3		3		3		3	
Significant value	.000		.000		.000		.000	

As shown in Table 3, vulnerability to negative cognitive factors associated with migratory patterns, such as sadness, difficulty in concentration, anxiety and deviant behaviors reveal that there is an association between these groups. Of the eighteen children out of nineteen surveyed whose both parents have migrated revealed that they have some kind of sadness; while 92 percent whose mothers have migrated for labor indicated that they suffered from bouts of sadness. Approximately 50 percent of the children

show anxiety in maternal migratory situation, while 25 percent in non-migratory parental situation. This mental health parameters are further justified by the analysis given in Table 4. It shows the problem solving behavior of different children and four groups. It reveals that the majority of children do not relying on their farther for their problem solving whether the mother has migrated or not. However, in general, the role of the parents on family matters is much higher in non-migratory situation.



Table 4: Tabulation of problem solving and relationship matrix

		Problem solving and relationships				Total
		I have a problem and need to discuss my personal matters with my mother	I have a problem/shy to discuss matters with my farther	I usually discuss my matters with someone else, not with parents	I usually discuss personal matters with my parents	
Migratory pattern	Both parents migrated	5	9	4	1	19
	mother migrated	17	28	39	5	89
	Farther migrated	1	9	0	3	13
	non migrant parent	12	24	8	35	79

Pearson Chi-Square -61.557a Df = 9 Significance .000

Table 5: Deviant behavior of Children with age categories

			Age of student					Total
			12	13	14	15	16	
Smoking and alcoholism								
I have smoked/ consumed alcohol more than once	Migratory pattern	Both parents' migrated	0	0	1	0	0	1
		mother migrated	4	1	2	1	5	13
		non migrant parent	2	0	1	2	0	5
	Total		6	1	4	3	5	19
I have smoked/ consumed alcohol only once	Migratory pattern	Both parents' migrated	3	0	1	1	1	6
		mother migrated	4	1	2	4	5	16
		farther migrated	0	0	0	2	0	2
		non migrant parent	0	3	2	2	0	7
Total			7	4	5	9	6	31
I do not consume alcohol or cigarettes	Migratory pattern	both parents migrated	0	4	2	3	3	12
		mother migrated	12	15	13	13	7	60
		farther migrated	0	4	3	4	0	11
		non migrant parent	16	13	16	11	11	67
	Total		28	36	34	31	21	150



I have smoked/ consumed alcohol more than once	Pearson Chi-Square	8.915 ^a	8	.003
I have smoked/ consumed alcohol only once	Pearson Chi-Square	18.456 ^b	12	.003
I do not consume alcohol or cigarettes	Pearson Chi-Square	12.566 ^c	12	.001

This study further revealed that children in the age group 15-16 show deviant behaviors such as use of alcohol, physical violence, including student-on-student fighting, are significant among the left-behind group (Table 5), further signaling that maternal migration could be linked to such cases even when the farther is their caretaker. However, there is no evidence to show the association of caretakers with both educational and cognitive functions of children.

The study also illustrated that the economic benefits linked to earning by woman migratory workers cannot be set off by the high social cost (Gamage, 2009); income problems (Karunaratne, 2008), life quality problems (Lasagabaster, Samuel and Hulugalle, 2005) and related health constrains (Senaratne, 2012) while gaps on educational achievements and psychological outcomes are very critical in child development.

4 CONCLUSION

This is a preliminary study to show the basic educational discrepancies of children of migratory and non-migratory families which further give emphasis to some psychological aspects such as anxiety and sensitivity of the teens. The study was conducted with 200 students who were in a tailored socio-economic situation due to relatively higher rate of female or maternal migration compared to other districts in Sri Lanka. However, the study shows that relatively higher level of negative cognitive aspects such as sadness, anxiety and tendency to quarrel with the friends among the maternal migrant children possibly resulted from negative wellbeing of the mental health of these adolescent children. The study further shows that the increasing possibility of children resorting to deviant behaviors are relatively at high risk level, where there is no

evidence to show the economic gains from the labour migration given the expected social benefit to the community in the Mawathagama region.

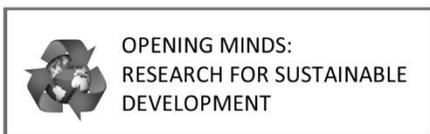
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Factors Related to Poor Attendance for Pap Smear Screening In Vavuniya

V.Janarththany¹, R. Kalavani¹, T.Vijayakumar¹, S.N. Merin Devini¹, H.M.S.P. Herath² and B.S.S. De Silva^{1*}

¹Department of Nursing, Faculty of Health Sciences, The Open University of Sri Lanka, Nugegoda, Sri Lanka.

²Department of Medical Laboratory Sciences, Faculty of Health Sciences, The Open University of Sri Lanka.

*Corresponding author: Email: wadmweragoda@gmail.com

1 INTRODUCTION

Cervical cancer is defined as uncontrolled growth of cells on the cervix (World Health Organization, 2002). It is the second most common cancer in women worldwide which causes 270,000 deaths annually (World Health Organization, 2002). Cervical cancer screening contributes to early diagnosis and thereby -minimize mortality and morbidity associated with the disease (Abdullah, Aziz and Su, 2011). Papanicolaou smear (Pap smear) is a screening method used for cervical cancer which can detect abnormal cells from the cervical epithelium (Matos and Eynde, 2004).

World Health Organization (WHO) recommended that cervical cancer screening programs need to cover over 80% of the risk population to successfully reduce the incidence of cervical cancer (WHO, 2002). The incidence and mortality rate of cervical cancer have decreased in developed countries during the last 50 years because of increased availability and attendance of cervical cancer screening programs (Nanda *et al.*, 2001). However, in developing countries the problem has become a burden due to under diagnosis, thus increasing the mortality rate (Forouzanfar *et al.*, 2011). The study further pointed out the reason as

the poor attendance of women for cervical cancer screening in these countries. Many factors have been identified as barriers to attending cervical cancer screening. These are; poor knowledge of cervical cancer prevention, limited access to health care, low socio economic status, ethnicity, fatalism, time constraints, religious factors wrong thoughts, beliefs and behaviours. (Al-Naggar and Al-Naggar, 2012; Abdullah, Aziz and Su, 2011). Moreover, cultural factors have been identified as a significant factor related to attendance of Pap smear screening (Gan and Dahlui, 2013). A study carried out in the United States evidenced that differences in cultural background between Asian and Caucasian women have a significant impact on the difference in attendance of Pap smear screening (Miklancie, 2007). Further, the author points out that Caucasian women were less modest regarding their bodies and sexuality, therefore more likely to have had a Pap smear screening than the Asian women.

In Sri Lanka, Pap smear screening is one of the most effective strategies in controlling cervical cancer. Conversely, Pap smear coverage rate is only 6% in the country (Fernando and Wijayanayake, 2013), which is much lower than WHO



recommendation (over 80% of the risk population). Knowledge, attitudes, cultural beliefs and availability of service have been some of the contributory factors that affect non-attendance for Pap smear screening (Fernando and Wijayanayake, 2013). The Ministry of Health reported that cervical cancer incidence rate was 3% in the Vavuniya district while Pap smear screening coverage is only 1.3% (Annual Health Bulletin, 2013). Due to the low coverage of screening, it is essential to identify the factors related to poor attendance for Pap smear Screening. Therefore, the purpose of this study was to identify the factors related to poor attendance for Pap smear screening among women aged 35-55 years in the Urban Council area of Vavuniya district. The specific objectives of the study were to assess the knowledge, cultural barriers, psychological factors and health care factors related to poor attendance for Pap smear screening.

2 METHODOLOGY

A quantitative, non-experimental descriptive design was utilized in this study. The study was conducted in the Urban Council area of Vavuniya, during the period of January to March 2017. Women who were between the ages of 35 – 55 years were recruited for this study. Critically ill and women with communication failure (hearing impairments/muteness) were excluded from the study. Data were collected from purposively selected sample of 259. Written informed consent was obtained from every participant. Pre-tested, self-administrated questionnaire was used to collect data. It contained the demographic data, knowledge, cultural influences, psychological factors and health care factors related to attendance for Pap smear screening. Content validity and reliability were assured by referring to the standard literature and the subject experts. Privacy and confidentiality of participants were secured throughout the study. Ethical

approval was granted by the ethical review committee, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka. Data analysis was done with descriptive statistics using Microsoft Excel software.

3 RESULTS AND DISCUSSION

Two hundred and fifty nine women were studied. Collected data were presented as five main categories; demographic factors, knowledge, cultural influences, psychosocial factors and health care factors related to poor attendance for Pap smear screening.

Demographic factors

3.1 Demographic factors

The mean age of all participants was 42 + 1.6 years. Over half of the subjects (59.8%) being between 35 to 40 years old. Among the participants, 81.5% were married. About half of them were educated only up to General Certificate of Education (Ordinary Level). A majority were of Tamil ethnicity. Significantly, 78.4% of the participants were unemployed (Table 1).

3.2 Knowledge regarding Pap smear screening

The study findings indicated that a considerable number of participants (66.8%, n=173) were informed about cervical cancer, whereas only 57.5% (n=149) had knowledge about Pap smear screening. However, a study conducted in the Rathnapura District, of Sri Lanka, found 87.6% of subjects had knowledge about cervical cancer which is higher than the findings of the present study (Nandasena and Ekanayake, 2016). Further, the present study results highlighted that 56.8% of respondents had known that Pap smear is used as a screening test for cervical cancer detection. Moreover, a majority of



subjects had - no satisfactory knowledge of symptoms and screening tests of cervical cancer, which may be a significant contributing factor for poor

attendance of women for Pap smear screening. Similar finding has been obtained in the study conducted by Gan and Dahlui (2013).

Table 1: Demographic characteristic of participant

Socio demographic factors		Frequency (n=259)	Percentage %
Age	35 - 40 years	155	59.8
	41 - 45 years	32	12.4
	46 - 50 years	37	14.3
	51 - 55 years	35	13.5
Education level	No formal education	1	0.4
	Up to grade 5	49	18.9
	Up to G.C.E O/L	119	45.9
	Up to G.C.E A/L	59	22.8
	Higher education	31	12
Ethnicity	Tamil	162	62.5
	Sinhala	41	15.8
	Muslim	56	21.6
Employment	Employed	56	21.6
	Unemployed	203	78.4
Civil status	Single	32	12.4
	Married	211	81.5
	Widow	13	5
	Divorced	3	1.2

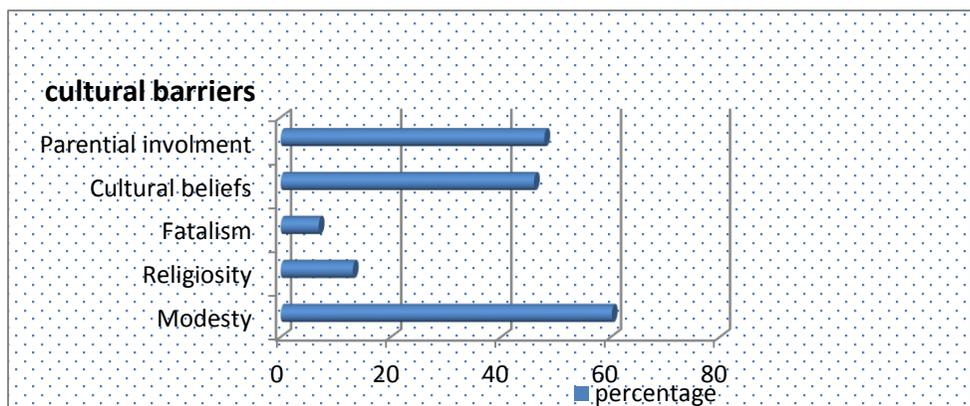


Figure 2: Cultural factors related to Pap smear

3.3 Cultural factors related to Pap smear screening

As shown in the figure 1, 58% participants pointed out modesty as being a major barrier for non-attendance of Pap smear examination. Cultural beliefs and parental involvement also were identified as barriers for poor attendance of Pap smear screening. Comparable results (65.6%, $p=0.068$, 95% CI) have been obtained by the contemporary research carried out by Abdullah, Aziz and Su (2011).

3.4 Psychological factors related to Pap smear screening

The study findings emphasized that several psychological factors contributed toward the lack of intent to appear for Pap smear screening such as belief it is painful ($n=159$, 61.5%), embarrassment ($n=131$, 50.6%), afraid about positive findings ($n=113$, 43.6%) and Pap smear screening is done by male doctors ($n=132$, 51%). A similar study done by Alfaro et al (2015) reported that in their study most women had no intention to appear for Pap smear screening because they viewed themselves as healthy, while half the study population of women answered that they were afraid to know the screening result.

3.5 Health care factors (hospital related factors) related to Pap smear screening

Eighty percent of the study participants emphasised that they had to wait a considerable length of time to receive health care services. Therefore, they pointed out that this was also a factor that affected poor attendance for Pap smear screening. Moreover, the absence of adequate number of trained staff (10.5%), staff members not helpful and not caring about patients (32%) were also contributory factors for poor attendance of women at Pap smear screening programs. A study carried out by Bessler,

Aung and Jolly (2007) revealed that limited access to health care services and lack of trained staff reduced the rate of Pap smear screening.

4 CONCLUSION AND RECOMMENDATION

According to the study findings, lack of awareness of Pap smear screening and its benefits, embarrassment, modesty, fear of unbearable pain during screening, afraid about positive finding, Pap smear screening done by male doctors, cultural factors and the need to wait a long time to get the health care services were identified as main factors related to poor attendance for Pap smear screening in the Vavunia district. These factors have a major impact on cervical cancer in Sri Lanka. Further studies should be extended to a larger population including other districts to clearly identify the factors influencing poor attendance for Pap smear screening in Sri Lanka. It is recommended that public awareness programmes about the importance of cervical cancer screening be conducted to educate all the communities. Furthermore, health care providers should understand the cultural and religious beliefs of Sri Lankan women in order to create a proper environment for screening such as providing female staff and adequate privacy, thereby encouraging women to present themselves for cervical cancer screening.

Acknowledgment

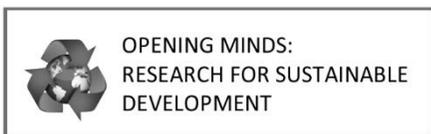
We thank the respondents for their voluntary participation for this study.

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Impact of Gender and Age on Taste Perception for Sucrose in Patients with Type II Diabetes Mellitus

Dinithi Vidanage^{1*}, Sudarshani Wasalathanthri² and Priyadarshika Hettiarachchi³

¹General Sir John Kotelawala Defence University, Sri Lanka.

²University of Colombo, Sri Lanka.

³University of Sri Jayawardenepura, Gangodawila, Nugegoda, Sri Lanka

*Corresponding author: Email: dinithividanage@gmail.com

1 INTRODUCTION

The prevalence of diabetes mellitus has dramatically increased over the world in the recent past. A cross-sectional study conducted between 2005 and 2006 has confirmed that one in five adults in Sri Lanka has either diabetes or pre-diabetes (Katulanda, *et al.*, 2008).

The sense of taste is an important chemical sense that play a critical role in human life. Sweet taste is the most pleasurable taste amongst the other tastes namely, sour, salt, bitter and umami. Consumption of sugar exceeding the healthy limits may disrupt the glycaemic control in patients with diabetes, causing an impairment of sweet taste perception (Green, 2010). A recent study has confirmed that ability to detect sweet taste is impaired in diabetes and it is proven that there is an alteration in the preference for sucrose amongst the diabetics (Yu, *et al.*, 2014). However, the impact of gender and age on taste perception for sucrose in diabetics has not been reported before.

Perception of taste (i.e. Supra-threshold sensitivity and preference) refers to a sensitivity that results from stimulation of gustatory nerves with different intensities, through a chemical sensing system.

Identifying the taste perception for sucrose in diabetics of different age and gender categories might provide useful information when recommending dietary adjustments. In a recent study we have confirmed that diabetics irrespective of the age and gender have significantly lower ratings for supra-threshold concentrations of sucrose when compared to normoglycemic controls (Wasalathanthri *et al.*, 2014). However, factors which contribute for this have not been uncovered fully. Thus, the aim of the current study is to assess the supra-threshold intensity ratings and preference for sucrose in patients with type II diabetes mellitus and to assess how the gender and age affects the taste perception for sucrose in them.

2 METHODOLOGY

This study is a part of a prospective cohort study conducted at the Department of Physiology, University of Sri Jayawardenepura. Baseline data of a total of 86 patients, aged between 35-60 years, with a history of type II diabetes mellitus for more than 5 years were considered. Patients who have oral ulcers which affect the taste perception and those who are on medications that change the taste perception were excluded from the study.



Data on socio-demographic and clinical characteristics such as age, gender, marital status, educational level, level of income, duration and family history of diabetes, adherence to diet control and complications of diabetes were obtained by an interviewer administered questionnaire after obtaining the written informed consent. The study was approved by the Ethics Review Committee of University of Sri Jaywardenepura.

Supra-threshold intensity ratings and the preference for sucrose were tested on participants who were asked to abstain from food, smoking, alcohol and betel chewing from 10pm, the previous day. A standard breakfast comprising of a

plantain and 2 slices of brown bread with margarine added was given 1 hour before sensitivity testing to standardize their satiety. Supra-threshold intensity ratings were assessed by a series of sucrose solutions (2.02M, 0.64M, 0.2M, 0.064M, 0.02M, 0.0064M) and the patients were asked to rate on a general labeled magnitude Scale (gLMS). The mean supra-threshold intensity rating was calculated for each concentration after 3 consecutive tests (Green *et al.*, 2010). Preference for sucrose was tested according to the “Monell 2-series, forced choice tracking method” for sucrose taste (Narukawa *et al.*, 2010). HbA1c was tested on all participants to assess glycemic control.

3 RESULTS AND DISCUSSION

Table 1: Demographic and clinical characteristics of study participants

Variable	Category	N	%
Gender	Male	36	42
	Female	50	58
Age	≤ 50 years	19	22
	>50 years	67	78
Duration of DM	5-10 years	64	74
	>10 years	22	26
Family history	Yes	52	40
	No	34	60
HbA1c value	≤7% Male	08	09
	Female	09	10
	>7% Male	28	33
	Female	41	48
Complications	Male	26	38
	Female	43	62
Adherence to diet control	Male	24	41
	Female	35	59

DM- diabetes mellitus



Table 2: Taste perception in relation to gender

Sucrose concentration	Gender	Mean/ \pm SD Supra-threshold intensity ratings for sucrose	P value (* $p < 0.05$) t-test
2.02M	Male	69.226 / \pm 24.44	0.063
	Female	78.158 / \pm 19.54	
0.64M	Male	56.639 / \pm 24.63	0.410
	Female	60.898 / \pm 22.74	
0.2M	Male	25.702 / \pm 13.57	0.074
	Female	32.140 / \pm 17.92	
0.064M	Male	12.016 / \pm 9.0	0.493
	Female	13.899 / \pm 14.5	
0.0202M	Male	4.985 / \pm 4.47	0.313
	Female	6.648 / \pm 9.0	
0.0064M	Male	3.066 / \pm 2.46	0.364
	Female	4.171 / \pm 6.95	
Mean preference			
	Male	0.183 / \pm 0.03	*0.023
	Female	0.097 / \pm 0.01	

The supra-threshold intensity ratings and preference for sucrose in men and women are given in Table 2. In the present study, supra-threshold intensity ratings for all concentrations of sucrose solutions were lower in men than women. Further, the findings indicate that men had a significantly higher preference for sucrose compared to women ($p=0.023$). In addition, only 41% of men in this study cohort controlled their diet. However interestingly, only 33% of men reported a poor glycaemic control (HbA1c of ≤ 7) and only 38% had self-reported complications. In contrast, greater percentage of women had HbA1c values of > 7 (48%) and had self-reported complications (62%) despite having a higher sensitivity and a lower preference for sucrose. In agreement to this finding, another study also reported a higher preference for sucrose by diabetic men compared to diabetic women (Yu, *et al.*, 2014). Although it appears that men have a higher tendency to consume more sugar because they have a higher preference for sweet taste, they may be consuming less due to lower ratings for supra threshold concentrations of sucrose as how the alterations in supra-threshold intensity ratings affect sweet consumption

in diabetics is still an unresolved question. The relationship between the taste perception and age is shown in table 3. The mean supra-threshold intensity rating for the sucrose solution with the highest concentration (2.02M) was significantly lower ($*p=0.04$) in patients above 50 years compared to those who were below 50 years. However, the mean supra-threshold intensity ratings for all lower concentrations of sucrose solutions (0.064M, 0.0202M, 0.0064M) were significantly lower ($p=0.04$, $p=0.002$, $p=0.01$ respectively) in younger patients (≤ 50 years). Furthermore, the results indicated that patients who were below 50 years of age had a significantly higher mean \pm -SD preference (0.27 \pm 0.24 vs 0.16 \pm 0.08) for sucrose compared to their older counterparts ($p=0.005$). Due to higher preference, the young patients are likely to consume more sugar. Liking for sweet-taste foods was reported to be higher even in non-diabetic individuals who are young suggesting that the young people may have unhealthy eating patterns as a result of greater preference for sweet taste (Sergi, *et al.*, 2017). However, when



HbA1c values are compared between the two groups, only 15% of younger patients appeared to have a poor glycaemic control (HbA1c>7%) whereas

68% of older patients reported a HbA1c>7%. This finding might be contributing to explain the current trend of onset of diabetes at a younger age (Sakurai *et al.*, 2014).

Table 3: Taste perception in relation to age

Sucrose concentration	Age	Mean/±SD Supra-threshold Intensity ratings	P value (*p<0.05) t- test
*2.02M	≤ 50 years	83.067/±19.20	*0.040
	>50 years	71.964/±22.31	
0.64M	≤ 50 years	65.551/±23.22	0.182
	>50 years	57.290/±23.43	
0.064M	≤ 50 years	9.904/±5.20	*0.049
	>50 years	14.020/±13.76	
0.0202M	≤ 50 years	3.000/±2.54	*0.002
	>50 years	6.789/±8.20	
0.0064M	≤ 50 years	1.978/±1.78	*0.011
	>50 years	4.199/±6.12	
Mean preference			
	≤ 50 years	0.267/±0.24	*0.005
	>50 years	0.163/±0.08	

4 CONCLUSIONS AND RECOMMENDATIONS

Diabetic men tend to have a higher preference for sweet taste and lower intensity ratings for supra-threshold concentrations of sucrose compared to women. Despite, men in this study cohort had a better glycaemic control with less complications compared to women. Although the tendency of consuming sugar is expected to be increased with higher preference, it is not clear how changes in intensity ratings for sucrose solutions affect sugar consumption in diabetics. Patients who are below 50 years showing a significantly higher preference for sucrose may be contributing to the tendency of consuming sweet-taste energy dense foods which is a popular dietary component in this age group. These findings should be considered when dietary recommendations are given to patients with type 2 diabetes mellitus.

Acknowledgments

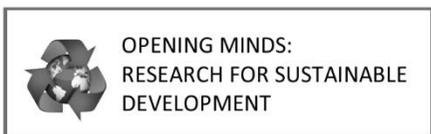
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Factors Related for Low Back Pain among Nurses at Teaching Hospital, Karapitiya

G.H.K.A. Priyadarshini¹, K.K.J.I. Kodithuwakku¹, A.G.M. Madushani¹, S.N. Marakanda² and K.A. Sriyani^{3*}

¹Teaching Hospital, Karapitiya, Sri Lanka.

²General Hospital, Kaluthara, Sri Lanka.

³Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: kasri@ou.ac.lk

1 INTRODUCTION

Low back pain (LBP) is known as the pain between the last rib and the pelvic bone with or without radiation to the buttock, back and front of the legs. It also defines as the pain which is not associated with menstruation, gynecological or genitor-urinary problems. Low back pain is a common cause of morbidity in healthcare workers, and nurses are the most vulnerable amongst (Cunninham *et al.*, 2006). Individuals who suffer from LBP may develop major disruptions in their physical, social and mental well-being, which could affect their quality of life. Among these influences, physical impact including loss of physical function and deterioration of general health, social impact including lack of participation in social activities are more common. Besides, psychosocial impacts which manifests through insomnia, anxiety and depression are required more consideration. Low back pain is reduced the quality of nursing care provides for the client and reduce their job satisfaction. Despite of that, LBP can cause occupational disabilities, increased cost of care and treatment while decreasing productivity and absence from work (Asadi *et al.*, 2016).

Low back pain is a multifactorial condition. Thus, understanding the related

factors for LBP is essential for prevention. Although various studies have been carried out to determine the risk factors for LBP and on strategies to control them in internationally and locally, this area was not yet studied at Teaching Hospital Karapitiya (THK). Therefore this study was carried out to examine demographic, physical and work related factors for LBP among nurses at THK.

2 METHODOLOGY

This was a quantitative descriptive cross sectional study conducted at THK located in the Southern province in Sri Lanka. A total of 350 nurses in both gender suffering from low back pain, those were permanently employed for more than two years in the service and those who had more than six months of experience in general surgical and medical wards were purposively recruited for the study. Data were collected using content validated, pre-tested self-administered questionnaire which was developed by reviewing literature and considering the researchers experiences in clinical setting. The questionnaire consists of questions focusing on demographic information such as age, gender, civil status, weight and height, education qualifications, physical activities and work-related



factors which could affect for low back pain of participants. Data were collected throughout in the month of March 2017 after obtained the ethical approval from the Ethics Review Committee, Faculty of Medicine, University of Ruhuna and permission from the hospital authorities. Nurses were volunteered for the study and signed written informed consent prior to participation. Completed questionnaire were collected in the same day of distribution to improve the quality of data collection.

Data were analyzed on Statistical Package for Social Sciences (SPSS) version 21 using both descriptive statistics including frequencies and percentages, and inferential statics including chi-square test. Level of significant was accepted at alpha <0.05.

3 RESULTS AND DISCUSSION

Of the total of 350 nurses invited, 297 nurses participate in the study, yielding a response rate of 84.9%. The majority of participants were females (n=252, 84.8%) and were 36-50 years (n=173, 58.2%) of age. Most of nurses were married (n=263, 88.6%) and had children (n=248, 85.5%). Most of the participants were overweight (BMI 25-29.9, n=125) or obese (BMI>30, n=145).

3.1 Demographic factors related for LBP

There was a significant associations between nurses' LBP and their age (p=0.011), gender (p=0.011), having children (p=0.010), and BMI (p<0.0001). However, there was no association between LBP and civil status and whether they smoke (Table 1).

Table 1: Demographic factors related for LBP

Characteristics	Category	Minor (n)	Moderate (n)	Severe (n)	Total (n)	p-value
Gender	Female	75	87	90	252	0.011
	Male	22	16	7	45	
Age (years)	20-35	42	29	8	79	<0.0001
	36-50	49	64	60	173	
	>50	6	10	29	45	
Civil status	Married	81	90	92	263	0.184
	Single	13	10	2	25	
	Widow	1	2	2	3	
	Divorced	1	1	1	5	
Children	Yes	72	85	91	248	0.01
	No	23	16	2	41	
BMI (Kg/m ²)	<18.5	7	0	0	7	<0.0001
	18.5-24.9	61	59	25	145	
	25-29.9	26	39	60	125	
	>30	2	5	12	19	
Smoking	Yes	5	4	1	10	0.263
	No	91	97	95	283	

Significance p<0.05



Low back pain was significantly higher among nurses between 36-50 years of age. Consistent with present finding, several studies have shown significant association between nurses' age and LBP (Abou El-Soud *et al.*, 2014; Al-Samawi and Higazi, 2015). This is possibly due to degeneration of vertebral discs and accumulative effects of prolonged exposure to strenuous works. As well musculoskeletal symptoms begin early in life and reached the peak between 35-55 years may be another reason. However, findings of Sudan study have not revealed any significant association between nurses' age and LBP (Al-Samawi and Higazi, 2015). In the present study female gender was significantly associated with LBP, perhaps it may be due to the majority of the sample represented by females. In light of the previous findings, LBP is higher among female nurses than male nurses (Al-Samawi and Higazi, 2015) and this is possibly be due to anatomical, physiological and structural difference of human body between the gender, in addition, strain is common in female than males.

According to the Egyptian study, LBP was significantly higher among married individuals (El-Najar and El-Fattah, 2014). Though expected, present findings have not shown any association between civil status of the individual and LBP similar to the findings of Burdorf and Shorrock (1997),

Perhaps it may be due to disproportionate representation of individuals in the variable of civil status in the present sample. In accordance with findings of Bejja *et al.* (2005), present findings have shown an association between increased BMI and LBP. Increased weight over the spine is lead to structural compromise and damage especially to the lower back or lumber region, therefore obesity may aggravate the existing LBP or contribute to recurrence of the condition (Naidoo and Coopoo, 2007). However, findings of several studies have not shown an association between BMI and LBP (Aljeesh and Nawajha, 2011; Homaid *et al.*, 2016). The association between LBP and females with having children is consistent with findings of another Sri Lankan study (Warnakulasooriya *et al.*, 2011). However, Yip (2001) failed to show any relationship between LBP and females with having children.

3.2 Physical factors related for LBP

Table 2 shows the physical factors related for LBP. There was significant relationship between LBP and physical exercises ($p= 0.001$) and traveling mode ($p=0.031$). However findings of Saudi Arabian study has not shown any relationship between low back pain and regular exercises. Present findings have not shown any relationship with nurses working place and LBP ($p=0.686$).

Table 2: Physical factors related for LBP

Factor	Category	Minor (n)	Moderate (n)	Severe (n)	p-value
Doing exercise	Yes	63	13	7	0.0001
	No	34	89	90	
Travelling mode	Motor bike	43	48	40	0.031
	Car or Van	5	8	4	
	Bus	32	48	40	
	Foot	17	26	22	

3.3 Work related factors causes for LBP

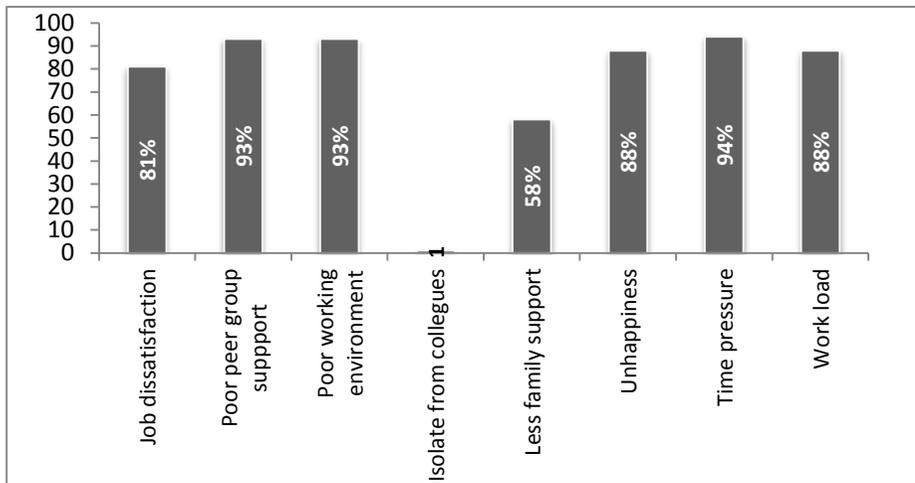


Figure 1: Work related factors causes for LBP

The present findings were revealed several work related causes for LBP (Figure 1). Particularly LBP was high among nurses who had time pressure (94%), poor working environment (93%), and less peer group support (93%). A previous study in Sri Lanka conducted among nurses has shown association between LBP and time pressure, job satisfaction (Warnakulasooriya *et al.*, 2011). In another recent study, Al-Samawi (2015) has shown significant association between

LBP and work load and poor working environment. Also findings of present study indicated that lack of support from immediate supervisor as a significant factor for LBP.

4 CONCLUSIONS AND RECOMMENDATIONS

The demographic factors of LBP among nurses in THK were found to be nurses' age, female gender, increased BMI and having children. Travelling mode and whether nurses engage in physical exercises were seems to be influenced for

LBP. Further, several works related causes were shown to be affected for LBP include time pressure, poor working environment, poor peer support, increasing workload, job dissatisfaction and unhappiness.

The results indicate a message to the nursing personals about the predisposing factors for LBP. It is needed to create a safe working environment and provide psychosocial supports for the nurses while conducting educational programs on prevention of LBP and coping strategies for LBP which will lead to promote efficiency in patient care and reduce the source of job stress. Since this study is limited to the general wards of the THK, further study covering with all the departments of the hospital is needed.

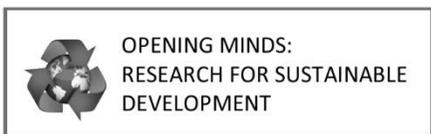
Acknowledgements

We would like to thank all the participants and hospital staff for their greatest support to carry out this study during their busy schedules.



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Contributory Factors of Coronary Heart Disease among Young Adults

S.A.C. Sampath¹, K.G.U. De Silva¹, P.C. Wickramasinghe¹, A. Colombage² and P.W.G. D.P. Samarasekara^{2*}

¹National Hospital of Sri Lanka.

²Faculty of Health Sciences, Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: pwsam@ou.ac.lk

1 INTRODUCTION

Coronary Heart Diseases (CHD) continues to be a major public health issue in Sri Lanka (Annual Health Bulletin, 2012). The latest studies show that incidences of CHD among young adults have significantly increased in the recent years, even though it is rare among this population segment (Yunyun *et al.*, 2014). Variants of CHD have been classified into chronic CHD, acute coronary syndromes, and sudden death and it also may present clinically, in many ways (Fuster *et al.*, 2011). The current study considers the array of CHD to identify factors that could be influential for those aged between 18 to 45 years who could suffer from CHD. This study intends to identify contributory factors of CHD among young adults aged between 18 to 45 years considering their life style patterns and describes diseases influencing CHD among those young adults.

2 METHODOLOGY

A quantitative, descriptive design was used in this study. Hundred and sixty seven (167) young adults with CHDs who sought care at the Cardiology Unit at National Hospital of Sri Lanka (NHSL) were selected using convenience sampling. A questionnaire was used to

gather information. The first part of the questionnaire consisted of close-ended questions to be answered by the participants and the second part was filled by researchers using history and medical records of the participants. This tool was developed by researchers using standard literature and through the professional experience of working at the Cardiology Unit. Ethical approval was obtained from the Ethical Review Committee of the NHSL. Written consent was obtained from each participant prior to the study. The data analysis was conducted using Microsoft Excel to obtain descriptive statistics.

3 RESULTS AND DISCUSSION

The gender distribution of the study population was 73.7% male and 26.4% female among 167 participants. The majority of the participants were aged between 41 to 45 years and the remaining two percent were between 18 to 25 years of age. One hundred and thirty two (79%) were married and the rest were unmarried. Almost half of the participants had completed school up to the GCE Ordinary Level (49.1%) and 13 (7.8%) participants had completed their higher education, whereas, only two participants indicated a very low literacy level. The majority of the participants (85.6%) were employed.



3.1 Life style patterns of among young adults

Participants’ smoking status, engagement in physical activities, food consumption patterns and perceived mental status such as work stress were factors that were

considered. According to the findings, 59.3% were non-smokers, which included all the female respondents. Comparable findings of Incalcaterra *et al.* (2013) and Tamrakar *et al.* (2013) identified that more than half of the population were identified as smokers.

Table 1: Smoking status and Physical activities of young adults with CHDs

Characteristics	No of Participants (n=167)	
Smoker	12	7.20%
Non Smoker	99	59.30%
Former Smoker	56	33.50%
Physical exercise		
Yes	42	25.30%
No	125	74.70%

Table 2: Food consumption patterns of young adults with CHDs

Food consumption	Daily	Occasionally	Quit at Present	Never
Meat	47, (28.1%)	109, (65.3%)	10, (6.0%)	1, (0.6%)
Fish	97, (58.1%)	68, (40.8%)	2, (1.2%)	NA
Eggs	48, (28.7%)	104, (62.3%)	13, (7.8%)	2, (1.2%)
Seafood	18, (10.8%)	125, (74.8%)	14, (8.4%)	10, (6.0%)
Milk and Dairy Products	70, (41.9%)	87, (52.1%)	9, (5.4%)	1, (0.6%)
Use Oil Products for Cooking	89, (53.3%)	53, (31.7%)	19, (11.4%)	6, (3.6%)
Consuming Processed Foods	47, (28.1%)	103, (61.7%)	10, (6.0%)	7, (4.2%)
Fast Foods and Snacks	55, (32.9%)	94, (56.3%)	14, (8.4%)	4, (2.4%)

Nearly three-quarters of the participants did not engage in any physical exercise. Likewise, in their study Sivajanani, Kuillini, and Madona (2014) identified the lack of exercise as the main influencing lifestyle factor for CHD. Perceived mental status of participants was measured using a five point Likert scale from ‘strongly disagree’ to ‘strongly agree’ on questions regarding their daily activities, including

work. A large majority (80%) indicated that their work environment and tasks were very stressful. A similar percentage declared that they engaged in tasks that were time sensitive. More than 70% stated that they had driving related stress, engaged in work that required rushing or multi-tasking. Similarly, Yunyun *et al.* (2014) also found in a correlation between CHD and high work stress. The current



study only found 10% of the participants who did not seem to perceive high levels of stress in their lives, both in and outside of work. The majority of the participants consume animal food products and fatty food products.

3.2 Diseases influencing CHD among young adults

Existing medical conditions that might be influential towards early onset of CHD were gathered by asking questions that specifically listing Diabetes Mellitus, Hypertension, Hyper-cholesterolaemia and being overweight. A high consumption of animal food products and other non-healthy foods might be contributory towards the elevation of Body Mass Index (BMI) and cholesterol levels in the blood. Similarly, Yunyun *et*

al. (2014) in China and Wong *et al.* (2010) in Singapore presented similar patterns in their studies. Nearly one-third of the population had Hypertension and Diabetes, similar to the results in studies conducted by Wong *et al.* and Incalcatterra *et al.* However, upon analysis of current findings, Hyper-cholesterolemia seems to have a significance influence to also having CHD, when compared with those who had Diabetes and Hypertension. In other words, more people who had CHD also possessed Hyper-cholesterolemia than the number of participants who had CHD and Diabetes or Hypertension. On the other hand, a combination of Diabetes, Hypertension and Hyper-cholesterolemia was present in a combination by most of the young adults with CHD.

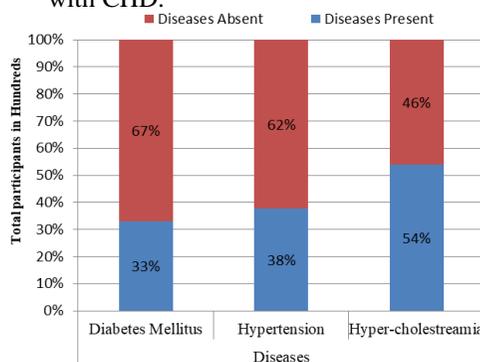
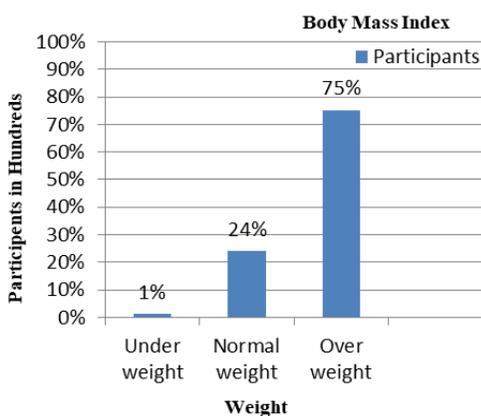


Figure 2: Diseases Influencing Coronary

4 CONCLUSION AND RECOMMENDATIONS

The distribution of the ages of study population showed a prevalence of and striking increase of CHD with ageing, even among young adults. According to the study findings, participants who were both married and employed were among the majority. This could indicate that

employment and life responsibilities, as indicated by the perceived mental health status as declared by participants, are strong contributory factors towards CHD prevalence among young adults. The results also show that one-third of the participants who identified as early

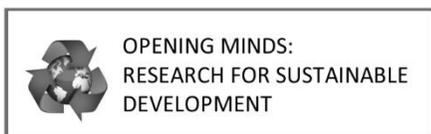


smokers suffered from CHD. Most of the participants seem to perceive high stress in relation to employment tasks with extensive time-constraints. Further, it emphasised that those with poor participation in regular physical exercises of participants with CHD. The findings of this study also revealed that the participants were more likely to also have hyper-cholesterolemia as opposed to Diabetes and Hypertension. Thus, it can be concluded that the existence of hyper-cholesterolemia or a combination with Diabetes and Hypertension is contributory towards early onset of CHD. Therefore, the results of this could be utilised to form the basis of health education and awareness programs in schools so that preventative measures and development of healthy behaviours and lifestyles can be encouraged. Screening of young adults through related diseases, family history, lifestyle and behaviours as well as encouraging self-motivation through multimedia channels in clinics and hospitals will assist in mitigating the increase of these identified factors that contribute towards early onset of CHD. Similarly, the findings can be used to educate nursing professionals and address the existing knowledge gap related to CHD among young adults.

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Assessment of Risk Factors for Falls among Elderly People in the Home Environment

W.W.L.S. Sandamali, P.A.D. Himali, W.A.T.N. Wijesundara, A.A. Edirisingha Arachchi, N.R. Kuruppu, A.V. P. Madhavi*

The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: avpma@ou.ac.lk

1 INTRODUCTION

Health concerns among elderly are multiple and complex which includes medical and psychosocial problems. Falls are one of the major problems in the elderly and are considered to be one of the “geriatric giants” leading to a significant proportion of morbidity (Vassallo *et al.*, 2005). Falls and consequent injuries are major public health problems that often require medical attention. Coleman *et al.* (2004) state that falls has been a common incident among elderly population and a major cause of morbidity and mortality in persons 65 years or older, with as many as one in three community dwelling elders reporting a fall. In Sri Lanka, population over 60 years old in 2000 was 9.2 percent, and people aged 60 years and above reaching almost 30 percent by 2050, with rapid increase of the share of the very old (World Bank, 2008). According to many studies various risk factors including personal, environmental and medical factors affects falls among elders all over the world. Most of these falls are associated with one or more identifiable risk factors and research has shown that attention to these risk factors can significantly reduce the rate of falling (Rubenstien *et al.*, 2016). Prevention and modification of these risk factors has been recently targeted.

Patil *et al.* (2015) conducted a community-based cross-sectional study with a sample of 416 elderly persons to

identify the risk factors for falls among elderly. Finally the authors identify that those with foot problems (71.4%), underweight (77.7%), abnormal gait (51.4%), Obesity (50%), difficulty with steps or stairs (45.3%), habit of smoking (45.1%), alcohol consumption (43.1%), difficulty in getting on or off toilet (42.7%) and wearing loose slippers (63.8%) were at higher risk of fall. In India, Ravindran and Kutty (2016) studied 251 cases and 250 controls with persons aged 60 years and above and revealed that steps or stairs and slippery nature of the floors, accentuated by the presence of water, slippery cloth, or polythene bags on floors and greasy ointment smeared on the foot were directly involved in injurious falls. Campbell, Barrie and Spears (1989) conducted a community based prospective study with a sample of 761 subjects and highlighted that decreased levels of physical activity, stroke, and arthritis of the knees and impairment of gait, total number of drugs and drugs liable to postural hypotension and muscle weakness were associated with an increased risk of falling.

Falls among elders are very common and often a devastating problem, causing a tremendous amount of morbidity, mortality and hospitalization (Patil *et al.*, 2015). Many people, who fall, even if they are not injured, become afraid of falling (Pinheiro *et al.*, 2010). This fear may cause a person to cut down on their



activities of daily living. When a person is less active, they become weaker and this increases their chance of falling. In addition, many complications like reduced physical activities, pressure ulcers, joint stiffness and adverse events related to medication administration can occur due to falls. As falls and consequent injuries are an enormous burden to individuals, society and our health care system it is of paramount importance to give research attention for this issue of falls among elders to reduce the burden in general. Therefore it is very important to examine the risk factors for falls among elders in the home environment. Hence the main aim of this study was to examine the risk factors for falls among elders in the home environment. The study was further guided by the following specific objectives: to examine the personal factors related to falls among elderly people, to examine the environmental factors related to falls among elderly people, and to examine medical factors related to falls among elderly people.

This study was carried out in the National Hospital of Sri Lanka in the Colombo district. This study identified common risk factors for falls among elders in their home environment. The findings of this study helped to get broader understanding of factors related to old people's falls in the home environment. This understanding will help health care professionals to take remedial actions to reduce or prevent fall incidences among the older population thereby increasing their mobility and reducing mortality rates of these population groups.

Moreover the study findings were a good source of information for home care givers to identify the risk factors for falls and to protect elderly people from identified risk factors because many of those are potentially remediable. Ultimately the findings will further help to increase the quality of life of elderly people.

2 METHODOLOGY

Quantitative research approach and descriptive research design was selected for this study. Study was conducted at the Accident Service, National Hospital of Sri Lanka. Researcher collected data from elders who fall in the home environment. But the patients who are admitted to the hospital were the only possible accessible sample to collect data. Therefore, the study sample was elders who were admitted to the Accident Service, National Hospital of Sri Lanka following a fall at home.

Convenience sampling method was used for this study and 200 subjects were selected. Data collection was done by using a questionnaire. The response rate was 100%. According to the timeframe data were collected from late February to late March of 2017. Institutionalized and critically ill participants were excluded. The content validity was gained by a comprehensive literature review and assessed by a subject expert. Reliability of questionnaire was test by test - retest method. Data Analysis was done using descriptive statistics and Microsoft Excel 2010 software.

Ethical approval was obtained from the ethical committee of the National Hospital of Sri Lanka in Colombo. Permission to collect data from the patients was obtained from the Director of National Hospital of Sri Lanka.

Throughout this study introduction of investigators, distribution of information letters to participants and receiving informed consent were performed prior to data collection for guaranteeing their confidentiality. To identify the subjects only a serial number was assigned to the questionnaire. Volunteer participation was encouraged by informing that they can refuse or resign from study at any time without any risk.



3 RESULTS AND DISCUSSION

Data consisted of four parts, demographic data, personal risk factors, environmental risk factors and medical risk factors for falls among elders. Among 200 participants, 65.5% were in 65–69, 27% were between 70 and 75, 16.5% were in 75-79, and 18% were 85 or above years of age group, respectively. Higher proportions of females (52%) were noted compared to males (48%) and majority is Sinhalese (53.5%). And those who live in the urban sector were 60.5% and in the rural sector was 30.5%. And 18% of them were living alone. Findings revealed that 28% elders were currently employed. And 43.5% had secondary education while 21.5% achieved higher education. 61.5% of them had a monthly income of 10,000 rupees or more.

When considering personal related factors, significantly higher fall rate was seen among elders who restricted their activity due to fear of falling (66%), persons without exercise (81.5%), those who wear long dresses (56%) and those with risk taking behaviour (57%) (Figure 1). This result is similar to three studies (Aoyagi *et al.*, 2008; Patil *et al.*, 2015 and Demetriades *et al.*, 2005) done in Japan, India and Latin America respectively. Chu *et al.* (2005) highlighted that use of walking aid is an extremely common finding for fall in China which is contrasting with the findings of this study as not using a walking aid was a risk factor for fall in this study.

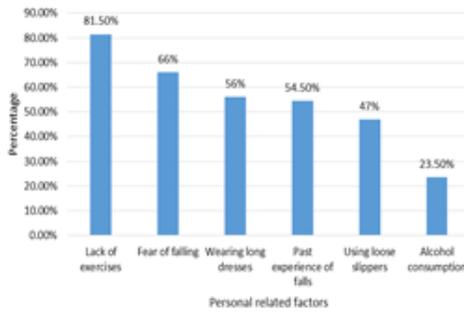


Figure 1: Personal factors related to falls among elders

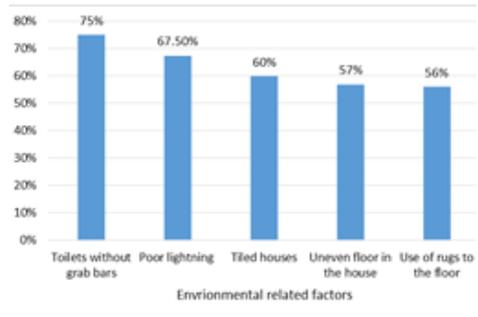


Figure 2: Environment related risk factors related to falls among elders

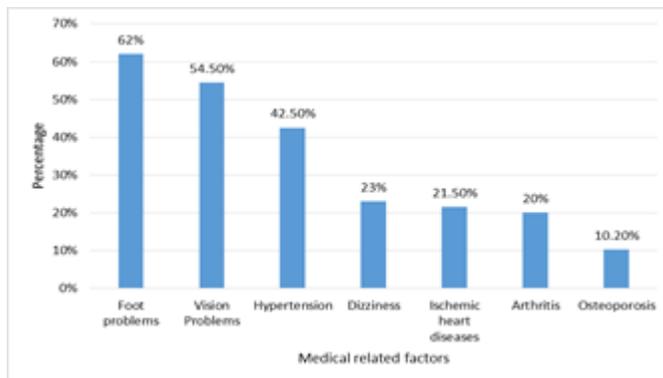


Figure 3: Medical related risk factors for falls among elders

As regards environmental factors for falls, toilets without grab bars (75%), poor lighting (67.5%), tiled houses (60%) and uneven ground (57%) were the most common risk factors in the home environment in this sample (Figure 2). Similar findings were noticed by a recent study conducted in Brazil and United Kingdom (Pinheiro *et al.*, 2010; Masud and Morris, 2001). And most falls occur on level surfaces (56.5%) within commonly used rooms such as bed rooms, kitchen and at the immediate home surroundings.

Findings revealed that 12% were not using any medication, 30% of them used 1 to 3 medications, 54.5% used four medications and 61.5% used more than four medications. This agrees with the studies done separately in Brazil, Netherlands and Sri Lanka respectively (Rozenfeld. *et al.*, 2003; de Jong, Vander Elst, and Hartholt, 2013; Ranaweer *et al.*, 2013). It was observed that the rate of falls among the study subjects with medical factors varied from 21.5% (ischemic heart diseases) to 62% (foot problem). The diseases associated with recurrent falls were foot problems (62%), vision problems (54.5%) and hypertension (42.5%). Investigators from USA and Rio de Janiro also suggested that elders with diabetes and hypertension have an increased risk of falling (Schwartz *et al.*, 2002; Pinheiro *et al.*, 2010).

4 CONCLUSIONS AND RECOMMENDATIONS

According to the findings of this study majority of the falls in the elderly are due to personal (past history of falls, reduced activity due to fear of falling, lack of exercise, risk taking behaviours, loose slippers, long dresses), environmental (slippery and uneven floors, rugs, not having stair railings, not having grab bars in the bathroom and poorly lit homes) and medical factors (diabetes, hypertension,

vision problems, foot problems and arthritis) which are predictable and hence they are preventable. Most falls are caused by a combination of risk factors. The more risk factors a person has, the greater their chances of falling. Healthcare providers can help cut down a person's risk by reducing these fall risk factors.

As the recommendations regular exercise program for elders should be conducted to improve strength, gait and balance and for the patients with gait and balance disturbances, specific assistive devices should be introduced to prevent falls. Care-takers need to be educated for early detection of risk factors among elders. Disease conditions such as diabetes, hypertension, vision problems, foot disorders and all these conditions should be prevented, treated, or managed better. Public health initiatives are required to raise awareness in older people and their care-takers of the importance of regular eye examinations and use of appropriate prescription glasses. Screening and modification of environmental hazards should be encouraged in the community to protect elders by preventing falls. Intervention strategies to address these modifiable risk factors may be beneficial in reducing fall among elderly population. Finally the efficacy of each of these interventions in reducing falls needs further investigation.

Acknowledgments

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Factors Related to Self-Care Practices among Patients with Type 2 Diabetes Mellitus: A Descriptive Study

H.W.M.S.S.H.Wijesinghe¹, A.I.K.Wijekoon¹, M.P. Sooriyaarachchi¹,
H.A.K.G.J. ayasinghe¹, H.U.C. Nuwansala^{2*} and W.N. Priyanthi¹

¹Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Department of Allied Health Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka

*Corresponding author: Email: cnuwansala@gmail.com

1 INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disorder which is caused by the deficiency of the hormone Insulin and is mainly characterized by hyperglycemia which affects every system in the body. Diabetes causes several complications such as cardiovascular diseases, nephropathy, retinopathy and neuropathy which can lead to chronic morbidities and mortality. Diabetes can occur due to the deficiency of Insulin production in the body (Type 1 DM) and due to body's ineffective use of Insulin (Type 2 DM). The exact cause for type 1 diabetes is not identified and it is currently not a preventable disease. A vast majority of people suffer from Type 2 DM around the world. Even though Type 2 DM is labeled as a disease which is seen only in adults, with the transition a person's life style it has begun to occur among children as well.

Due to the chronic nature of this disease, most of the diabetic patients are treated as out-patients, and therefore, they have to control and manage the disease at home through self-care practices. Self-care in diabetes can be defined as a process which is characterized by the development of knowledge or awareness by learning how

to survive with the complex nature of diabetes in their social context. A set of behavioural patterns belongs to self-care practices such as healthy eating, being physically active, monitoring of blood sugar levels, compliant with medications, good problem-solving skills, healthy coping skills and risk-reduction behaviour which should be practiced by people with or at risk of diabetes in order to successfully manage the disease on their own which are identified to be positively correlated with good glycemic control, reduction of complications and improvement in quality of life (Shrivastava, Shrivastava and Ramasamy, 2013).

2 METHODOLOGY

2.1 Study Design and Sample

A descriptive cross - sectional study was conducted among 300 patients above the age of 18, who have been diagnosed with Type 2 diabetes and who has visited the diabetes clinic at the Teaching Hospital, Kandy for more than three months.



2.2 Ethical Clearance

Ethical approval was obtained from the ethics review committee of the Teaching Hospital, Kandy. Informed written consent was obtained from every participant prior to their involvement in the study.

2.3 Study Instrument

A pre-tested self-administered questionnaire was used for data collection. Questions were included under 03 sections which was based on demographic data, knowledge regarding self-care

practices and barriers related to self-care practices.

2.4 Data Analysis

Sample characteristics were analyzed by using descriptive statistics, SPSS version 16 was used as the data analytic tool.

3 RESULTS AND DISCUSSION

Among 300 participants 51% were male and 49% were female. Majority of the respondents (66%) were educated up to G.C.E Ordinary Level.

Table 1: Demographic details of participants

Description		Amount	Percentage
Gender	Male	153	51%
	Female	147	49%
Age group (years)	18-30	7	2.30%
	31-45	36	12%
	46-60	127	42.30%
	Above 61	130	43.30%
Marital status	Married	253	84%
	Unmarried	44	14%

Among the participants 82.3% possessed a sound knowledge about a diabetic’s diet, 80.3% carried out regular blood glucose monitoring and 84% were under regular medication while 20.3% possessed poor knowledge regarding regular exercises. A similar study conducted with newly diagnosed type 2 diabetics in Bangladesh, has found that the majority of respondents had average basic (66%) and technical (78%) knowledge regarding diabetes mellitus and they emphasized the importance of the patients’ knowledge level to bring about positive changes in self-care practices with regard to diabetes control (Saleh *et al.*, 2012).

Study showed that the total sample has identified a medical officer as the major source of information (Figure 1) and a majority has identified a nursing officer as a source (51.3 %). Even though the internet is an important resource, only few participants (11.6%) have identified internet as a resource for gaining knowledge which suggests the reluctance of accessing new technology to learn about the disease. A study conducted in December 2001 estimated that approximately 40% of the adult US population with Internet access used the Internet for health care information and pointed out the importance of encouraging patients to access internet (Baker *et al.*, 2003).



When considering the barriers related to self-care practices, 71.3% of the respondents have identified the long waiting time in the clinic as a major reason. Some of the participants have identified the difficulties in doing outside investigations (36.6 %) and transport problems (27.3%) as barriers. While a fewer number of patients had language problems in the clinic (8.6%).

A qualitative study has been conducted to explore the factors which influences the quality of diabetic care provided in primary health care in Oman and it has

revealed several factors which could affect the quality of diabetic care including delays in getting appointments; lack of proper utilization of the waiting area for the purpose of health education; language barriers with diabetic nurses; inadequate provision of continuity of care; lack of sufficient clarification of disease related issues; delays in obtaining investigation results; long waits for ophthalmology appointments, inadequate supplies of prescribed medications to cover the time between appointments, and lack of referrals to dieticians (Al-Azri *et al.*, 2011).

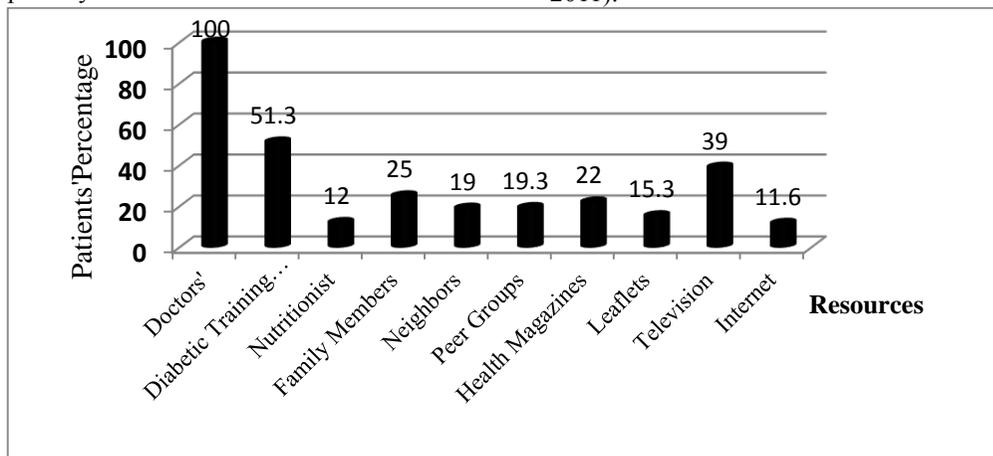


Figure 1: Resources used for gaining knowledge regarding self-care practices

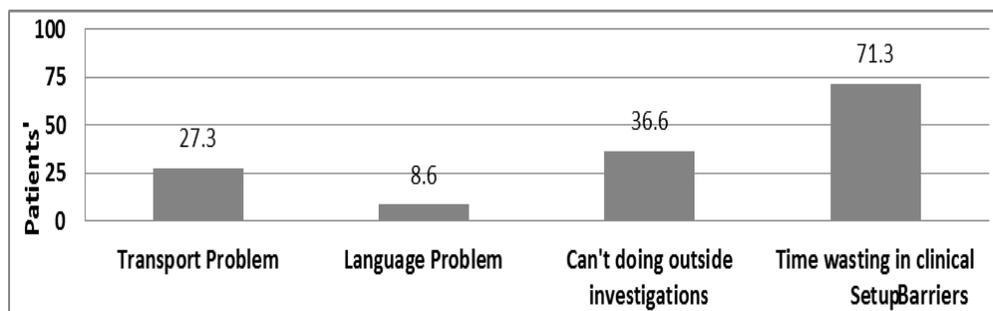


Figure 2: Barriers related to the self-care practices in a clinic set-up

Among the participants of the study sample, most of the participants have family support to in regular clinic visits and investigations (63.6%), to prepare a diabetic's meal (60%) and to take medications (42%). Some correlational studies have proved that there is a positive and significant relationship between family support and adherence to diabetes self-care practices (Miller and Di Matteo, 2013).

4 CONCLUSIONS AND RECOMMENDATIONS

Knowledge is the most important factor related to self-care as it directly influences the patient's self-care behaviors. According to the study most of participants possessed a good knowledge level regarding some of the self-care practices like diet, regular blood glucose monitoring and regular medications, but a smaller number of participants knew about regular exercises, foot care and body checkups.

Results revealed that most of the participants faced common barriers relating to achieving self-care practices. Most of them faced many barriers when attending the clinic and there was reluctance to visit regularly due to the long waiting time, lack of facilities and difficulty in carrying out prescribed investigations from outside due to financial constraints. When the patients neglected the self-care practices, they faced difficulties in managing and controlling the disease and caused an increase in the number of recurrent admissions in hospitals.

To perform effective self-care practices attitudinal change is also required. Therefore recommendations can be made to implement programmes to change their attitudes simultaneously with the enhancement of knowledge for patients

and family members because the family is an important aspect of adherence to diabetes self-care practices

Acknowledgments

The authors are grateful to the diabetic patients who attended the diabetes clinic at the Teaching Hospital, Kandy for their cooperation during the period of data collection. We are also thankful to the staff members of the hospital, especially of the diabetic clinic for allowing the study to be done in their facility and for their cooperation.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
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Barriers to Implement Kangaroo Mother Care among Post- Natal Mothers with Premature Low Birth Weight Babies

G.G.A.W. Gamlath¹, P.G.S.S. Wijayarathne¹, P.A.C.R. Gunadasa¹, S.S.N.D. Sakalasooriya¹, N.R. Kuruppu^{1*} Kumudini Cooray² and W.N. Priyanthi¹

¹Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Provincial General Hospital, Rathnapura, Sri Lanka

*Corresponding author: Email: nipunarandini@gmail.com

1 INTRODUCTION

Kangaroo Mother Care (KMC) also known as “skin-to-skin care” is an evidence based approach of caring for new born infants where the mother uses her own body temperature to keep her infants warm (Kavitha *et al.*, 2012). It reduces mortality and morbidity in premature Low Birth Weight (LBW) babies, which was first developed in developing countries (Seidman *et al.*, 2015). It is the best method to meet the infant’s essential needs which are warmth, nutrition, protection, stimulation, parental contact and love (Solomons, 2012). During KMC, the mother holds her baby in an upright position in skin-to-skin contact under her clothes (DiMenna, 2006).

LBW and prematurity is a major contributor to both neonatal and child mortality because they lack the ability to control their body temperature. It is estimated that 15% to 20% of all births worldwide are LBW and it represents more than 20 million births a year (UNICEF, 2015). According to the Sri Lankan health records, the premature delivery rate is considerable and it is around 24 000 preterm deliveries per year (Family Health Bureau, 2012). Kavitha and his colleagues state that KMC is the most reliable method for premature LBW

babies to keep warm, and also it gives many benefits for both the baby and the mother as it provides better thermal care, improves the survival of preterm and LBW infants and reduces the length and cost of hospitalization (Kavitha *et al.*, 2012).

Based on increasing evidence of the positive effect and outcomes of KMC, it has been rapidly accepted worldwide (Shrivastava, 2013). When implementing KMC, some of the barriers were identified. Lack of awareness regarding KMC among mothers, lack of support from health staff, cultural effect, and fear/anxiety/shame of having a preterm baby impaired this process (Chan *et al.*, 2015). Therefore, this study was focused to identify barriers related to implementing KMC among post-natal mothers with premature LBW babies. In this study, barriers were categorized in to four groups; mother’s existing knowledge regarding KMC, perceived physical barriers, psychological barriers and socio-cultural barriers among post natal mothers with premature LBW babies to implement KMC.



2 METHODOLOGY

A quantitative descriptive study was conducted in the Neonatal ICU and SCBU, Well Baby clinic, mother baby care unit and post-natal wards at the Provincial General Hospital (P.G.H), Rathnapura which is one of the biggest full-fledged, tertiary care hospitals with 1320 beds. The population for this study was post-natal mothers with premature LBW babies who were admitted to the three maternity wards, Well Baby clinic, Neonatal ICU and the mother baby care unit of P.G.H Rathnapura. Purposive sampling technique was used to select the study subjects. For this study, 150 mothers who were between 18-40 years of age and premature, low birth weight babies who were below two months of age were selected and premature babies who were between 28-34 weeks of gestational age and below 2.4 kg of birth weight were selected. When collecting the data, it was done without any disturbance to the baby. The questionnaire consisted of five sections including socio-demographic characteristics, knowledge, physical barriers, psychological barriers and socio-cultural barriers to implement KMC. The validity of the questionnaire of this study was achieved using a panel of subject experts and relevant literature. Reliability was established using a pilot test by collecting data from ten post natal mothers with premature and LBW babies who did not actively participate in the study but met the inclusion criteria of the study.

Ethical approval was obtained from the ethical committee of the Colombo South Teaching Hospital (CSTH). To collect data, permission was obtained from the Director of the P.G.H. Rathnapura and consultants, matrons, ward sisters or in-charge nurses of relevant sections and wards. Data collection commenced after obtaining informed consent from the convenience sample of mothers.

One hundred and fifty questionnaires were completed from post natal mothers with premature and low birth weight babies in postnatal wards at Provincial General Hospital Rathnapura. Resulting in a total response rate of 88%. Data was analyzed by using Microsoft Excel 2010 and data was expressed as a frequency distribution and percentages.

3 RESULTS AND DISCUSSION

A total of 150 post-natal mothers participated in this study. Demographic characteristics are shown in Table1.

Table1. Demographic characteristics of participants

Variable	n	%
Age (years)		
18 – 25	46	30.6
26 – 30	61	40.6
31 – 35	32	21.3
36 – 40	11	7.3
Education Level		
No education	5	3.4
Passed grade 5	23	15.4
Passed O/L	74	49.3
Passed A/L	32	21.3
Higher education	16	10.6
Type of employment		
Housewife	96	64
Self-employment	14	9.6
Semi – government	6	4
Government	27	18.3
Private	7	4.1

3.1 Knowledge regarding Kangaroo Mother Care

When considering the knowledge regarding KMC, it was found that 90.67% mothers have heard about it. Out of those mothers, 95.49% mothers had knowledge about the correct position of KMC while all mothers knew that KMC helps with the wellbeing of their baby. According to the findings, 98.48% mothers knew that both



parents can do KMC whereas 54.55% of mothers knew that KMC is a recommended method by WHO to practice worldwide.

3.2 Physical barriers against implementing Kangaroo Mother Care

When considering the physical barriers, difficulty in sitting for a long time (19.18%) and difficulty in waiting in the KMC position for a long time (17.91%) were identified as major physical barriers to implementing KMC while body aches (4.55%), low health care facilities to protecting privacy (7.2%) and low space (9%) were not significant barriers in implementing KMC.

3.3 Psychological barriers against implementing KMC

59.09% of mothers had a fear to handling the small infants with a cannula, N.G tubes, monitors and nasal prong oxygen while 22.72% mothers thought that KMC causes pain to their babies.

3.4 Socio-Cultural barriers against implementing KMC

Lack of information regarding KMC (96.21%), lack of knowledge on benefits of KMC (22.73%) and traditional wear (31.82%) are identified as major socio-cultural barriers to implementing KMC.

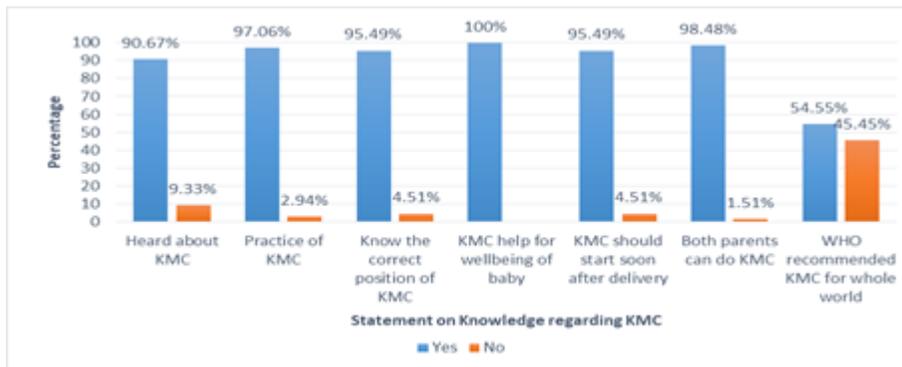


Figure 1: Mothers' Knowledge regarding Kangaroo Mother Care

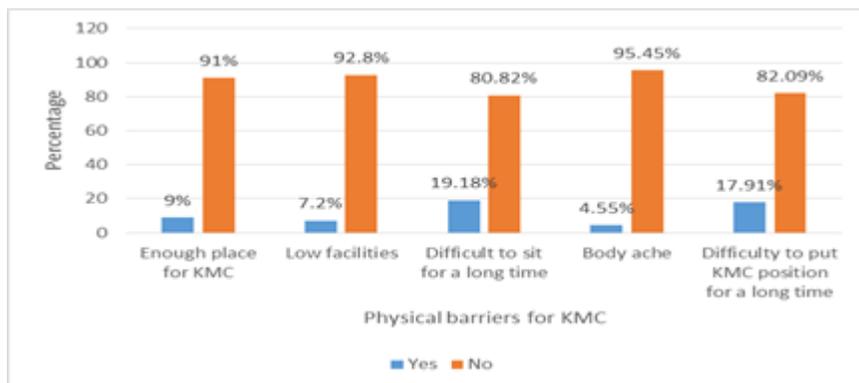


Figure 2: Physical barriers against implementing KMC

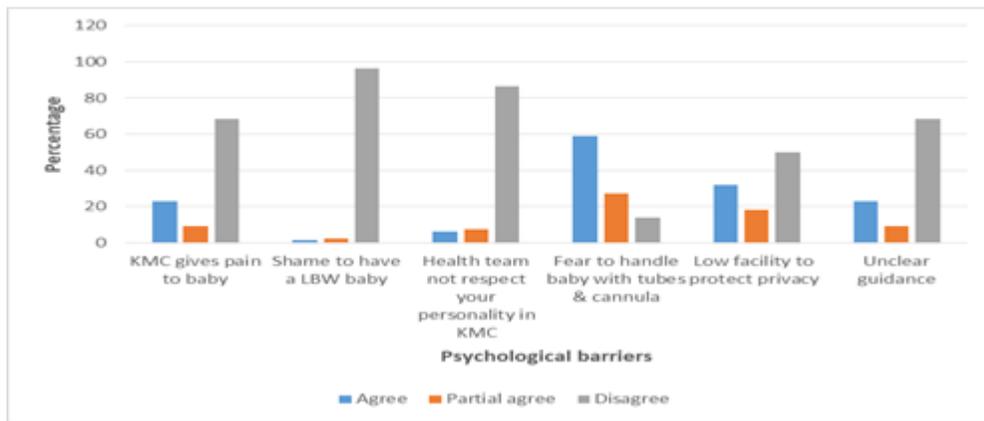


Figure 3: Psychological barriers against implementing KMC

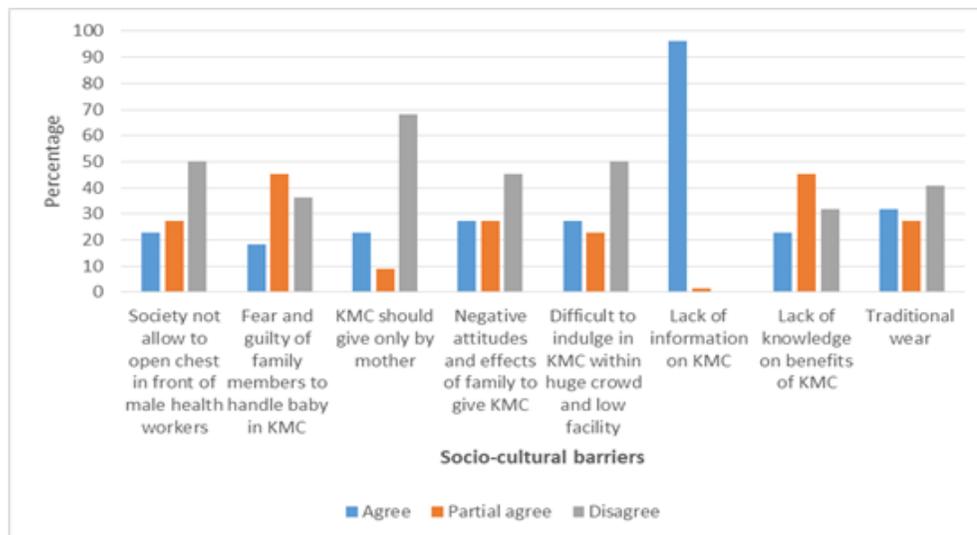


Figure 4: Socio-cultural barriers against implementing KMC

4 DISCUSSION

The purpose of this study was to reveal the barriers against implementing KMC among postnatal mothers with premature low birth babies in PGH, Rathnapura. When considering the knowledge regarding KMC, the findings highlighted that a majority of mothers had good knowledge regarding KMC where it gives similar results to two studies done in India (Castalino *et al.*, 2014; Kavitha *et al.*, 2012).

In this study, the difficulty in sitting for a long time and difficulty in holding the baby in the kangaroo position for a long time were identified as the main physical barriers against implementing KMC. But fatigue is was not a barrier for any mother in this sample. Similar findings were reported by Seidman *et al.* (2015) concluding that discomfort on the chest or back of the mother and discomfort related to temperature were barriers for a



considerable amount of mothers of that sample. Furthermore they highlighted that a lack of resources of the working environment as a main physical barrier which is a contrast with the findings of this study as only 7.2% of mothers identify low facilities as a barrier.

From current study findings some psychological barriers were identified including the fear of handling a small infant with a cannula, N.G tubes, nasal prong and monitors. This result is similar to the study which was done in USA (Blacke and Gregson, 2011). Nearly one fifth of the mothers thought that KMC would hurt their little baby. It was highlighted by a study result in Pakistan (Seidman *et al.*, 2015). Further, low facility to protect privacy during KMC was identified as one of the psychological barriers among post-natal mothers.

Regarding socio-cultural barriers against implementing KMC, maintain cultural acceptable privacy standards in the ward when practicing KMC is identified as the one of the barriers for a few mothers. The same result was found in studies in South Asian countries (Seidman *et al.*, 2015). Furthermore, it was found that low awareness on benefits of KMC is one of the socio-cultural barriers among post-natal mothers. In contrast to the current study, Blacke and Gregson (2011) found that mothers are well aware of the benefits of KMC in USA. In this study there were no barriers against implementing KMC by fathers. However, in settings like Zimbabwe fathers did not perform KMC due to the cultural and social norms (Chan *et al.*, 2015).

5 CONCLUSIONS AND RECOMMENDATIONS

It is critical to understand the barriers against practicing KMC for the end-users, often the mother, of this life-saving practice, which has many additional

benefits for both, the infants and the mothers. As a summary of this study, considering all the factors that have been investigated, it is evident that, there are some barriers against implementing KMC among post-natal mothers with premature, low birth weight babies. This study findings provided baseline data that will be useful in planning health promoting lifestyle interventions for post-natal mothers who have premature low birth weight babies.

After considering the findings, some tasks have been identified which will be implemented more successfully in the future. Giving continuous training using leaflets, posters, videos in relevant languages, conducting teaching sessions, using trained staff to demonstrate the method, KMC can be implemented. Single training is not enough for health care providers and it should be conducted at regular intervals. By addressing barriers and by building trust, effective uptake of KMC into the health system will increase and this will help improve neonatal survival.

Acknowledgments

We would like to express our sincere gratitude to all the participants, the Director of Provincial General Hospital (P.G.H), Rathnapura, consultants, matrons, ward sisters and in-charge nurses of relevant sections and wards and the Ethical Review Committee of the Colombo South Teaching Hospital for their kind co-operation.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Knowledge, Attitudes and Practices on Oral Rehydration Salt Solution for Diarrhoea among Mothers with Children under Five Years Old

T.T.D.D. Fernando, S.D.N. Tharanganie, S.M.C.J. Subasinghe, K.P.S.D. Pathirana, R.B.B.S. Ramachandra, A.S.P.L. Senadheera* and W.N. Priyanthi

Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: lakmalisenadheera89@gmail.com*

1 INTRODUCTION

Diarrhoea is the passage of loose or liquid stools three or more times per day or more frequent passage of stools than normal for the individual (World Health Organization [WHO], 2013). Diarrhoeal diseases have become the second leading cause of death among children under five years old (WHO, 2013). Nearly 1.3 million childhood deaths occur per year due to diarrhoea (United Nations International Children's Emergency Fund [UNICEF] 2012) as a result of severe dehydration and fluid loss (WHO, 2013). Dehydration can be defined as loss of water and salts essential for normal body function (Oxford Medical Dictionary, 2017). As the major public health effort in management of diarrhoea, prevention and treating for dehydration is practiced and it has reduced the annual death rate. It can be primarily achieved by ensuring the children with diarrhoea are provided with more fluids during the acute episode. Using Oral Rehydration Salt (ORS) solution combined with increased fluids have proven as very powerful interventions in preventing childhood deaths from diarrhoea (UNICEF, 2012). ORS is simple, inexpensive, easy and most effective primary intervention to treat dehydration (WHO, 2006). ORS is a glucose, citrate and salt mixture which is

called as "Jeewani" in Sri Lanka. Composition of new ORS formula in grams per litre is Sodium Chloride 2.6, Potassium Chloride 1.5, Tri-sodium Citrate dehydrate 2.9, and Glucose anhydrous 13.5 (WHO, 2006). ORS is the immediate and best applicable step in effective home management of acute childhood diarrhoea (Chattopadhyay, 2008) and a simple proven intervention to prevent and treat dehydration due to diarrhoea (Munos *et al.*, 2010). Dehydration from diarrhoea and vomiting threaten lives of children under five years old especially, in developing countries (Onwukwe *et al.*, 2015).

When consider Sri Lanka, childhood deaths due to diarrhoeal diseases has reached 1646 (1.3%) of total deaths (WHO, 2014). Better maternal knowledge, attitudes and their practice towards the usage of ORS are associated with more compliance to use it (Al-Atrushi, Saeed and Yahya, 2012).

Therefore, it is paramount important to study about knowledge, attitudes and practice on ORS among mothers with children under five years old in Sri Lanka.



2 METHODOLOGY

The aim of this study was to assess the knowledge, attitudes and practices on ORS among mothers with five years old children in District General Hospital, Kalutara. A descriptive quantitative study was used in this study (Burns and Grove, 2007). A sample of 228 mothers within 18- 45 years having under five years old children who were admitted to the paediatric wards in the District General Hospital, Kalutara was recruited for this study by using convenience sampling. A self-administered questionnaire was used to collect data on mothers’ knowledge, attitudes and practices on use of ORS for diarrhoea. Content validity of the questionnaire was assured by referring standard literature

and opinions of experts. Ethical approval was obtained from the Ethical Review Committee at the National Institute of Health Sciences in Sri Lanka (NIHS). Informed consent was taken from each voluntary participant. Anonymity and confidentiality were assured by securing the information only among research team. The data were analysed using Statistical Package of Social Sciences (SPSS) 22.

3 RESULTS AND DISCUSSION

Among a total of 228 participants, majority (32%) were 26-30 years old, Sinhalese (87%). Most of the mothers (80%) were not employed and, 52% were educated up to O/L (Table 1).

Table 1: Demographic data

Race		Age Group (Years)		Employed Status		Education Level	
Sinhala	87%	18-25	21%	Employed	20%	Up to Grade 8	12.5%
Muslim	10%	26-30	32%	Non- Employed	80%	Up to O/L	52%
Tamil	3%	31-35	29%			Up to A/L	27%
		36-40	11%			University Education	0.5%
		41-45	7%				

3.1 Mothers’ awareness of on ORS

The findings of this study revealed that most (95%) women had heard about ORS. Further, the majority (90%) knew about the proper way of ORS preparation, storage after preparation (90%) and the correct time to discard ORS (72%). Similar results have been obtained in a study done in India (Kadam, Hadaye and Pandith, 2013). However, findings of a study conducted in Iraq (Al-Atrushi *et al.*, 2012) has shown that 67% of participants did not know exactly about ORS. Further, they showed that 48% and 35.7% did not know the proper way of preparation and administration of ORS

respectively. In that study 54% of mothers had a low level of education and most of them were housewives.

Further, current study shows that the most mothers (90%) also were aware of dehydration. This finding is also supported by similar studies conducted in Nigeria, Pakistan and Kenya (Kalu *et al.*, 2016; Sultana *et al.*, 2010 and Othero *et al.*, 2008). However, on the contrary only a minority of the participants were aware of dehydration in a study done by Senevirathne (2003). In this study, 66.6% had detected diarrhoea through body



weakness whereas 58.3% detected it by observing dry lips and tongue. But, in Kenya, they used excessive thirst and sunken eyes (Othero *et al.*, 2008). However, in this study, 12% of mothers were unable to identify any sign or symptom of dehydration. This is compatible with the findings of the study done in Nigeria (Kalu *et al.*, 2016). This is consistent with the study findings performed in India (Dhadave *et al.*, 2012). In the current study, a majority (86%) of participants had heard about diarrhoea and dehydration from various sources including health care workers (doctors and nurses) while others from Television and radio (45%), parents and friends (38%), posters and leaflets (15%), and through the internet (10%).

3.2 Mothers' attitudes on ORS

With regard to the attitudes of mothers on ORS solution, majority believed that ORS is the best treatment (77%) for

dehydration and can cure diarrhoea (75%). However, unfortunately, some thought Jeewani exaggerates diarrhoea (15%), and it harms the child by increasing the salt level of the body (15%). Further, 58% thought that physician's prescription is needed to initiate ORS. This finding further highlighted the study findings of Rasaniam *et al.* (2005) which was conducted in India. Those Indian mothers believed that ORS has a bad taste. Furthermore, current study findings revealed that 23% believed that ORS administration should be started after passage of stools two times, while 12% thought after once and 11% stated it should be after the child becomes weak. In contrast, in Iraq 77% of women did not believe ORS is enough as a treatment. The lack of understanding of the correct effects of ORS is further highlighted by study findings obtained from a study done in India, as 31.72% mothers thought ORS stops loose motions (Kadam, Hadaye and Pandith, 2014).

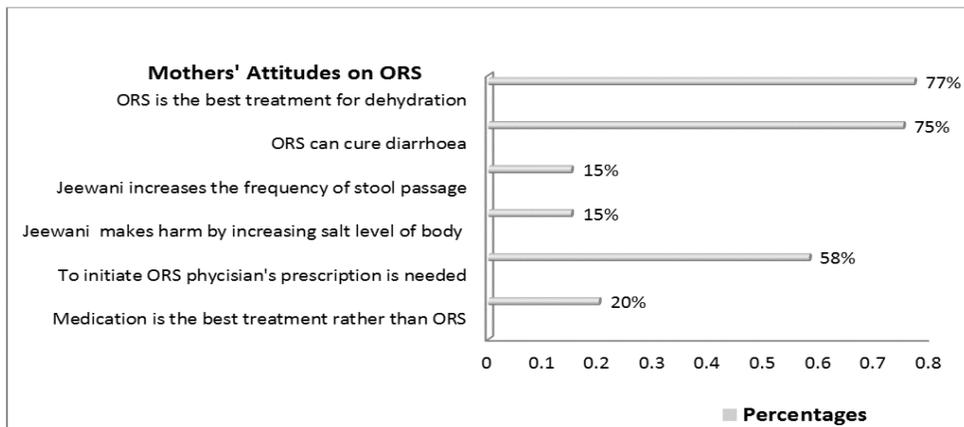


Figure 1: Mothers' attitudes on ORS

3.3 Practices on usage of ORS

With regard to the practices on ORS solution among mothers of this study, 71% have used ORS to prevent diarrhoea

induced dehydration at least once. Similarly, a study done in South Africa, 66% of mothers had used ORS (Onwukwe

et al., 2015). In contrast, a study revealed that only 46% had used ORS in India (Rasania, 2005). In Gambia also found a low use rate (4%) of ORS in practices (Sillah *et al.*, 2013). Of the sample of current study 50% (n=114) have administered ORS according to physician’s instructions while 37% had done it after following the instructions of the packet. Comparatively, a study which was conducted in Brazil found that mothers commenced administration of ORS after the physician’s prescription. In this study 90% of mothers had used boiled cooled water to prepare the solution. However, in India, only 50% of women had used boiled cooled water in ORS preparation (Chattopadhyay, 2008). Moreover, current study findings have shown that only 72% of participants had discarded ORS after 24 hours whereas others were after 12 hours (8%) and after 6hours (17%). Similarly 83% women discarded ORS after 24 hours (Chattopadhyay, 2008). However, according to findings of a study, in Iraq 59% did not know that ORS should be

discarded after 24 hours (Al-Atrushi *et al.*, 2012). When considering the storage of the solution, in this study, 90% of women had kept ORS at room temperature, while the rest stored it in refrigerator or had no idea about storage. As a major barrier of ORS usage, the current study further revealed that ORS is not available at home (72%).

When considering the education level of mothers, most mothers (92%) in the current study were educated up to A/L and they knew about ORS and could identify that dehydration resulted from diarrhoea. Therefore, the contrast for the differences of knowledge, attitudes and practice about ORS among mothers may be due to less education level of mothers. The findings of a study conducted by Gazi (2015) revealed that, knowledge level of mothers was average (66.2%), favorable attitude was (76.5%) while an average level of practice (72.2%). Furthermore, they found that education level, occupation and socio-economic status as influencing factors of KAP on home care of diarrhea.

Table 1: Mothers’ practices on ORS

Practice of Mothers on ORS	Percentages
Commenced ORS administration after passage of loose stools more than two times	23%
Administered ORS following instructions on the packet	37%
Stored ORS in room temperature	90%
Discarded ORS after 24 hours its preparation	72%
ORS packets are readily available at home	28%

4 CONCLUSIONS AND RECOMMENDATIONS

According to the findings of this study, maternal knowledge level on ORS and dehydration was good. Majority of mothers were aware of diarrhoea and dehydration and they had known ORS as a treatment method. Most of the mothers had the ability to identify signs and symptoms of dehydration. However, their attitudes on ORS were poor. The majority

believed that without physician’s prescription they could not initiate ORS. They have some misconceptions on ORS such as, ORS increases the frequency of diarrhoea, salt level of the body and it leads to body swelling. Moreover, the practices on ORS usage were average among the study participants. When considering the practices, the majority had



used ORS but only small number of mothers had followed the instructions on the packet. Their practice is not satisfactory on initiation, administration, storage and discarding of ORS solution. Mothers have inadequate concern about keeping ORS packets available at home. There are some gaps still present in knowledge, attitude and practice of home management of acute diarrheal diseases among mothers with five year old children.

As ORS is a vital treatment to prevent dehydration due to diarrhea, awareness programs are highly recommended to improve mothers' knowledge on dehydration and especially proper usage and practice of ORS. As the education level is at a higher level it will be easy to transfer the correct messages to them. Both hospital and community based awareness campaigns and poster competitions should be organized and mass media should be used effectively in enhancing the knowledge, attitudes and practices on ORS solution. The government in conjunction with relevant pharmaceutical agencies should ensure regular provision and prompt availability of ORS sachets in all health care settings. Further research should be carried out on knowledge of ORS among mothers in different settings.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Knowledge, Practices and Affecting Factors Regarding Contraceptive Methods among Married Women in the Estate Community

Ramani Kumari*, W.S. Wickaramathunga, R.M.C.S. Bandara, A.T.L. Ganegoda, and W.N. Priyanthi

Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: kumara.ramani47@yahoo.com*

1 INTRODUCTION

The world population density is rapidly increasing and it will reach around 2.5 billion by the next 43 years (United Nation, 2007). Minimal usage of contraceptive is one of attributing factors that lead to expansive growth of population in developing countries (Olugbenga-Bello *et al.*, 2011). In addition, family planning is an strategy in promoting maternal and child health. It helps to enhance maternal health through maintaining adequate spacing of birth, and avoiding pregnancy at high-risk maternal ages (Handady *et al.*, 2015). Although, there is a wide availability of various types of family planning methods, the rate of population growth and unplanned pregnancies are still remaining in a higher position in developing countries (Davanzo and Adamson, 1999). Further, unplanned pregnancies can be reduced by using contraceptive methods properly (Sherpa *et al.*, 2013).

Furthermore lack of awareness, low level of education, religious beliefs and fear of side effects are some reasons for avoiding family planning methods (Handady *et al.*, 2015). With the result of that, unintended pregnancies and illegal abortions have increased which contribute to a high maternal mortality rate (Monjok, 2010).

When consider the situation of Sri Lanka, family planning was accepted as a part of the National Health Policy (NHP) in 1965 and the records have proved that Sri Lanka has shown the best family planning performance in the region (Annual Health Bulletin, 2012). However, maternal and infant mortality rate has been reported at a higher level, especially in the Tea estate areas, than rest of the country in Sri Lanka (Ministry of Health and Nutrition, 2008). Family planning methods have been recognized as one of paramount important factors in reducing maternal and infant deaths in developing countries (Ahmed *et al.*, 2012) through reducing the number of births (Fortney, 1987). Therefore, it is pivotally important to assess women's knowledge, and practices on family planning methods among women in tea estate area, Haputale, Sri Lanka.

2 METHODOLOGY

The main purpose of this study is to assess the knowledge, practices and affecting factors on family planning methods among married women in Tea estate community of MOH area, Haputale in Badulla District, Sri Lanka. A quantitative approach and descriptive design were used for this study. The population of this study was married women, who live in the five tea estates; Haputale, Kahagala,



Glenanore, Pitaratmale and Dambetenna of MOH area of Haputale in the Badulla district. One hundred and fifty (150) married women aged 18- 49 years were selected as participants by using simple random sampling method. The widows and divorcees were excluded from the study. Interviewer administered questionnaire was used as the data collection tool. The first part of the questionnaire consisted of a participant’s demographical data, second part sought to identify knowledge regarding contraceptive methods. Practices regarding contraceptive methods and affecting factors regarding contraceptive methods were included in the third and

fourth part of the questionnaire respectively. The content was validated by sound literature review and assessing by subject experts. A pilot test was done by collecting data from 10 students and they were not included to the sample but met the inclusion criteria of the study to establish the reliability. Ethical approval was obtained from National Hospital of Sri Lanka (NHSL). Prior to administering questionnaires, the aims and objectives of the study were explained to the participants and written informed consent was obtained. Voluntary participation was encouraged. Data analysis done by using the statistical package for Social Sciences (SPSS) 16.

3 RESULTS AND DISCUSSION

Table 1: Socio demographic characteristics

	Variable	n=150	Percentage (%)
Age	19 – 29	78	52
	30 – 39	69	46
	40 – 49	03	02
Ethnicity	Sinhala	04	2.7
	Tamil	142	94.7
	Muslim	4	2.7
	Variables	N=150	Percentage (%)
Religion	Buddhist	2	1.3
	Hindu	117	78
	Christian	22	14.7
	Islamic	09	06
Education	Below O/L	76	50
	Pass O/L	44	29.3
	Pass A/L	27	18
	Degree Holders	03	02

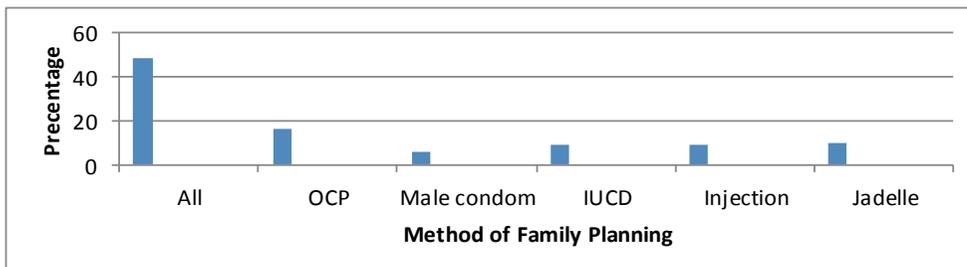


Figure 1: Awareness regarding family planning methods.



According to socio demographic characteristic, most of participants of this study were Tamil 142(94.7%), Hindu 117 (78%) and 78 (52%) aged between 19 – 29 years. Out of 150 participants, 76 (50%) had educated up to ordinary level [GCE (O/L)] examination.

3.1 Awareness regarding family planning methods

With regard to the knowledge of family planning methods, 48.7% have heard about all the family planning methods considered in this study. Further, 16.7% heard about oral contraceptive pills (OCP) only, while 6.0% male condoms, 9.3% intra uterine contraceptive devices (IUCD) and Depo-Provera injection, and 10.0% had known of the skin implantation (Jadelle) (Figure 1). According to Sharma and Kafle (2017), 14% of the respondents were not aware about any methods of family planning methods (Figure 1). Similar results were obtained from a study conducted by Handady *et al.*, (2015) as the majority of women (87.0%) were aware of family planning, while (13.0%) had very poor knowledge on this matter. Concerning the resources of information among this study sample, 85.3% had received the knowledge from health care

workers, while 4.7% from friends, 4.7% though printed materials and 6.0% via formal education.

In the study population, 23.3 % showed an excellent knowledge level while 18.0% were very good, 25.3% were good whereas 33.3% were in an unsatisfactory level. Although 74% had known that family planning methods can prevent pregnancy, only 53.3% had known that such methods can prevent human immune deficiency virus (HIV/ AIDS) by using contraceptives (especially male condoms). Similarly, Olamijulo (2012) found that 6.6% had poor knowledge about contraception while the rest had fair to excellent knowledge.

3.2 Practice of Family Planning Methods

According to the practice of family planning methods, 7.3% have used OCPs , 8% male condoms, 16.0% IUCD , 10.0% Depo-Provera injection, 11.3% Jadelle, 6% ligation and resection of tubes (LRT), whereas 1.3% have practiced traditional methods like calendar method, withdrawal and basal body temperature method (Figure 2).

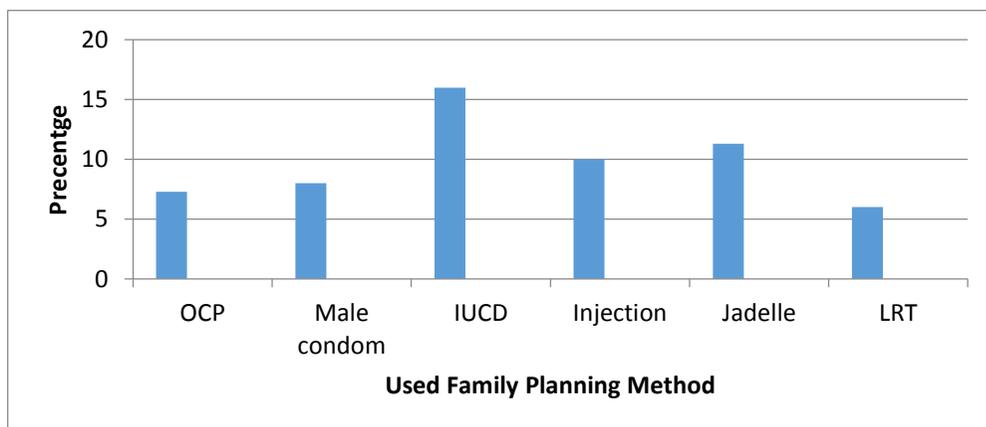


Figure 2: Practices regarding family planning methods

Considering the reasons for not using family planning methods, of the sample 26.7% of women were planning to get pregnant. Further, 15.3% avoided due to fear of side effects, 6.3% preferred to use traditional methods, 9.3% identified husbands as the main obstacle. Similar results were found by Utoo *et al.* (2010) as 36.5% of women refused contraceptive methods because of desire for more

children. Moreover Olamijulo *et al.* (2012) found that 69% women stopped using contraceptive because they wanted to get pregnant. When asked what they prefer to use as family planning, both male and female mostly prefer to use IUCD, secondly injection, then OCP and the lowest preferred method among them was the traditional methods.

Table 2: Reasons for not using family planning

	n=150	Percentage %
Expecting pregnancy	40	26.7%
Fear for side effects,	23	15.3%
Like to use traditional methods,	10	6.3%
Obstacles of husband	14	9.3%

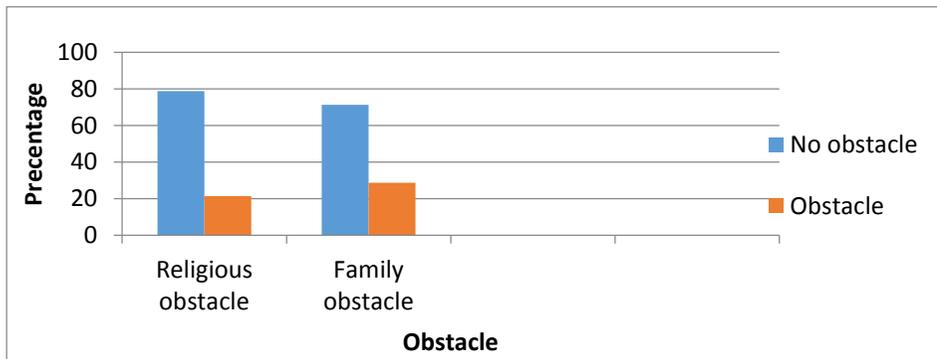


Figure 3: Affecting factor on family planning

Moreover, the study found religious obstacles for using family planning methods among Hindu (21.3%) and Islam (78.7%). Obstacles from family members were 28.7% and 71.3% had support them (figure 3). Most of them(77.3%) preferred to get family planning services from the MOH centers while the others from hospitals (19.3%), from pharmacies (3.3%). There were similar findings, fear of side effect and husbands’ disapproval

being the main reasons for the non-use of contraceptive methods (Olugbenga-Bello *et al.*, 2011). Furthermore 37.4% felt that the husband should solely decide on family planning, while 21.4% felt it was the wife/partner, but 41.2% felt it is a joint responsibility of husband and wife/partner. Moreover 92.0% had good sexual relationship with husband and 4 % had not.

4 CONCLUSIONS AND RECOMMENDATIONS

The study findings conclude that the women's knowledge on family planning is inadequate, and the practice of using contraceptives was poor. Fear of side effects of contraceptives and preference for more children were found to be the main reasons for avoiding contraceptives. Socio-demographic factors like education level, gender and number of children and partners' support for family planning are the influencing factors on the usage of contraceptive methods among the participants. Therefore, it is highly recommended to organize awareness programmes on family planning for the tea estate population. It is better to improve knowledge and attitudes among both partners and conduct counseling session regarding this matter. In addition, importance of the role of a nurse in health education is highlighted and her partnership for reducing maternal mortality rate among the tea estate community is highly emphasized both nationally and internationally.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

The Reasons for Delayed Presentation of Breast Cancer: A Descriptive Study at the Teaching Hospital, Kandy

H.T.P. Lakmali¹ A.W.D.S. Dharmathilaka¹ H.M.S. Herath¹ K.D.S.N. Weerasekara¹ R.S.R. Rajakulasooriya² and B.S.S. De Silva^{1*}

¹Department of Nursing, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Department of Medical Laboratory Sciences, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: bssil@ou.ac.lk

1 INTRODUCTION

Breast cancer is a disease that causes cells in the breast to change and grow out of control (American Cancer Society, 2015). It is the most common diagnosed cancer and the leading cause of cancer deaths among women, accounting 25% of all cancer cases and 15% of all cancer deaths among females (Ferlay, *et al.*, 2012). According to a report published by the International Agency for Research on Cancer (Ferlay, *et al.*, 2012), almost 50% of patients with breast cancer and 58% of breast cancer deaths occur in developing countries. The problem has become a burden in developing countries due to the delayed presentation of breast cancer, thus increasing the mortality rates (Khakbazan *et al.*, 2014).

Delayed presentation of breast cancer is defined as delay between first detection of symptoms and first medical consultation. Prolong delay is usually taken as intervals greater than 12 weeks (Montazeri *et al.*, 2003). A Delay of more than 12 weeks is associated with more advanced stages of cancer and reduced survival (Unger & Saldaña *et al.*, 2015). According to a review study on delay in presentation of breast cancer done by Caplain (2014), prognosis of the breast cancer and mortality is increased by 24% for a delay of more than six months and by 13% for a

delay more than three months. Because the main reason is, by the time subject seeks medical attention, the cancer has developed to advanced stages.

This leads to increased psychological stress of patients and use of more toxic treatments such as chemotherapy agents (American Cancer Society, 2015). Therefore, the delayed diagnosis of breast cancer can have a negative effect on quality of life. Literature highlights that delayed presentation of breast cancer is influenced by knowledge, attitudes, socio-economic and psychological factors of the patient (Khan *et al.*; Iqbal, 2014).

Therefore, understanding the perceived factors that influence delayed presentation of breast cancer is crucial in order to increase the awareness of women about breast self-examination, seeking of health care and to develop specific prevention strategies. Accordingly, the purpose of this study is to describe the perceived factors related to delayed presentation of breast cancer among patients admitted to female oncology wards at Teaching Hospital, Kandy.

2 METHODOLOGY

A quantitative, descriptive study was



carried out during the period of February to March 2017 in the Female Oncology Wards and the Clinic at the Teaching Hospital, Kandy. A total of 128 patients between 16-51 years age who were diagnosed as delayed presentation of breast cancer on admission during 2015 to 2016 at the cancer unit were purposively recruited for this study.

Data was collected from volunteered patients using a pre-tested self-administrated questionnaire. Information, including knowledge and attitudes, socio-economic and psychological factors influencing delayed presentation of breast cancer, was collected. Content validity of the questionnaire was assured by referring to the standard literature and the subject experts. Ethical clearance was obtained from the Ethics Review Committee, Teaching Hospital, Kandy. Informed written consent was obtained from each participant prior to the study. Data analysis was done with descriptive statistics using Statistical Package for the Social Sciences (SPSS).

3 RESULTS AND DISCUSSION

The response rate was 94% (120).

Table 1: Demographic characteristics of the participants (n=120)

Demographic character		Frequency	Percentage
Age group (years)	16 - 20	0	0.0
	21 - 30	03	2.5
	31 - 40	22	18.3
	41 - 50	48	40.0
	≥ 50	47	39.2
Civil status	Married	64	53.3
	Divorced/ Widowed	48	40.0
	Unmarried	08	6.7
Ethnicity	Sinhalese	48	40.0
	Tamil	34	28.4
	Muslim	30	25.0
	Other	08	6.6

Perceived factors were discussed under three main categories: knowledge and attitudes, socio-economic factors and psychological factors.

The Majority of the study population (79.2%) was above 40 years, showing that they were a high-risk group vulnerable to breast cancers. Among the participants, 53.3% were married, 40.0% divorced or widowed, while 6.7% were single (Table. 1). Although a large number of participants were married, significant number of divorced or widowed women (40%, 48) have delayed presentation of breast cancer. Kumari and Goonawardena (2011) reported that widowed and divorced women have significant delay ($p=0.037$, 95% Confidence Interval (CI)) for presentation of breast cancer compared to married women. Similar findings have been also reported by Montazeri *et al.* (2003). Significant delayed presentation of breast cancer among divorced or widowed participants was mainly due to the lack of self-motivation or lack of motivation by relatives to seek medication.

3.1 Knowledge and Attitudes

The study findings indicated that 35% (42)



of participants had poor knowledge about early symptoms of breast cancers while 28.8% (34) did not know about the breast cancer screening tests. Lack of awareness due to the painless nature of the breast cancer was the main reason for delayed presentation (36%, 43). About 16.6% (19) of delayed cases were presented as wasting time on alternative medicines and home remedies. Cases that presented delay due to misbeliefs or negative attitudes about cancer and cancer treatments were 5% (06) of the participants.

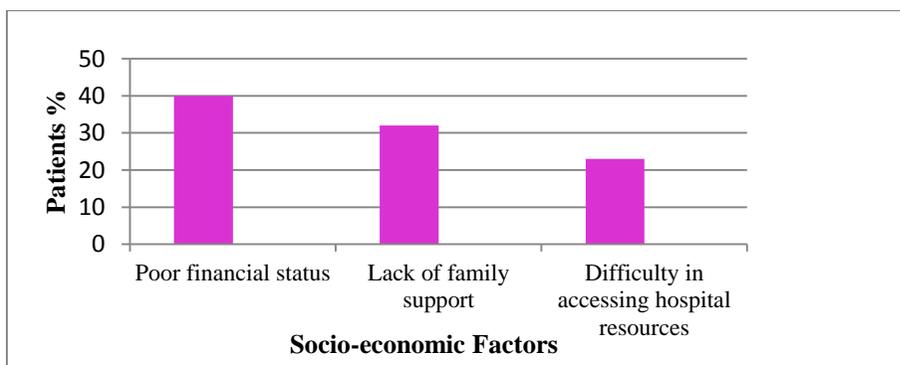
3.2 Socio-economic Factors

Delayed presentation for health care (40%, 48) was prominent among participants with monthly income less than 35,000 Sri Lankan Rupees (LKR). In

addition to that lack of family support (31.6%, 38) and living in a rural area with poor cancer screening or treatment facilities (22.5%, 27) were further highlighted (Figure. 1). Kumari and Goonawardena (2011) also observed that more than half of the patients in their study had income less than 10,000 LKR. Rathnayake, Halyale, Tharanga, Herath and De Silva (2017) reported that 56% patients with breast cancer had monthly income less than 10,000 LKR while 22% were unemployed.

In this study, majority of the study population was living in urban areas. However, 22.5% (27) participants from rural area were observed. Kumari and Goonawardena (2011) has reported that distance from patient's residence to the first contact health care and time taken to seek treatment have significant association ($p=0.003$, 95% CI).

Figure 1: Influence of socio-economic factors on delayed presentation of breast cancer



3.3 Psychological Factors

As shown in the Figure 2, 36.6% (44) participants stated the fear of hospitalization and surgery as the reasons for delayed presentation. However, contribution of other psychological perceived factors such as, shyness for showing breast cancer to physician (25%,

30) and fear of unbearable pains or treatments (18.3%, 22) were also revealed. Meechan, Collins, and Petrie (2003) have found that distress on discovery of the breast cancer has significantly affected the delay in presentation of breast cancer.

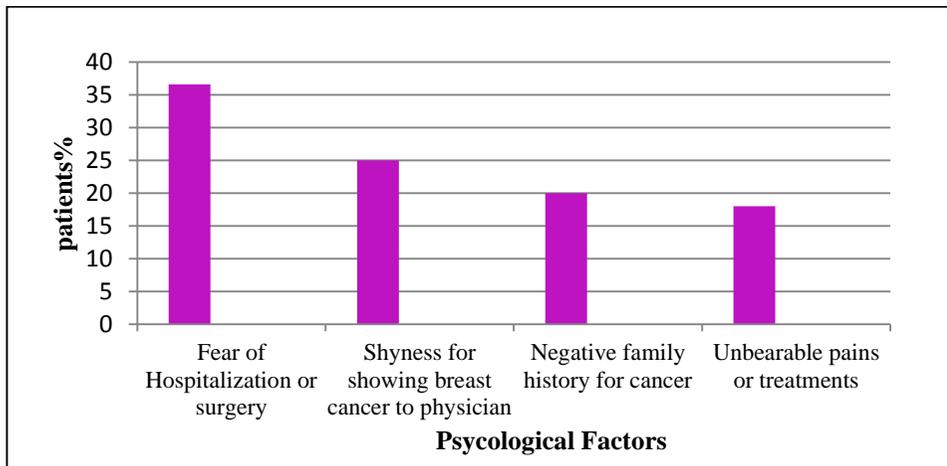


Figure 2: Influence of psychological factors on delayed presentation of breast cancer

4 CONCLUSIONS AND RECOMMENDATIONS

Study findings highlighted that lack of knowledge regarding the symptoms of breast cancer, poor financial status, lack of family support and fear of hospitalization and surgery were commonly perceived factors for delayed presentation of breast cancer. Special attention is required on these areas when developing the prevention strategies to prevent delaying presentation of breast cancer. Further studies should be extended to a larger population including other hospitals to clearly identify the factors influencing delayed presentation of breast cancer in Sri Lanka. According to the findings of the current study we recommend public awareness programmes about breast cancer highlighting the importance of early detection of breast cancer through breast self-examination, and early seeking of health care.

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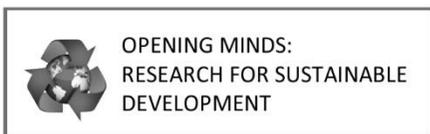
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**LAW, MANAGEMENT AND SOCIAL
SCIENCES**



Broadcast Ratings System in Sri Lanka: Issues and Implications

G.T. Madhubhashini*

Department of Social Studies, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: gtmad@ou.ac.lk*

1 INTRODUCTION

The media is one of the faster growing industries in the world today. People today can access varied media content anytime and from a multitude of platforms such as radio and TV sets, Smartphones, computers etc. Having more pathways available to more users than ever before has drawn a greater number of advertisers, marketing professionals, brand managers and media buying companies to the industry. Way (2014) notes that these professionals need media consumption details to understand the audience behavior patterns. Once they understand audience behavior and preferences through the ratings, media owners, managers and content creators can optimize their programming and also sell advertising space/time more efficiently.

The ratings data is used by media buyers, managers, journalists/producers, marketing and promotion officers and advertisers for their own purposes. They all want to remain relevant, focused and effective in how programming content and advertising content are positioned and delivered. This is a legitimate business activity in today's market based media industry. Broadcast ratings data is the trusted solution worldwide to understand media consumers' preferences and engagement with TV, radio, digital, mobile, out-of-home and social media content according to Way (2014).

As far as Sri Lankan Media industry is concerned, there are more than 60 radio

channels, 20 television channels and 200 newspapers in all three languages. Two market research companies only operate audience rating systems on radio and television broadcasting in Sri Lanka, namely, Lanka Market Research Bureau (Pvt) Limited (LMRB), and Survey Research Lanka (Pvt) Limited (SRL). The ratings data has a disproportionately high level of control over the economic viability of broadcast stations, as well as on their programme scheduling decisions and content creation action.

The ratings are used by corporate advertisers to determine much of their advertising spending in the broadcast media. Naturally, all advertisers like to be associated with programming belts and content types that attract a greater audience as evidenced by the ratings. Meanwhile, broadcasters use ratings data to judge their individual performance against their competitive stations. In addition, they too may commission customized market research to better understand how their audiences behave. Yet the ratings systems operating in Sri Lanka have generally lacked transparency in terms of their methodology and process. Apart from giving basic descriptions on their corporate websites, neither ratings company discloses details about their surveying methodologies in public. In the absence of details, the methodology has been questioned and even challenged by some broadcasters in recent years (Sri Lanka. Secretariat for Media Reforms, 2016).

In other words, some key players in the



Lankan broadcast industry raised a credibility issue and questioned the authenticity of the ratings data provided by the ratings companies, arguing that these do not necessarily reflect the public's real viewing or listening habits. In this context, few questions can be identified: Why does the Lankan broadcast industry not satisfied with the current broadcast ratings system in Sri Lanka? What are the issues in current broadcast ratings system and how to overcome these issues? Therefore, the purpose of this study is to identify the issues in contemporary broadcast ratings system in Sri Lanka with a view to recommend solutions to overcome these issues.

2 METHODOLOGY

Qualitative approach was used to collect the data of this study. Mainly in-depth interviews were conducted with broadcasters, advertisers, advertising companies, and rating companies within a specific 3 week period. It is important to interview these key players in the broadcast industry to identify the issues in the ratings system in Sri Lanka. Semi-structured questions were prepared and formal interviews were personally conducted with the resource persons.

There are 40 registered institutions for Radio and TV licenses in Sri Lanka (Rebuilding Public Trust 2016). Therefore, all the broadcasters in Sri Lanka were invited for the interviews, but only 10 broadcasters were presented at the interviews (IWS Holdings (Art TV) ,The Buddhist TV ,Sri Lanka Rupavahini Corporation (SLRC), Telshan Networks (Pvt) Limited (TNL) , EAP Broadcasting Company (EBC) – Radio , MTV Channel (Pvt) Limited MBC Networks (Pvt) Ltd (popularly known as Sirasa Media Group), EAP Broadcasting Company Limited (Swarnawahini) Power House Ltd, TV Derana and FM Derana and ITN). Two rating companies were interviewed (Lanka Market Research Bureau (LMRB)

Survey Research Lanka Ltd). Top 5 advertisers and advertising agencies were invited to identify the issues in broadcast ratings in Sri Lanka, but a few participated, they are: Advertising agencies - Association of Accredited Advertising Agencies (4As), Group M PHD Sri Lanka, PhD Sri Lanka and Advertisers - Ceylon Biscuits Ltd and Sri Lanka Telecom.

3 RESULTS AND DISCUSSION

The purpose was achieved according to the results/ findings of the study. Therefore, the data were analyzed in order to identify the issues in broadcast ratings system in Sri Lanka. Based on the findings, some significant issues can be identified as follows:

Impact on programme content, format and scheduling:

Broadcast managers emphasized that they use rating reports to decide on the placing of advertisements as well as the scheduling of programmes. The input of resources for various programmes is decided accordingly. Therefore, the rating reports have a direct impact on the content, format and scheduling of programmes on radio and TV. This is an imperfect approach. Even the most rigorously produced ratings system can only provide relative rankings for broadcast timeslots and programme types that are favoured by more listeners or viewers, in other words, an indication of popularity.

Lack of Transparency:

A clear majority of stakeholders mentioned that there is insufficient openness of the methodology followed by the two ratings service providers with regard to key factors like sample size, data collection, analyzing and delivering process. In the absence of transparency, there is room for omissions, errors and biases. Some smaller broadcasters completely ignore the ratings, and use



alternative methods for generating advertising or sponsorship revenue. How do broadcast channels get listed and covered in the broadcast ratings? This process is also not clear. Do they seek to be added and, in return, do they need to subscribe to the services? Is there any correlation between a station being a subscriber to ratings reports and its channels being included in the ratings coverage? These questions were raised by some broadcasters. Reacting to these concerns, LMRB says that some broadcasters seem to follow a “policy of using ratings only when they are favourable” and that “ratings provider is used as scapegoat to cover up (broadcasters’ own) deficiencies”.

Methodology and Sampling issues:

LMRB uses a type of People Meter (known as Rapid Meter system) to determine the ratings for each TV channel in Sri Lanka. About 600 People Meters were installed all over the country and a sample size of 2,200 individual viewers is covered. Therefore, there is no mechanism to cover island wide population by this method. Both LMRB and SRL use the diary system to measure radio audience preferences. The diary method has several inherent limitations: it does not reflect shorter listening periods, and the diary is not likely to reflect tuning when no listening occurs, some sample members may not be able to provide the level of detail, or use the concepts that the researcher is interested in and etc.

Market Domination:

As mentioned earlier, there is a duopoly in the rating industry. Broadcasters, advertisers and any other users have a simple choice between LMRB and SRL. Of them, LMRB is owned by an international market research group, while SRL is fully locally owned. Both companies have their niche products and niche services. Also, their scope of activities is significantly broader than

producing broadcast ratings.

High equipment costs:

Ratings companies in many countries have been automating the capturing of audience behaviour by investing in modern technology. The technical equipment that measures the audience quantitatively are sophisticated and also expensive. Therefore, it is not easy for ratings service providers to make much profit. One way to reduce capital and operating costs is to manufacture the equipment in Sri Lanka. SRL says it once explored the possibility of producing people meters locally by collaborating with the University of Moratuwa. So far, however, such local manufacturing has not happened. LMRB has also explored this possibility, but says it “could not find any local party with the necessary technical knowledge and manufacturing capability”.

4 CONCLUSIONS AND RECOMMENDATIONS

As per the purpose of the study, research questions were answered according to the findings /results. In other words, Lankan broadcast industry is not satisfied with the current broadcast ratings system in Sri Lanka due to above issues and reasons. Therefore, the following conclusions and recommendations can be suggested to overcome these issues. Broadcast ratings are inherently contentious because they rank competitive broadcasters, who in return determine advertising revenue that impacts their economic viability. The big challenge is to ensure the ratings have a high level of integrity and credibility. It is clear from stakeholder interviews that there is considerable distrust and tension between broadcasters and the ratings service providers in Sri Lanka. There should be an independent monitoring body with multi-stakeholder participation (i.e. with suitable representation from the Media Ministry, state and private



broadcast companies, advertising industry and broadcast rating service providers, along with eminent researchers or academics). Such a body needs to be independent of the state, as well as of the ratings service providers and their subscribers. The scope and functions of such a body needs to be defined carefully. The overall mandate would be to: monitor and validate the existing and future rating systems; provide some technical oversight on ratings methodologies; carry out periodical audits of the ratings results; serve as a dispute resolution body and complaints investigation mechanism; and carry out audits on unethical promotions and attempted manipulations by broadcasters and report on findings.

It is important to strengthen the current ratings service providers. This is to be pursued through a more rigorous methodology leading to more credible and acceptable results; use of a sample more representative of the diverse and multicultural audience; and better serving the needs of advertisers as well as of broadcasters. Some other specific recommendations can be also identified. There is a clear need for increasing the sample size to represent the adequate numbers, geographical distribution and diversity of television viewers in Sri Lanka. The sample size should go up from the current 2,200 viewers to at least 8,800. Sample distribution of households with People Meters should be expanded based on a good sample frame. More efforts should be made to enhance the transparency of the TV rating methodology and outcomes without compromising the necessary confidentiality of the system. The independent monitoring body with multi-stakeholder participation can provide this. Viewership should be averaged not daily or monthly, as currently done, but once every three months as well as on an annual basis. If the People Meter is so expensive for LMRB to afford more units, the government should provide duty free concessions for importing these meters.

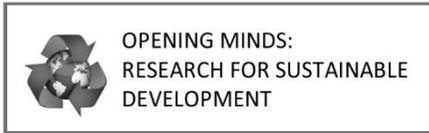
Alternatively, the frequency could be increased installing People Meters every three months' time to another randomly selected 6,000 households (on rotation basis). The rating system should be audited and validated from time to time by an independent body outside the ratings service providers and their subscribers. There should be regular audience surveys by market research companies and/or mass media researchers to better understand the qualitative aspects – the likes, dislikes, unmet needs and behaviour patterns of audiences.

It is also important to understand the requirements of niche audiences, as well as nationally significant broadcast content that do not fall within the popular demand categories. Ways must be found to accommodate these special interests. Measuring English and Tamil audiences and various genres independently may provide a better picture of the minority tastes. This will also help the advertisers to make specific and targeted placement decisions. The quality of radio and TV programming should also be assessed on a regular basis. For this, it is suggested that the Media Ministry sets up a review panel that uses a transparent qualitative method to assess and benchmark programming on an annual basis. Such a process should be driven by a public service broadcasting perspective. There needs to be a code of ethics for broadcast channel and programme promotion. This should ideally emerge from the broadcast industry itself, but media savvy civil society groups and media researchers can also play a role in drafting one.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
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Comparative Analysis of Collective Management Organizations of Copyrights and Related Rights; with Special Reference to Sri Lanka

W.A. Sanath S. Wijesinghe*

Department of Legal Studies, Faculty of Humanities and Social Sciences, The Open University of Sri Lanka

**Corresponding author: Email: waswi@ou.ac.lk*

1 INTRODUCTION

This research aims to review the existing models of collective management of copyrights and related rights, with particular reference to the Sri Lankan Intellectual Property (IP) framework. At international level different models of Collective Management Organizations (CMOs) can be identified which provide an effective platform for utilizing the results of the creativity of the human mind. CMOs are authorized to manage copyrights and related rights by the right holders as an economically efficient means of managing their rights (Richard, 2016). In this context, CMOs carry out the task of monitoring, licensing, collecting and distributing royalties relating to copyrighted works on behalf of the right holders. Such an initiative would immensely contribute to strengthen the intellectual property rights of the owners who may find it difficult to do so individually on the one hand, and such a system offers advantages to the users or the prospective users of such works on the other. However, we cannot identify a comprehensive and authoritative system of CMOs in Sri Lanka that is comparable to other more sophisticated jurisdictions where CMOs are functioning effectively. It should be noted that the effectiveness and the efficiency of the CMOs depends heavily on whether a country determines the legal status of the CMOs appropriately

(Liu, 2012). It indicates that there should be a country specific and unique system established in order to reap the maximum benefits from CMOs. Therefore, this research aims to describe the importance of CMOs, identify the different models under which CMOs operate, analyses the existing Sri Lankan legal regime on CMOs, identify the weakness of existing Sri Lankan law, and finally to make suggestions to enhance the effectiveness of CMOs in Sri Lanka

2 METHODOLOGY

This research is a normative research that is primarily based on an extensive literature review. The research engages in comparative analysis of the law relating to CMOs in other jurisdictions such as India, China and United Kingdom (UK). The purpose of selecting comparative methodology is to identify the recent developments in this field and discuss its applicability in the Sri Lankan context. As primary sources, international legal instruments and legislation of selected jurisdictions, and particularly the Intellectual Property Act No.36 of 2003 of Sri Lanka have been used. Furthermore, the World Intellectual Property Organization's (WIPO) publications on CMOs, journal articles, web resources and



text books have been referred to as secondary sources in order to enrich the research.

3 RESULTS and DISCUSSION

3.1 CMO's scope and functioning

Authors' organizations or performing rights societies were established in European countries in the 19th century and gradually spread to other jurisdictions also. The main objective of such societies was to ensure and advance the moral interests of the authors and defense of their material interests. (Section 05, 1926). With the expansion of international norms relating to IP such as Trade-Related Aspects of Intellectual Property Rights in 1994 (TRIPS Agreement) and WIPO Copyrights Treaty in 1996 (WCT), and WIPO Performances and Phonograms Treaty in 1996 (WPPT), as well as the development of new technologies and new modes of communication, the task of CMOs became considerably highlighted in the sphere of IP. However, as "there are no direct provisions governing CMOs in these international conventions; the enjoyment and exercise of copyrights and related rights are left to national legislations" (Tarja and Nicholas, 2014). Therefore we can identify different types of CMOs which function in different regions and countries.

In the modern context the functioning of CMOs is considered as a part of the comprehensive copyright protection in some countries (Dietz, 2000). As some commentators pointed out, CMO is the exercise of copyrights by statutorily established organizations and societies that represent the interests of the owners of such rights (Ficsor, 2002). Thus, the main role of the CMO is to serve as a link or an agent between copyright owners and users to cater to the interests of both parties. Therefore, it can be argued that the CMOs serve as a vehicle which carries the creativity to the end users and the benefits

of creativity to the right holders. However, the entire functioning of a CMO is heavily dependent on the acquisition of the rights from the rights owners because the task of CMOs begins with the acquisition of the rights from the right holders under different contractual arrangements such as compulsory licenses and voluntary licenses. Remarkably, international as well as domestic copyright law does not put any barrier on rights owners to alienate their rights to a third party by entering into a contract. As an example, the economic rights of a copyright owner encapsulates certain rights which can be exploited by the owners on their own or to authorize others to do so. Thus, by joining a CMO the copyright owners can assign CMOs to exercise their rights on their behalf. Upon the authorization of the rights owners, the CMO can exercise their power to monitor the use of their works, to negotiate with prospective users, to grant licenses to the prospective users under certain conditions, to collect remunerations and distribute it among the owners of rights (Ficsor, 2003). The efficiency and the effectiveness of CMOs can be evaluated under four broad themes namely, legal status of the CMO, acquisition of rights, dispute settlement and controlling anti-competitive activities in any jurisdiction (Liu, 2012).

3.2 CMOs from a perspective of comparative jurisdictions

Though it is hardly possible to find international consensus in the international IP instruments on CMOs, some initiatives of WIPO concerning CMOs can be identified. Though, TRIPS, WCT and WPPT provides no direct provisions relating to CMOs, the sub-committee to the Rome Convention of Performers Rights adopted a recommendation which contained guidelines for the operation of collective societies for related rights in 1979 (Ficsor, 2002). However, in the last two decades CMOs have acquired a considerable



importance in managing copyrights and related rights worldwide. In the modern context we can identify public CMOs, private bodies of CMOs and semi-public CMOs functioning and administering copyrights and related rights (Helfer, 2010). However, all CMOs have a legal basis which empowers their functioning and defines their scope of application which have been drafted based on the needs of the particular country.

When analyzing the Indian experience, it can be seen that the Section 33(3) of the Indian Copyright Act No.14 of 1957 provides a legal mandate to register collective administration societies. A copyright society can issue or grant licenses in respect of literary, artistic, cinematographic works etc. as per Section 33(1) of the Indian Copyright Act. Issuing licenses, collecting fees and distribution of fees are the main functions of Indian CMOs. The most noteworthy fact is that the Indian Copyright Act provides a comprehensive legal framework for CMOs.

The Chinese context also encapsulates a rich legal basis for establishing and functioning of CMOs. The amendments that were brought in 2001 and 2010 respectively to the Copyrights Law of the People's Republic of China introduced these significant changes into Chinese law. The changes made by the 2010 amendment to Section 08 of the Copyrights Law are important in various aspects as it offered a legislative basis for CMOs and provided provisions to establish CMOs based on the examples drawn from other countries (Chao, 2005). Also, in China the right holders have the freedom to join with a CMO or exploit their rights individually.

The UK experience of CMOs can be considered as a more pragmatic example when compared to the other two jurisdictions because it provides a new type of licensing system of collective management of copyrights and related rights, and a cost-effective and efficient

dispute settlement system by the Copyrights, Designs and Patent Act of 1988. Nonetheless, the Collective Rights Management Directive (CRMD) published by the UK Intellectual Property Office in 2016 provides a comprehensive guideline for the smooth management of CMOs. Therefore, this CRMD can be used as a guideline in designing a law relating to CMOs in Sri Lanka.

Also, it is worth noting that the CMOs can be considered as a good solution to issues of fragmentation, scale and complexity in protecting copyrights and related rights in a digital environment (Liu, 2012). Interestingly, it can be argued that CMOs would provide a better vigilance for the rights holders as they are unable to look into each and every type of exploitation of their creations.

3.3 Recognition of CMOs under Sri Lankan IP law

When analyzing the Sri Lankan law, a direct reference to CMOs can be found in Section 25 of the Intellectual Property Act No. 36 of 2003 (the Act). Section 25(1) tries to streamline the process of CMOs by putting a general restriction on the functioning of CMOs subject to the later provisions of the Act. Section 25(1) (c) provides a discretion to the Director General of Intellectual Property to grant permission to commence or carry on businesses in respect of collective management of copyrights and related rights. Accordingly this section provides legal parameters on the Director General's scope, function and powers relating to monitoring of CMOs. Furthermore, Section 25(2) (b) indicates that such society can enter into any agreement with foreign societies or organizations which administer copyrights and related rights. These provisions open up an avenue for cross-border transactions of domestic works. Thus, although these provisions are not very details they provide considerable recognition to CMOs. However, a possible question may arise on

the adequacy of such non-descriptive provisions in an era where the history of man is written in the electronic medium.

The scope of Section 25 has been expanded by Section 5 of the Gazette Extraordinary No. 1415/18 dated 19.10.2005 (Gazette). The Gazette addresses some untouched areas relating to CMOs in the principle enactment viz. the nature of the license, auditing of yearly financial reports of the societies and dispute settlements. The Director General has been entrusted with the power of inquiry relating to the matters connected with such collective management societies. Thus, it can be argued that both the Act and the Gazette provide some legal certainty for CMOs in the Sri Lankan context. The Sri Lanka Performing Rights Society was the first established society in this particular field, and consequently Authors, Composers and Performers Organization of Sri Lanka was established. Thus, it can be argued that CMOs have been granted considerable legal recognition in Sri Lanka.

3.4 What are the weaknesses of law relating to CMOs in Sri Lankan context?

However, when compared to other jurisdictions the existing legal framework for CMOs in Sri Lanka has a lesser effect on collective management of copyrights and related rights. The lack of participation of the right holders, concerns on transparency and reliability and functioning on CMOs can be considered as root causes for the unpopularity of the CMOs in the Sri Lankan IP paradigm. Nonetheless, the lack of a descriptive and comprehensive legal regime that governs CMOs, also may dilute the effective functioning of the CMOs in Sri Lanka. Moreover, the lack of institutional support also would adversely affect the performance of CMOs in the Sri Lankan context. Thus, it is worthwhile to consider possibilities of expanding the framework of CMOs in Sri Lanka in order to

overcome the above mentioned weaknesses.

4 CONCLUSIONS

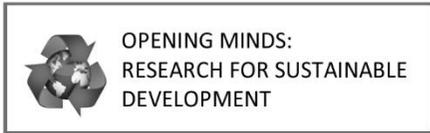
The entire discussion of this research reveals that the existing framework of the collective management of copyrights and related rights in Sri Lanka is inadequate to address the contemporary challenges posed by new technology and digitalization of copyrights and related rights. It can be argued that CMOs can make a considerable contribution to protect the legitimate interests of the rights holders as well as the general public in a digital era.

The most important factor is the involvement of both rights holders and users in the CMO process. Thus, the transparency, credibility and authenticity of the CMOs should be enhanced in order to provide wider participation. Nonetheless, there is a need to establish a platform with the participation of other stakeholders in relevant fields such as Sri Lanka Film Corporation, Broadcasting and Television Corporations, Governmental and non-governmental institutions etc. which supports the smooth functioning of CMOs. Also, it is worth considering the legal status of the CMO, acquisition of rights, dispute settlement and controlling anti-competitive activities in legislating for CMOs in Sri Lanka. The examples drawn from comparative jurisdictions can be effectively used to draft a country specific model of CMOs in Sri Lanka. Finally it can be suggested that the existing legal provisions relating to CMOs in Sri Lankan IP law should be revisited and redesigned either as a separate law or as an amendment to the Act in order to facilitate the smooth functioning of CMOs in Sri Lanka.



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Youth Labour Market in the Northern Province of Sri Lanka

Balamurali Navaratnam^{1*} and Priyanga Dunusinghe²

¹*The Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of Economics, University of Colombo, Colombo, Sri Lanka*

**Corresponding author: Email: nbala@ou.ac.lk*

1 INTRODUCTION

This study explores issues pertaining to labour force participation, unemployment, employment, underemployment of youth in the Northern Province. Despite the war coming to an end and a consequent increase in the country's economy and decrease in overall employment, the rising unemployment and under-employment in the Northern Province should be carefully studied. The youth unrest that led to decades of violent conflict in Sri Lanka has often been attributed to the lack of employment and educational opportunity as well as to poor attitudes about work among youth. Hence, it is of paramount importance to identify the problem of youth living in the formerly war-affected areas. This study aims to analyze youth labour market issues in the post-war Northern Province of Sri Lanka by way of comparison with national trends to shed some light on the above area. This research was conducted with the following research problem: to what extent do the labour market characteristics of youth in Northern Province differ from that of the rest of the island? This study compares the Northern Province with the national trend in terms of labour force participation, under-employment, employment and unemployment-based characteristics of the labour market.

2 METHODOLOGY

This study is a quantitative research in a statistically descriptive format. We extracted four years (from 2011 to 2014) of data from the Labour Force Survey (LFS) conducted by the Department of Census Statistics of Sri Lanka. This study used only youth who fall between 15 years and 29 years old regardless of what they do and their civil status. In addition, the researcher purposively omitted fulltime students as this study analyses the status of youth in the labour market. Because of the civil war, the LFS surveys did not cover Northern and Eastern provinces from 1990 to 2010. Hence, the data for this study covers the current (2015) data from 2011 to 2014. With such imitations, the sample was extracted from the macro level data as 9,703 in 2011, 10,213 in 2012, 12,601 in 2013 and 12,606 in 2014. The study was conducted by facilitating basic tables, graphical displays and percentage values etc. which have been used to explore the above statistical relationship as a preliminary analysis to present the data.

3 RESULTS AND DISCUSSION

3.1 Youth as Labour Force Participants (LFP)

The Youth Labour Force Participation Rate (YLFPR) is higher in the Northern Province compared to the national rate in



all the years. Although Sri Lanka's YLFPR declined from 58.4 per cent to 55.9 per cent in 2012, it increased slightly from 58.4 per cent to 59.2 per cent in the Northern Province. It reached the peak in 2013 where the YLFPR was 56.7 per cent in Sri Lanka and 61.2 per cent in the Northern Province. However, the YLFPR in Sri Lanka in the last four years (2011 – 2014) recorded its lowest rate in 2014. The national and the provincial level statistics show nearly the same pattern in terms of the YLFPR by age.

The LFPR of the youth in the first category (15 – 19 years) was observed to be the lowest level where youth in the category (25 – 29 years) youth was at the highest in the YLFPR. However, the YLFPR of the first category of youth always tends to be higher at the national level than in the Northern Province whereas YLFPR in the third category, is higher at the Provincial level than at the National level.

The YLFPR of male youth in the Northern Province was lower than the national level whereas the YLFPR of female youth in the Northern Province was higher than the national level. The largest gap between the YLFPR at the National and Provincial level in the selected four years was registered in 2013. Labour force participation of young men is higher than that of women. One of the main reason for the lower labour force participation of young women is education.

3.2 Youth Unemployment

It is interesting to note that although the Northern Province is a formerly war-torn Province, the unemployment rate of youth is low compared to some other Provinces such as the Sabaragamuwa, Southern, Central and Uva Provinces. As at 2013, The North-Western Province records the lowest Unemployment rate of 8.6 per cent. Sri Lanka's youth Unemployment rate was recorded to be 14.7 percent while it

was 13.9 per cent in the Northern Province. The unemployment rate of female youth is very high compared to males in the Northern Province in the last four years (2011 – 2014). The unemployment rate of female youth in the Northern Province gradually reduced by 9.6 percent from 34.5 in 2011 to 24.9 in 2014 whereas at the national level, it declined by 0.4 percent only between 2011 and 2014. The decline in the Northern Province is 24 times higher than the decline in the national unemployment rate. The data on Youth Unemployment by age in Sri Lanka shows that the third category of youth (25 – 29) have the lowest unemployment rate at the national and the Northern Provincial level. Likewise, the share of unemployment is very high among youth who are below 25 years old. The largest share of unemployed youth have been waiting for a job for more than one year. This is a very crucial condition for youth to wait more than one year for a job. The Northern Provincial situation is worse than the National situation. As at 2014, there are 53.7 percent of unemployed youth who have been waiting for a job for more than one year in the Northern Province while this rate is 40.6 percent of youth in Sri Lanka. It is 13.1 percent higher in the Northern Province than for the national level.

3.3 Youth Employment

The main source of the employment is the private sector, where around 80 percent of employed young males and females are working in Sri Lanka. While workers in the semi-government sector reduces, workers in the Government sector have gradually increased in the last four years in Sri Lanka. The government sector records higher in the Northern Province than at the national level. That is the share of workers in the government sector increased from 17.8 percent in 2011 to 24.1 percent in 2014. It shows a 6.3 percent increase whereas there is only a 1.8 percent increase in Sri Lanka. In the Northern Province, the contribution of



agriculture to youth employment declined from 2011 to 2013 and it slightly increased in 2014. However, agriculture covered 11.4 percent of total employment in 2011 but it declined to 6.8 percent in 2014. When National statistics are compared with data from the Northern Province, the proportion of agricultural workers in Sri Lanka continuously declines. Notably, it declined from 8.5 in 2011 to 5.2 in 2014. Although the larger share of agricultural workers are males, males are the ones who leave agriculture to a larger extent than females both in the Northern Province and at the National level. The share of males who engaged in agriculture in the Northern Province in 2011 declined by 8.3 in 2014 where it shows a 1 percent decline in terms of female agricultural workers.

3.4 Informal Employment

The research findings show that the rate of informal employment is decreasing continuously in the Northern Province as well as in Sri Lanka. 82.5 percent of the total employment of youth in 2011 declined to 78.4 in 2014 in Sri Lanka.

And, in the Northern Province 97.6 percent of total youth employment was informal employment in 2011 and it declined to 93.0 percent in 2014. The results reveal that Sri Lanka's overall rate of informal employment is lagging behind the Northern Province by 14.6 percent in 2014. Likewise, when it comes to the employment sector, the informal sector of employment is declining both at the National level as well as at the Provincial level. However, the percentage of youth who work in informal sector employment in the Northern Province is higher than the data for Sri Lanka. The statistics show that youth employment participation in the informal sector in Sri Lanka declined by 6.2 percent from 68.6 percent in 2011 to 62.4 percent in 2014 whereas it declined by 12.7 from 92.9 in 2011 to 80.2 in 2014. It shows that although the decline is two times higher in the Northern Province than for Sri Lanka, the Northern Province has a

larger share of youth who engage in informal sector employment. As at 2014, youth employment in the informal sector is 17.8 percent higher than the data for Sri Lanka. Informal employment is available in the formal sector whereas formal employment is available in the informal sector. According to the data, 18.1 percent of informal employment in Sri Lanka was in the formal sector in 2011 and it increased by 3.8 percent in 2014. Likewise, in the Northern Province, it increased by 10.2 percent from 4.8 percent in 2011 to 15.0 percent in 2014. Furthermore, the participation of formal employees in the informal sector decreased in Sri Lanka by 0.6 percent from 6.1 percent in 2011 to 5.5 percent in 2014 whereas it increased rapidly in the Northern Province as it increased by 16.7 percent from 2011 to 2014. The statistics show that informal employment in the formal sector is increasing in Sri Lanka as well as in the Northern Province. Formal jobs in the informal sector are decreasing in Sri Lanka while it rapidly increases in the Northern Province.

The informal employment rate declined by 18.8 percent from 95.3 percent to 76.5 in the Mannar district; by 17.9 percent from 89.1 percent to 71.2 percent in the Jaffna district; by 11.5 percent from 97.4 to 85.9 in the Mullaitivu district; by 3.8 percent from 81.9 percent to 79.2 percent in the Vavuniya district. Although the informal employment rate declined by 6.6 percent in the Kilinochchi district from 2011 to 2014, it can be observed that it started increasing as it was 80.5 percent in 2013 and increased to 81.9 percent in 2014. Informal employment is continuously decreasing in the Northern Province. However, the rate of informal employment declines very fast in the Jaffna and Mannar districts. In the Vavuniya district, the decline is very slow. Interestingly, the informal employment rate started to increase in the Kilinochchi district only in 2014.

3.5 Under-employment

Youth under-employment is not a big problem in the present context as it had been recorded less than 0.5 in 2014. However, youth under-employment in 2013 was somewhat problematic in the Northern Province as it was 2.1 percent in 2013. Thereafter it declined to 0.4 percent in 2014. The national level youth under-employment rate is recorded at 0.3 percent in 2014 which is the lowest rate in the last four years.

4 CONCLUSIONS AND RECOMMENDATIONS

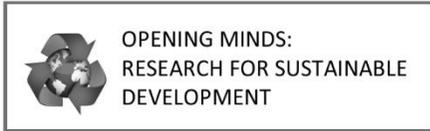
Although the Northern Province is a formerly war-torn Province, the unemployment rate of youth is lower compared to some of the other Provinces. Furthermore, the gap between the gender-based unemployment is larger in the Northern Province than at the national level. A positive trend in the Northern Province can be observed in the unemployment rate of female youth. The largest share of unemployed youth who have been waiting for a job for more than one year is higher in the Northern Provincial situation than the data for the entire Island. Although the informal economy still plays a very big role in the Northern Province, the contribution of the informal economy declines faster in Northern Province than at the National level.

The share of workers in the private sector is lower by 10 percent in the Northern Province whereas the proportion of Government workers is higher in the Northern Province. However, the continuously declining in rate of the informal economy and agricultural workers may result in some issues related to youth unemployment in the future.

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Nation Branding of Small States through Economic Diplomacy: Prospects and Challenges (A Case Study of Sri Lanka)

Hashan Viraj Wijesinghe*

Political and Economic Affairs, Embassy of the Republic of Indonesia, Colombo

**Corresponding author: Email: hashanviraj@gmail.com*

1 INTRODUCTION

At a glance, branding is very much related to products. Branding gives a particular product a unique identity and greater consumer base which ultimately help to increase the revenue for the branded product. However, today branding is not all about products. At present, a country image is a key factor in attaining national interests. In today's highly competitive market place, the country image has become a critical success factor which is difficult to build and sustain (Odia and Isibor, 2004, p.204). One major reason as to why countries focus on nation branding is to gain competitive advantage. Nation branding was first put forth by Simon Anholt in the late 1990s. Nation branding can be simply identified as the unique, multi-dimensional blend of elements that provide the nations with culturally grounded differentiation and relevance for all its target audience (Dinnie, 2008, p.15). Despite the fact that nation branding is a complex and controversial phenomenon (ibid, p.13), it is one which is growing in frequency given the increasingly global competition that nations now face in both their domestic and external markets (ibid, p.17). According to Anholt (2010), nation branding is an idea that has gained much currency during the last 10 years, and as he argues, a good national image, attracts tourists, investors and talent, enhances exports and wins the approval of other governments and international public opinion; with a negative or weak image, everything is a struggle (ibid). As Dinnie

(2008) suggests, the unbranded state has a difficult time attracting economic and political attention, and that image and reputation are becoming essential elements of the state's strategic equity. Nation branding is so much important for small states compared to the powerful states. After an in depth study of literature on small states, a working definition on small states has been put forth. Accordingly, a small state is a state that can never act alone and make a significant impact on the international system, using its quantitative or tangible elements of power. These elements include geographical size, population, military strength etc. Going by this definition, given small states' inability to influence the international system through its hard elements of power, small states like Sri Lanka should use nation branding as one of the key policy objectives.

As far as Sri Lanka is concerned, today it is at a crucial juncture as it strives hard to promote cooperation with all the countries in the world as a mean of fulfilling its national objectives. Looking at the foreign policy dynamics of the country, especially during the post presidential and general election in 2015, several significant changes can be observed. Largely driven by its economic interests, today the country is making effort to strengthen its relations with all countries alike. Since 2015, Sri Lanka is striving to attain economic development, through greater



international cooperation. The main pillars of Sri Lanka's new economic development program include: trade, foreign direct investments and tourism. In other words, the current government in particular has given greater importance to economic diplomacy. Soon after assuming duties, the former Minister of Foreign Affairs, Ravi Karunanayake highlighted the importance of enhancing commercial diplomacy to usher the country towards economic prosperity. Economic diplomacy can be simply defined as the management of economic relationships between (two or more) countries (Romih and Logozar, 2014, p.135). Today the country has identified economic diplomacy as the main tool of branding Sri Lanka in the world stage, especially as a small state, as mentioned earlier, economic diplomacy plays a critical role in attaining its national objectives. Economic diplomacy consists of a number of pillars and among those, trade, investments, tourism occupy a prominent place.

Looking at Sri Lanka, today, these pillars of economic diplomacy are what some areas of the country is banking on. Against this backdrop, this particular study will focus on branding Sri Lanka, which falls under the category of small states, through economic diplomacy. The main objective of this study will be to understand the prospects and challenges ahead for Sri Lanka in the context of branding itself through economic diplomacy. Among the elements of economic diplomacy, the study will focus on international trade, source of Foreign Direct Investments and tourism. Given that Sri Lanka today is focusing on economic diplomacy as a mean of as a means of attaining its national goals, this study will have greater policy relevance as well.

Main objectives of the research include:

- Understand the importance of nation branding for small states like Sri Lanka
- Understand where Sri Lanka stands with regard to the practice of

economic diplomacy.

- Identify the strengths and weaknesses Sri Lanka exhibits in the context of branding itself through economic diplomacy.
- Identify an effective strategy of branding for Sri Lanka through economic diplomacy.

This particular study is carried out to answer two main research questions, namely:

- Why Sri Lanka needs nation branding?
- How can Sri Lanka brand itself through economic diplomacy?

2 METHODOLOGY

This particular research is a case study which involves an up close, in depth and detailed examination of how Sri Lanka can use economic diplomacy to brand itself. Basically, this research is a qualitative research and the main source of data collection is secondary data source. The study will be conducted based on secondary data collected through various sources including books, journals, magazines, newspapers, Internet and annual reports, surveys and researches conducted by various national and international institutions. The study shall look into a wide array of statistics related to trade, Foreign Direct Investment inflows and arrival of tourists, to understand the recent trends in the practice of economic diplomacy by Sri Lanka.

Further, among the various pillars of economic diplomacy, the study will focus on three main elements of economic diplomacy namely: trade, Foreign Direct Investments and tourism.

3 RESULTS AND DISCUSSION

Looking at the current status of the practice of economic diplomacy, Sri Lanka is certainly lagging behind



compared to many developing countries. With the exception of the tourism industry, both trade and Foreign Direct Investments

do not show any significant improvement. (Figure 1 and Figure 2)



Figure 1: Sri Lanka’s Trade performances 2012-2016 (USD million) (Source: Created by author based on Central Bank of Sri Lanka Annual Report 2016)



Figure 2: Sri Lanka’s FDI Performance (USD million) (Source: Created by author based on Statistics of Ministry of Development Strategies and International Trade)

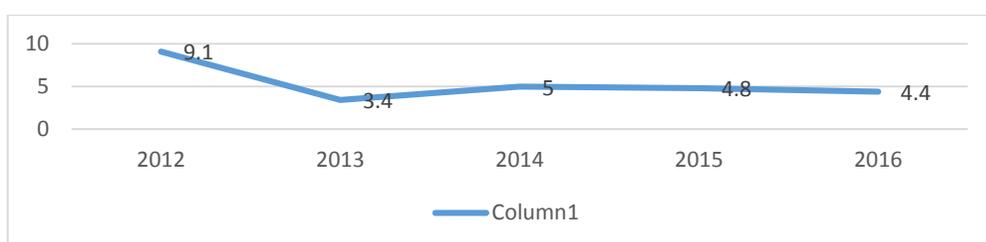


Figure 3: Economic growth rate of Sri Lanka 2012-2016 (% GDP) (Source: Created by author based on Central Bank of Sri Lanka Annual Report 2016)

Looking at the statistics, Sri Lanka’s economic performances over the last few years have been on the decline. Trade and investments in particular have not performed up to expectation. These poor

performances have had a number of adverse effects on the economy. This impact is clearly reflected by the declining economic growth performances of the economy (Figure 3)

Based on results and findings, the study draws up a SWOT analysis in order to clearly understand the strengths and weaknesses Sri Lanka possesses, opportunities to seek and threats to overcome in the context of Sri Lanka branding itself through economic diplomacy. Under strengths, the study has identified: 1) non-aligned foreign policy 2) political stability 3) gradual process towards good governance and 4) membership in regional and international organizations.

Under weaknesses, the study identifies: 1) incompetence of missions abroad 2) lack of coordination among key policy making units 3) overlap of duties and responsibilities among ministries 4) lack of economic freedom and 5) lack of diversification of exports, both in terms of products and markets. With regards to opportunities, Sri Lanka should work on: 1) effective coordination with the Diaspora 2) peaceful environment and abundance of natural resources to attract tourists 3) diversifying exports both in terms of products and markets and 4) enhance regional cooperation. Finally as far as main threats to overcome are concerned, the study has identified three, namely: 1) regional competition for Foreign Direct Investments 2) international competition for major exports.

In the context of branding Sri Lanka, the study has put forward a strategy identified as TACC for C strategy. Here this strategy focuses on how and why Sri Lanka should be accountable, transparent, cooperate and coordinate to attain greater competence in branding itself in international politics.

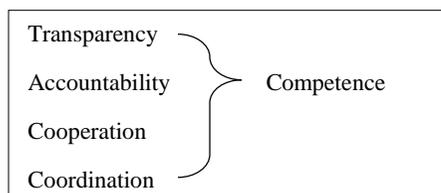


Figure 4: TACC for C concept

4 CONCLUSIONS

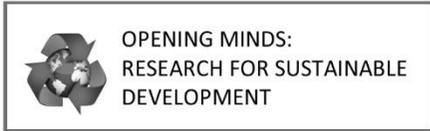
In conclusion. It is clear that Sri Lanka has great potential in terms of branding itself through economic diplomacy, as the country already has the background and the willingness. It is a matter of proper implementation. In this regard, the country should first strategically use the strengths to address a large audience of international community; second, to address the weaknesses which obstruct Sri Lanka’s objective of branding itself; third to capitalize on opportunities through which Sri Lanka can attract and influence the international community; and finally to effectively counter all threats from external forces.

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Consumer Conformity Behavior in Virtual Communities; a Study of Generation “Y” Consumers in Sri Lanka

P. L. W. G. S.D. Piumali* and D.T. Rathnayake

Department of Marketing Management, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka

**Corresponding author: Email: dilanka.sdp@gmail.com*

1 INTRODUCTION

Consumer behavior is considered to be a major concern for marketers in making their business a success. Apparently, social influence is a major determinant of consumer behavior. This is reflected in consumer decision making where social norms and interpersonal considerations influence behavior intentions (Sages and Grable, 2008). Also some of the marketers use interpersonal influence in their persuasive communications (Choubtarash *et al.*, 2013). The change of consumer behavior based on social influence can be called consumer conformity, which is defined as compliance with group norms, susceptibility to group influence, and behavioral changes in consumption due to a reference group (Sages and Grable, 2008).

In the past, communities tended to be closed systems with relatively clear boundaries, stable memberships, and few linkages to other communities. We are now entering into an 'age of open systems.' Mobility creates new communities and new kinds of communities. But the impacts of mobility are far less than those of information and communications technology. Cyberspace has become a new kind of social terrain, crowded with 'virtual communities (Ruiz-Mafe *et al.*, 2016). Consumers are influenced by a variety of social networks, including but not limited to family,

friends, acquaintances, neighbors, and social partners. One particularly powerful form of social networking is eWOM (Electronic Word of Mouth). eWOM is defined as "the informal communication directed at other consumers about ownership and characteristics of particular goods and services and/or their sellers" (Tseng and Hsu, 2010) Some virtual communities do both. Community members are allowed to interact over a shared passion through various means: message boards, chat rooms, social networking sites, or virtual worlds (Kananukul *et al.*, 2015).

In conformity behavior, groups can moderate the strength of normative and informational influences to explore the processes that underlie social influences on consumer behavior. It is evident that previous research has measured consumer conformity using task / situation characteristics, personal characteristics, brand characteristics and group characteristics. However online consumer conformity is a relatively unexamined area (Park and Feinberg, 2010). Therefore, the main objective of this study is to examine consumer conformity behavior in virtual communities. Further, few studies have been done to examine the impact of factors such as self-esteem, personal involvement, sense of belongingness and community expertise on online conformity (Park and Feinberg, 2010) despite the fact that eWOM has been



examined as an antecedent of the same. Hence, this study specifically focuses on examining the impact of these variables on consumer conformity behavior in virtual communities.

2 METHODOLOGY

The study was mainly guided by the positivist research paradigm and the study was quantitative in nature. As the study attempts to examine the association between several determinants and consumer conformity, descriptive, single cross sectional (survey) design was adopted as the major research design. All variables were operationalized using established scales and a structured questionnaire was used as the instrument for collecting data.

Unit of analysis of the study was generation Y consumers who belong to at least one virtual community in Sri Lanka. Sample size was 200 individuals representing both males and females subject to generation Y age groups. The sample was selected using the convenience sampling technique. Accordingly, the researcher used convenience sampling method due to the absence of a sampling frame.

3 RESULTS AND DISCUSSION

Prior to the analysis, data were tested for reliability and validity. Cronbach’s alpha was greater than 0.7 for all variables ensuring internal consistency. Further, AVE values were greater than 0.5, composite reliability values were above 0.7, thereby convergent validity was established. As all skewness and kurtosis values were in between the +2 and -2, it was concluded that data was normally distributed (Malhotra, 2006). Therefore, a regression analysis was applied to test the research hypothesis.

Below table represent the significant values of five independent variables. The significant values of eWOM, Personal Involvement, Sense of belongingness and Community Expertise are 0.000 which is less than the alpha value of 0.05. So there is significant impact of those factors on consumer conformity behavior in virtual communities with special reference to generation Y in Sri Lanka. The significant value of self-esteem is 0.528 which is greater than the alpha value of 0.05. So there is no significant impact of self-esteem on consumer conformity behavior in virtual communities with special reference to generation Y in Sri Lanka.

Table 1: Predictors: (Constant), eWOM, Self-esteem, Personal Involvement, Sense of belongingness, Community expertise. Dependent Variable: E-formity

Model	Mean Square	F value	B Value	R square	Sig.
eWOM	46.488	111.287	0.612	0.360	.000 ^a
Self esteem	.261	.400	0.060	0.002	.528 ^a
Personal Involvement	43.811	101.590	0.572	0.339	.000 ^a
Sense of belongingness	21.343	39.181	0.460	0.165	.000 ^a
Community Expertise	42.098	95.697	0.759	0.326	.000 ^a



According to the R square value consumer conformity behavior in virtual communities is explained by the eWOM and according to the eWOM, Personal Involvement, Sense of belongingness and Community Expertise have strong positive impact on consumer conformity behavior.

4 CONCLUSIONS AND RECOMMENDATIONS

The final conclusion of this study is there is positive impact of eWOM), personal involvement, sense of belongingness and community expertise on the consumer conformity behavior in virtual communities (E-formity) with special reference to generation Y in Sri Lanka. But according to the findings there is no significant impact of self-esteem on consumer conformity behavior in virtual communities with special reference to generation Y in Sri Lanka.

Previous studies conclude that there is a negative impact of self-esteem on consumer conformity behavior in virtual communities (Park and Feinberg, 2010). In western counties, consumers have individualistic behavior. Therefore, if they value themselves they do not depend on others' behavior (Sages and Grable, 2008). But Asians like to depend on others' ideas, because Asian countries have collectivistic behavior (Sages and Grable, 2008; Venkatesan, 1966).

According to the findings it can be recommended to emphasize more positive WOM (word of mouth) communication practices through the virtual community groups; such as facebook, twitter, linkedIn, youtube and etc as motivate the

Conformity behavior of certain product or service. At the same time negative eWOM communication practices can discourage consumers. Companies can create virtual community groups to achieve their marketing objectives. According to the research findings consumer conformity

behavior does not depend on self-esteem. Therefore marketers don't consider self-esteem under the concept of consumer conformity behavior. Due to efficiency and effectiveness of the internet, consumers personally engage with virtual communities to search for information and it impacts on the conformity behavior as well. Marketers can provide more information through the community groups to motivate customers. But it is necessary to identify their information requirements before providing the information. Sense of belonging is a concept related to quality of life, encompassing a feeling that individuals matter to one another and to a group. If people feel that they are belong to the relevant virtual community it increases the consumer conformity behavior. Marketers can take the engagement of the consumers to the discussions and give value for their ideas. It can enhance the community trustworthiness as well. To enhance the relationship, the consumers expect the knowledge or opinions of the virtual communities. For that it is necessary to provide and share actual expertise knowledge through the virtual community groups, such as the desire to fit in or value socially acceptable information. Marketers can build trust through the virtual communities using expert knowledge. Trust is important in relationships because it allows the free flow of information without reservation.

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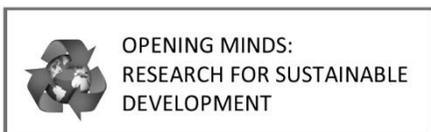
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Social Media Usage of Sri Lankan Consumers: Compulsive Consumption Perspective

T.H. Rathnayake^{1*} and D.T. Rathnayake²

¹*Department of Management Studies, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of Marketing Management, University of Sri Jayewardenepura, Sri Lanka*

**Corresponding author: Email: tharindu.thr@gmail.com*

1 INTRODUCTION

Social media has become pervasive, impacting the social and cultural fabric of our society and changing the nature of social relationships (Mahmood and Farooq, 2014). Facebook, being the second most visited website in the world and the most visited in Sri Lanka, could be identified as a special source of addiction. Today, an average user browses Facebook at least for 30 minutes a day as a habit using computers or smart devices and gets exposed to diverse content on Facebook (Andreassen et al., 2013; Griffiths, 2012). An addiction is known to destroy human beings and their relationships and Facebook addiction is no exception to this (Grant, Potenza, Weinstein, and Gorelick, 2010). Marlatt, Baer, Donovan, and Kivlahan (1988), defined addictive behaviour as “a repetitive habit pattern that increases the risk of disease and/or associated personal and social problems” or “the behaviour continues to occur despite volitional attempts to abstain or moderate use”. Compulsive, excessive, impulsive, uncontrolled, and indulgent were also listed instead of the term “addictive” (Alavi, Maracy, Jannatifard, and Eslami, 2011). According to Socialbakers.com, approximately there are 70% male users and 30% female users of Facebook in Sri Lanka. In this study, the researchers have

attempted to investigate the relationship between compulsive consumption behaviour on Facebook and the gender of those individuals. This relationship between gender of the user and the user’s addicted behaviour on Facebook is not only a highly interesting issue but a potential element which can affect the increase of compulsive buying behaviour on Facebook. Further, there has been a significant lack of empirical studies that investigate the relationship between gender of individuals and compulsive buying behaviour on Facebook. The specific objectives of the study are:

1. To describe the degree of compulsive buying behavior on Facebook among Facebook users in Sri Lanka.
2. To examine if the Facebook addiction varies between males and females.

2 METHODOLOGY

The main purpose of the study is to examine the relationship between gender of the individuals and compulsive consumption behavior on Facebook with special reference to Sri Lankan Facebook users. As per previous literature, the term addictive behavior on Facebook and compulsive buying behavior are used



interchangeably. Bergen Facebook Addiction Scale (BFAS) has identified many factors that might have been symptoms of Facebook addiction (Andreassen, Torsheim, Brunborg, and Pallesen, 2012). As the above research gap explains, there is a need to use salience, mood modification, tolerance, withdrawal, conflict and relapse dimensions to examine Facebook addiction.

The study is descriptive in nature and a survey was carried out to test the association between compulsive consumption behaviors on gender of individuals. The research was single cross-sectional as data was collected from the sample at a single point of time. The unit of analysis was individual level consumers. Due to the unavailability of a sample frame, the convenience sampling technique was employed to draw the sample from the population and the sample size was 254. The survey method was used to collect data and sample data was collected using a self-administered questionnaire which was distributed among the respondents. Descriptive statistics were generated using SPSS version 23.

Following hypotheses were developed by the researcher in order to determine the relationship between the independent variable and the dependent variable.

H1: Degree of Facebook addiction is low among Facebook users in Sri Lanka.

H2: There is no significant difference between males and females in Facebook addiction.

3 RESULTS AND DISCUSSION

In order to satisfy the reliability requirement Cronbach's Alpha values were calculated and they were greater than 0.7. Therefore, reliability of the variable

was satisfied. Moreover, KMO value of all dimensions of Facebook addiction were greater than 0.5, Sig value of the respected dimensions were less than 0.05, AVE values were greater than 0.5 and the composite reliability (CR) values were greater than 0.7. Therefore, convergent validity of respective dimensions was satisfied. All shared variances among constructs were lower than the AVE on the individual constructs satisfying discriminant validity.

In this section the researchers validate objectives by testing hypothesis developed for each objective by using analysis techniques as appropriate. The first objective is to describe the degree of Facebook addiction among Facebook users in Sri Lanka.

According to Objective 1, the Degree of Facebook addiction is tested by comparing whether the Mean (μ) of Facebook addiction variable (According to Table 1, Mean of Facebook addiction is 2.84) is significantly less than the test value (3); in the present case. Researcher decided to use 3 as test value because it is neutral score of the scale and to test whether the mean value of Facebook addiction is significantly towards the positive side of the value scale that used to measure all the items in the Facebook addiction variable.

(Scale: 1 - 2.5 = Normal users, 2.5 - 3.5 = Lightly Addicted, 3.5 - 5 = Seriously Addicted).

According to the Methodology, the test appropriate for this measure is one sample t-test.

According to the one sample t-test, the significant value is 0.004 which is less than the alpha value of 0.05. Therefore, the researcher concluded that mean value of Facebook addiction is not equal to 3 among Facebook users in Sri Lanka.



Table 1: Mean value of scale variables

	N	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic
Facebook Addiction	254	2.8451	.84203	.280	.089
Valid N (list wise)	254				

Table 2: One sample Test for Degree of Facebook Advertising

Test Value = 3						
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Facebook Addiction	-2.932	253	.004	-.15492	-.2590	-.0509

3.1 Gender and Facebook Addiction

Second objective is to examine whether there is a significant difference between males and females in terms of Facebook addiction. An independent sample t-test was carried out to see if there are any significant differences in the means of 2 groups in the variables interest (Table 3).

According to the result of Independent sample t-test, the significant value is 0.000 which is less than the alpha value of 0.05, the mean value of Facebook addiction of Males is significantly different to mean value of Facebook addiction of Females. Therefore, the researcher concluded that Facebook addiction varies according to the Gender.

Table 3: Independent Samples Test

	Levene's Test				t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
FBA Equal variances assumed	2.363	.12551	4.014	252	.000	.41423	.10319	.21101	.61745
Equal variances not assumed			4.062	249.949	.000	.41423	.10197	.21339	.61506

According to the Table 4, 76 of respondents were Normal users, 88 of respondents were lightly addicted and rest of 90 respondents were seriously addicted to Facebook. Out of 88 of lightly addicted respondents, 21.4% of respondents are male and 40.4% of respondents are

female. Further, out of 90 of seriously Facebook addicted respondents, 53.6% of respondents are male and 13.2% of respondents are female. Therefore researcher concluded that males are lightly or seriously addicted to Facebook than females.



Table 4: Gender * Facebook Addiction Categories Cross-tabulation

		Facebook Addiction Categories			Total	
		Lightly	Moderately	Highly		
Gender	Male	Count	30	35	75	140
		% within Gender	21.4%	25.0%	53.6%	100.0%
	Female	Count	46	53	15	114
		% within Gender	40.4%	46.5%	13.2%	100.0%
Total	Count	76	88	90	254	

4 CONCLUSIONS AND RECOMMENDATIONS

Among sample Facebook users, 55.1 % of respondents are Male while 44.9% of respondents are Female which indicated that there is no much difference between number of users according to gender. Although previous literature mentioned that Females are more in Facebook, current statistics suggest that Males (Mean - 3.0310) have used Facebook more than Females (Mean - 2.6168) in Sri Lankan context. As per Socialbakers.com, (which compiles social media statistics globally) higher number of Facebook users in Sri Lanka are males. So, this evidence is further validated by the sample’s gender composition. Therefore researcher can conclude that marketing activities on Facebook should consider posting content that are favorable to men than women on Facebook, due to the fact that Male are dominant on Facebook in Sri Lanka. Majority of users (77.2%) are belong to age 18-27 which means that young generation in Sri Lanka is much engaged in Facebook. This finding is mainly consistent with the findings of Thompson (2012). In Thompson’s (2012) study, gender differences were examined and according to the findings, females were more likely than males to report spending more time on Facebook. Liang, Zhou, Yuan, Shao, and Bian, (2016) pointed out that; males were more likely to surf the Facebook for pleasure and less likely to surf the facebook to search for

information, compared to females. These findings suggest that gender specific preventative and interventional strategies should be developed to reduce Facebook addiction.

There are many success stories about Facebook usage but at the same time, it also has some negative impacts because of addictive behavior on Facebook. Facebook addiction, excessive use of the Internet or, compulsive consumption behaviour on Facebook has been discussed. The amount of time spent on Facebook, checking social media frequently, spend entire nights on the site, daydreaming about the status updates and comments that have been received are the emerging evidence for negative impact of Facebook addiction. It is essential to understand the level of addiction to predict the other factors, because the reality of addictive behavior on Facebook is a growing problem for many users.

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OPENING MINDS:
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Levels of Efficacy Factors in the Usage of Electronic Information Resources among Social Sciences and Humanities Undergraduates in Four Universities in Sri Lanka: An Approach Based on Frequency of Library Use

C.N.K. Alahakoon^{1*} and S. Somaratne²

¹Library, University of Peradeniya

²Department of Botany, Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: champa098kumari@gmail.com

1 INTRODUCTION

Self-efficacy is the belief in one's own capabilities to organise and execute the courses of action required to produce given attainments. According to Bandura, (1977), Bong and Skaalvik (2003), self-efficacy theory suggests that there are four main sources of information used by individuals when forming self-efficacy judgments such as mastery, vicarious, social persuasion and people's anxiety. Relating to these four sources it was hypothesized that measure of Information Communication Technology (ICT) self-efficacy, ICT training, ICT anxiety and library support respectively determine the use of electronic information resource in library (EIR) by the final year undergraduates.

The primary objective of the present paper was to measure the levels of efficacy factors that affect undergraduates in four universities; to determine the variation of efficacy levels of undergraduates based on frequency of library use; and to make appropriate recommendations to strengthen their use of ICT and EIR in the libraries.

2 METHODOLOGY

The sample included the final-year undergraduates in the Faculties of Humanities and Social Sciences (HSS) in the four universities in Sri Lanka since they have four years of experience using the library and since these students are required to submit a dissertation in partial fulfilment of the special degree. Out of the ten universities where HSS streams are available in Sri Lanka, the four universities; University of Peradeniya (PDN), University of Sri Jayawardenepura (SJP), University of Ruhuna (RUH) and Rajarata University of Sri Lanka (RJT) were chosen for the purpose of presenting a broader sample.

Computer self-efficacy items developed by Murphy, Coover, and Owen (1989) and Internet self-efficacy (ISE) measurement developed by Hsu and Chiu (2004) were used to develop the ICT self-efficacy (ICTSE) scale of the study, which included 23 items. The ICT anxiety scale incorporated items from Heinszen, Glass, and Knight's (1987). Computer Anxiety Rating Scales (CARS) were used with slight modifications and 10 items out of 21 were chosen. The library support measure was developed with 15 items and 07 items



were selected. ICT training scale included 03 items.

A pilot survey was conducted with 100 students from four universities during the academic year 2015/2016 with 5 point Likert scale and content and face validity was established. The main survey consisted of 604 undergraduates selected from stratified random sampling method from the four universities. The data were analyzed with SPSS Ver. 20 and frequency distribution and ANOVA was used to compare the levels of efficacy of undergraduates in each university. Since each efficacy scale has a different number of items, the total score range for each individual item of the scale was in the 3-115 range i.e. $23=1.04, 1.65/10=2.8, \dots 3.5/07=1.14, \dots 2.71/03=3, 1.3, \dots 1.6$ respectively for each scale.

3 RESULTS AND DISCUSSION

The data collected through stratified sampling method indicated that the sample represented 21.7% of male students and 78.3% of female students and, 86.6% and 11.6% of the sample represented the Sinhala and English medium students respectively, while 1.8% the sample consisted of students in Tamil medium. Since the samples are imbalanced, the gender and the language of instruction on the usage of ICT and EIR are not addressed in the present study.

The frequencies of library use vary from frequently use 31% (5-7 days/week); 55.3% moderately use (3-4 days/week); and to rarely use 7% (1-2 days/week).

Table 1 shows the students' efficacy level of each scale in percentage value, the mean scores, and the standard deviations. The ICT self-efficacy levels of almost all university undergraduates were considerably higher and the mean score ranged from 81-95, with a maximum score of 115, and the overall value was 78%. The respondents of universities of

PDN and RJT have achieved high levels of ICT self-efficacy.

Anxiety levels indicate that students feel low levels of anxiety, except for RJT students, whose mean score was 30 (60%). However, in general, results of the analysis showed that students across all four universities showed a moderate level (50%) of ICT anxiety. This finding suggests that though students' ICT self-efficacy is higher, they are subjected to a considerably higher anxiety levels during the usage of ICT facilities at libraries. The mean score for the library support scale was 68% and it was an indication of availability of satisfactory library support in ICT and EIR usage for undergraduates.

The ICT training scale shows that students from the SJP have achieved a high level of ICT training, whereas students from the other three universities have only received a moderate level of training. In general, 73% of undergraduates believe that they need training delivered by the library. This was a major requirement for library users, and according to the results of the present study, provision of training on library EIR use may alleviate the ICT anxiety and address the problem of lack of support from library staff. The results of the analysis suggest that undergraduates enrolled at the four universities need to be trained on EIR use.

According to Table 2, the mean level of students' ICT self-efficacy was low among all students who used the library 'rarely' (71%). However, the mean levels for frequent and moderate users were higher and ranged from 77% to 77%, respectively. Comparatively, ICT anxiety level also indicated a quite high mean level for undergraduates who used EIR rarely than the mean level of those who frequently and moderately used EIR. However, the overall percentage value for ICT anxiety level was 50% across universities; this indicated the average level of anxiety during their use of ICT and EIR at the library.



Table 1: Variation of efficacy levels of undergraduates between the universities.

University		ICTSE (115)	Level %	ANX (50)	Level %	LS (35)	Level %	TR (15)	Level %
PDN	Mean	4.14		2.42		3.54		3.60	
	Std. Dev.	0.81		1.11		0.58		0.87	
	Minimum	1.78		1.00		2.29		1.00	
	Maximum	5.00		4.90		5.00		5.00	
Mean x No. of items		95	82	24	48	25	71	10	66
SJP	Mean	3.88		2.49		3.42		4.08	
	Std. Dev	0.83		1.03		0.63		0.94	
	Maximum	1.04		1.00		1.14		1.00	
	Minimum	5.00		5.00		4.86		5.00	
Mean x No. of items		89	77	24	48	24	68	12	80
RUH	Mean	3.56		2.37		3.37		3.18	
	Std. Dev	0.84		0.94		0.58		0.83	
	Minimum	1.17		1.00		2.00		1.00	
	Maximum	4.91		5.00		5.00		5.00	
Mean x No. of items		81	70	25	50	23	66	09	60
RJT	Mean	3.98		3.05		3.45		3.85	
	Std. Dev	0.64		0.78		0.52		0.92	
	Minimum	2.74		1.20		2.29		1.67	
	Maximum	4.83		4.80		4.57		5.00	
Mean x No. of items		91	79	30	60	24	68	11	73
Total	Mean	3.92		2.50		3.45		3.71	
	Std. Dev	0.83		1.03		0.59		0.95	
	Minimum	1.04		1.00		1.14		1.00	
	Maximum	5.00		5.00		5.00		5.00	
Mean x No. of items		90	78	25	50	24	68	11	73

ICTSE=ICT self-efficacy, ANX= Anxiety, LS= Library support, TR= Training

Table 2: Variation of efficacy levels of undergraduates based on frequency of library use.

University Frequency Level		ICTSE 115	%	ANX 50	%	LS 35	%	TR 15	%	
PDN	Frequently	Mean	4.34	87	2.32	46	3.58	71	3.87	77
	(7-5 days per week)	S.D	0.69		1.17		0.58		0.85	
	Moderately	Mean	4.09	82	2.44	48	3.52	70	3.46	69
	(4-3 days per week)	S.D	0.79		1.09		0.59		0.85	
	Rarely	Mean	2.82	56	3.11	62	3.41	68	3.08	62
	(2-1 days per week)	S.D	0.99		0.55		0.36		0.64	



SJP	Frequently	Mean	3.98	79	2.14	42	3.64	73	4.07	81
	(7-5 days per week)	S.D	0.95		1.15		0.59		0.88	
	Moderately	Mean	3.90	78	2.59	52	3.45	69	4.12	82
	(4-3 days per week)	S.D	0.71		0.96		0.56		0.92	
	Rarely	Mean	3.76	75	2.55	51	3.16	63	4.02	80
	(2-1 days per week)	S.D	0.97		1.05		0.73		1.03	
RUH	Frequently	Mean	4.10	82	1.9	38	3.34	67	3.38	68
	(7-5 days per week)	S.D	0.56		0.68		0.44		0.75	
	Moderately	Mean	3.32	66	2.51	50	3.40	68	3.23	64
	(4-3 days per week)	S.D	0.84		0.96		0.65		0.65	
	Rarely	Mean	3.37	67	2.77	55	3.34	67	2.62	52
	(2-1 days per week)	S.D	0.79		0.99		0.55		0.73	
RJT	Frequently	Mean	4.01	80	3.39	68	3.55	71	3.85	77
	(7-5 days per week)	S.D	0.71		0.59		0.52		0.95	
	Moderately	Mean	4.02	80	2.66	53	3.47	69	3.82	76
	(4-3 days per week)	S.D	0.57		0.89		0.44		0.96	
	Rarely	Mean	3.58	72	2.74	55	2.74	55	3.93	78
	(2-1 days per week)	S.D	0.33		0.09		0.39		0.59	
Total	Frequently	Mean	4.16	83	2.39	47	3.54	70	3.82	76
	(7-5 days per week)	S.D	0.75		1.11		0.55		0.88	
	Moderately	Mean	3.87	77	2.52	50	3.47	69	3.67	73
	(4-3 days per week)	S.D	0.81		1.00		0.58		0.95	
	Rarely	Mean	3.57	71	2.66	53	3.20	64	3.62	72
	(2-1 days per week)	S.D	0.95		0.97		0.66		1.08	
Total			3.92	78	2.50	50	3.45	69	3.71	74

ICTSE=ICT self-efficacy ANX= Anxiety LS= Library support TR= Training

According to the ICT training scale, most study participants preferred training in EIR use. Though the average value obtained for ICT training scale was high (74%), students need further support through ICT training on library services with staff support. A comparison of students' responses of the PDN and RUH universities, reveals that they request ICT

training less frequently than do students from the SJP and RJT universities. This finding implies that training should be prioritized for library users before they access ICT and EIR services. The provision of adequate ICT training may minimise the need of library support from library staff, ICT anxiety felt by students, and may increase the students' ICT self-efficacy levels.



4 CONCLUSIONS AND RECOMMENDATIONS

Self-efficacy levels of the universities did not show much variation while the ICT anxiety showed the highest variation across the universities. The level of ICT training was found to be poor and the library support available in the university libraries was in the lowest level. The level of library support stands out from the rest of the scales having lowest level in the scales. The results of the overall analysis indicate that users received moderate library support when they used library ICT and EIR resources. This inconsistency in efficacy scales across the universities possibly resulted from the differences in the infrastructure facilities and the availability of training programmes. The comparison of the results of the present study with the previously published research is impossible since the studies concerning these scales are scarce or limited.

The overall analysis of the scales revealed that some items in some scales received lower values, and thus, they were loaded in the factor analysis at acceptable levels. As this was a generalizable study, individual loadings may not affect the scale because it indicated high internal consistence reliabilities in the analysis. It can be mentioned that although these students have a high level of ICT self-efficacy, they are subjected to considerably higher anxiety levels when using the ICT facilities in their library. Although the respondents' ICT self-efficacy levels were high across the universities, majority of students need further ICT training on the use of EIR and additional library support. A cross-sectional, longitudinal study is necessary to understand the level of ICT training students would like to have and the types of library support they have requested.

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OPENING MINDS:
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Innovation Practices of Large-Scale Manufacturing Organizations Located in Industrial Estates in the Western Province of Sri Lanka

S. Ranaweera* and V. Sivalogathan

Department of Management Studies, Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: sajeeva@inergic.com*

1 INTRODUCTION

Innovation management is a growing area of academic research. Though it is accepted that innovation leads to growth and success of individual industries and entire economies, Sri Lanka is ranked 85th out of 142 countries in the Global Innovation Index 2015 provision (Cornell University, INSEAD, WIPO, 2015). This is despite Sri Lanka being a country with a high level of literacy as well as secondary education compared to many other developing countries.

As Sri Lanka is currently utilizing almost full labour according to the Central Bank (Central Bank of Sri Lanka, 2016), with industries reporting a shortage of labour, value addition (an outcome of innovation) is the key to economic success of individual workers, companies and the country as a whole. Although a few studies on innovation management has been carried out in Sri Lanka, studies to obtain an overall view of innovation management in large scale industries are lacking.

1.1 Objectives of the study

The objectives of this study are the analysis of current innovation practices in large-scale manufacturing organizations located in the Industrial Estates in the Western Province of Sri Lanka, to identify

the current gaps in innovation management practices in such selected industries and to identify internal and external barriers to innovations of these organizations.

1.2 Literature Review

The conceptual framework for the Global Innovation Index, which has been developed and fine-tuned since 2004, provides a comprehensive view of macro-level factors that contribute to innovation (Cornell University, INSEAD, WIPO, 2015).

Different paths to innovation have been identified by Dosi and Nelson (Dosi and Nelson, 1994), Michael Porter, (Porter, 1990), Rogers (Rogers, 2003) and (Hamel, 2006). Different models of innovation at organizational level have been identified by Goffin and Mitchell - Innovation Pentathlon Framework (Goffin and Mitchell, 2010). Hanson and Birkinshaw - Innovation Value Chain (Hanson and Birkinshaw, 2007), and Kline and Rosenberg - Chain-Linked Innovation Model (Kline and Rosenberg, 1986).

The Organization for Economic Cooperation and Development (OECD) has developed a manual for measuring innovation in individual organizations (Organization for Economic Cooperation and Development,



Statistical Office of the European Communities, 2005). It is based on a framework that has been incrementally developed. Wu and Sivalogathan have developed a model and conducted a study on organizational performance in the apparel sector in Sri Lanka, based on intellectual capability and innovation (Wu and Sivalogathan, 2013), and also a study on intellectual capital and innovation in Sri Lanka, was carried out in the textile and apparel sector in Sri Lanka. (Sivalogathan and Wu, 2015).

2 METHODOLOGY

This is a qualitative, cross-sectional analytical study with purposive sampling, using the case-study approach, which used a study framework developed following an extensive literature review. The highest levels of the management were interviewed, which frequently was the Chairman / Managing Director. Deductive qualitative analysis was carried out through group and coding, based on the interview guide developed. This method was chosen over the inductive method used in qualitative research as the factors relating to innovation are widely known.

The sampling frame was obtained from the Ministry of Industries which operate these Industrial Estates. In this study, the size of the firm (Large - over 100 Employees) and the sector "Manufacturing", as defined by International Standard Industrial Classification - ISIC Classification Level 1 Code "C" was selected (Organization for Economic Cooperation and Development, Statistical Office of the European Communities, 2005). The geographical location, Western Province was predetermined, as the largest number of industries was located in this Province. Within the ISIC Level 2, six sectors were chosen from the manufacturing sectors established in the Industrial Estates in the Western Province, based on their contribution to industrial output of Sri

Lanka as specified in the Factory Industry Production Index (Central Bank of Sri Lanka, 2016).

3 RESULTS AND DISCUSSION

The findings of this study are consistent with models of different aspects of innovation proposed by Cooper and Edgett (Cooper and Edgett, 2000), Innovation Pentathlon Framework (Goffin and Mitchell, 2010), Innovation Value Chain (Hanson and Birkinshaw, 2007) and Chain-Linked Innovation Model (Kline and Rosenburg, 1986).

All organizations studied had implemented more than one type of innovation (organizational, process, product or service) during the last three years. The findings strongly suggest that the external macro factors had a significant impact on the organization level factors related to innovation. Though most organizations were constantly engaged in innovating processes and products, formal research units were available only in three firms. Reverse-engineering of products was the commonest method of acquisition of knowledge. The firms felt that there was an overwhelmingly negative attitude of officials towards manufacturing organizations at both policy making and policy implementation levels that impacted negatively on innovative practices as well as on investments for innovation. This was a significant aspect brought into focus in this study. None of the companies reported significant marketing innovations they had undertaken during the last three years. All firms indicated that funding was not an issue for innovation. No company purchased or obtained research or licenses from external sources, domestically or internationally.



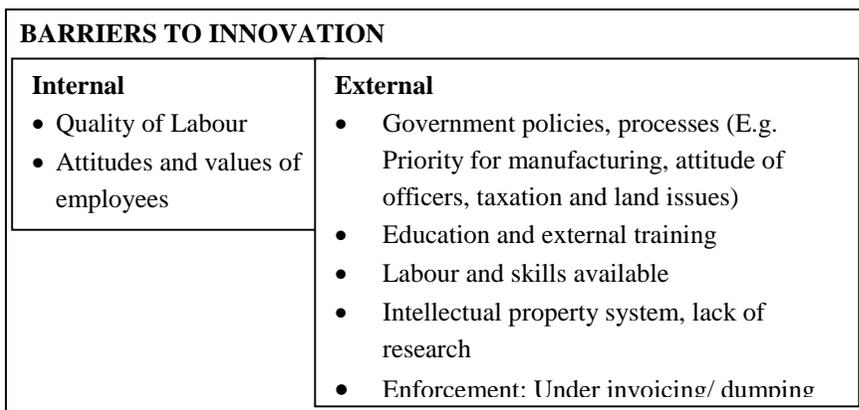
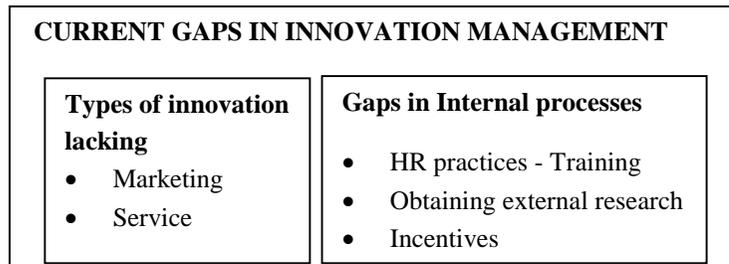
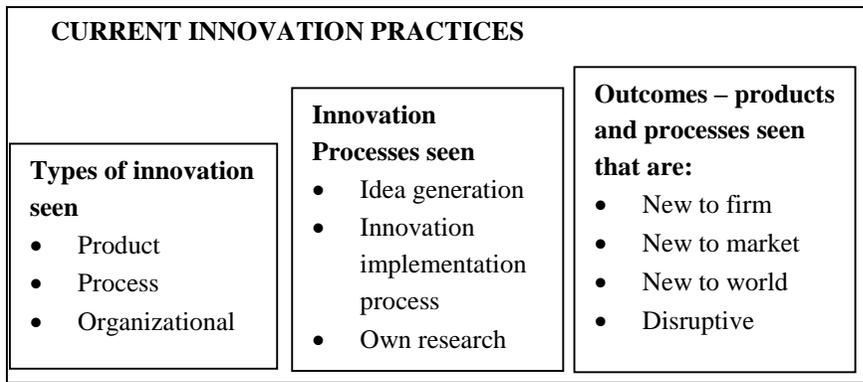


Figure 2: Findings in relation to objectives of the study

4 CONCLUSIONS AND RECOMMENDATIONS

The government should give clear and sustained signals as to the priority given to local manufacturing to address the uncertainty of the policy environment. It should also ensure that the field level officials of agencies such as the

Departments of Labour, Inland Revenue, Local Authorities and the Central Environment Authority are aware of the contexts and requirements of the manufacturing sectors and work with objective facilitation rather than enforcement. Priority consideration should be given to establish a system of helping start-up companies and

concurrently, steps should be taken to forage a closer link between the intellectual property authorities and the large scale manufactures.

The government agencies should prioritize their research, on the basis of the needs of different industries. As internal research was lacking in most companies, a need for specific assessment to address this is required. Optimum, equitable taxation methodologies which enhance government revenue without negative consequences to innovation and growth of the industries should be developed. Similar analyses must be undertaken to adjust the price of electricity to strike a balance between the electricity production

costs and the benefits for local manufacturing. Provision of adequate space for expansion of the manufacturing firms should also be a priority consideration as the availability, costs of land and the tedious procedures and time required to address land issues has had negative effects on innovation through delaying installation of new machinery as well as expansion of industries.

To improve innovation at national level, an in depth analysis of the indicators used for measurement of countries in the Global Innovation Index should be undertaken by the government and steps taken to improve each one of them to improve innovation in Sri Lanka.

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OPENING MINDS:
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***‘God of the Betel Creeper’*: Betel as an Object of Folkloric Imagination and Biodiversity in Sri Lanka**

S. Somaratne^{1*} and L. Medawattegedara²

¹*Department of Botany, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of Language Studies, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

**Corresponding author: Email: ssomaseneviratne@gmail.com*

1 INTRODUCTION

Though folkloric texts like folktales, folk songs, folk poetry and folk drama might be neglected cultural spaces for empirical research, one should not neglect what folklore scholars and scholars of other disciplines, such as history, ethno-botany and anthropology have to say about these speech acts. Man (2011), a historian specializing in Chinese and Mongol empires, relies on folklore whenever his objective historical research hits a dead end. Wickramasinghe (2002), a historian, offers ‘oral history’—“...history written with evidence gathered from a living person, rather than from a living person” (Wickramasinghe 2002)—as one of the modalities of writing history. The anthropologist Obeyesekera (2002) has recreated an alternative history of King Kasyapa’s demise by collecting folktales from the Sigirya region. And the geologist Madduma Bandara (2008), while establishing a powerful link between Sri Lanka’s biodiversity and folkloric narratives (and other ancient literary texts) encourages researchers and activists to exploit the link between biodiversity and culture in Sri Lanka in their environmental preservation initiatives. Madduma Bandara’s research inspires the present study which attempts to undertake a close reading of the representation of the popular Sinhala folk motif, the betel creeper, both in the modern scientific discourse and the folk imaginations of southern Sri Lanka. The study attempts to

locate and analyze the discourse of science and the folkloric thoughts related to the betel creeper. The folktale sample under consideration are sourced from Sri Lanka’s very first collection of southern folktales collected, annotated and published by the colonial (British) irrigation officer Henry Parker under the title *Village Folk Tales of Ceylon*. This collection appeared at the beginning of the twentieth century in three volumes featuring a total of 266 folktales. In that collection, the betel creeper plays critical role in the primary plots of two tales, namely *The Gamarala’s Son-In-Law* and *How a Tom-Tom Beater Got a Marriage*. Parker’s folktales were Sri Lanka’s first collection of folktales and this study, which is a preliminary version of a much larger study currently under way, sees his work as a suitable starting point.

The vernacular name betel refers to the botanically well-established plant species, *Piper betle* (Fig. 01), which is native to South East Asia. In the Indian traditions it is believed that betel was brought from heaven by a semi-divine character called Arjuna and the celestial origin of betel is reproduced in many South Asian cultures, including in Sri Lanka. Thus betel is valued highly in South Asian nations, especially among the Indian and Sri Lankan communities. At southern Sri Lankan marriage ceremonies for example, the bride and bridegroom exchange betel



leaves with the belief that this ritual brings divine blessings and prosperity.



Figure 1: Photograph of fertile shoot of Piper betel

2 METHODOLOGY

We undertook an analytical reading of the two tales by fore-grounding the betel creeper to locate how this plant could have aided the meaning-making endeavors of the story tellers. In other words, rather than taking the betel creeper as a static/background motif in the fictitious space of a tale, we treated it as a living/participating motif which carried known information to an interested listener. The scientific discourse located around the betel creeper and the meaning-making endeavors of the folk story tellers form the basis of this paper's conclusions.

3 RESULTS AND DISCUSSION

In the both tales under study here, the betel creeper is located around the act of marriage. In *The Gamarala's Son-In-Law*, one of the critical tests devised by the Gamarala (the village headman) to ascertain the physical strength and efficiency of potential sons-in-law is the ability to water twelve betel creepers. Many potential suitors fail in this endeavour—suggesting that it is difficult work or that the younger males do not consider this act to be a worthy task. However, in the Gamarala's worldview, a betel creeper holds a special place and he

expects a potential son-in-law to understand and be sensitive to his point of view. One of the men who seeks the hand of the Gamarala's daughter, instead of watering the plants, uproots the betel creepers and feeds them to young calves—a clear act of sabotage and lack of respect—prompting Gamarala to devise means to kill this young man. Gamarala, it could be argued, would kill on behalf of his betel creeper. Further, in this tale, working men are seen munching betel while engaged in tilling the soil.

In the tale, *How a Tom-Tom Beater Got a Marriage*, a wealthy man from the devalorised drummer caste seeks a marriage for his son from a Gamarala who has fallen on hard times. The caste-conscious and proud Gamarala rejects the man's offer outright—his main argument being that he is unable to entertain the possibility of 'caste pollution.' After twilight, this low caste man climbs a tree that supports a betel creeper, which is situated in front of the Gamarala's house. The man mimics a deity and demands that the Gamarala give his daughter in marriage to the tom-tom beater's son. The Gamarala accepts this order, offering the strong suggestion that the betel creeper has sacred connotations for him. In other words, the Gamarala is willing to violate caste rules to propitiate a deity from the betel creeper.

In both these stories the following betel-creeper-related motifs are prominent: a) for the cultivating adult male, betel is an important sacred plant; b) the ability to nourish and sustain a betel creeper is a unique trait of masculinity and could be rewarded with a bride; c) the betel creeper is planted in front of the house; d) males tend to munch betel leaves when engaging in physical labour; and e) the uprooted betel creeper can be used to feed calves.

The discourse of science on the betel creeper suggests that: though chewing betel leaves leads to habituation and withdrawal symptoms of psychoactive



effect, it increases the capacity to exercise physical and mental functions for a longer duration (Chu, 2001; Garg and Jain, 1996). In addition, it has recently been reported that betel leaves and roots possess aphrodisiac properties and may also function as a contraceptive.

4 CONCLUSIONS AND RECOMMENDATIONS

The Indian folk belief surrounding betel as a sacred plant in all probability has been absorbed by the common folk of Sri Lanka. Thus, the Gamarala, locates this plant as scared, and considers it worthy of nourishment and sustenance. He expects younger males to follow such traditions. The sacrosanct nature of the betel creeper is so established that a low-caste male exploits this notion to achieve the near-impossible task of gaining access to a higher caste for his son—a process known as hypergamy. The scared nature of the betel creeper might have promoted the Gamarala to plant it in front of the house, so that the creeper is the first thing he sees in the morning—an auspicious sight.

Closely bonded to the sacrosanct nature of this plant is the idea of masculinity and sexuality. Modern research connects the betel plant with sexual prowess. Perhaps, the Gamarala's motive of testing a younger male's ability to nurture this plant is a symbolic representation of their sexual prowess—an important role in a marriage necessary for cultivating family and producing offspring, specifically males, who could provide more labour to sustain cultivation. For the Gamarala, the 'maleness,' or the 'masculinity' of a son-in-law resides in his ability to be fertile and strong. Thus, watering twelve betel creepers—an act of sustenance—could be interpreted as an act that represents the idea of male sexuality. Those males who failed to water the betel creeper could be

considered sexually inactive or impotent; and the one who uprooted the betel creeper could be a male whose sexuality was aggressive and out of control—perhaps the reason why the Gamarala attempts to kill him. We read this act of killing as a metaphoric act, whereby the killing of the 'male' represents the attempt to moderate his aggressive and reckless sexuality.

Munching betel leaves in the midst of physical labour under the harsh sun, could offer physical and mental strength—the possible reasons why the male working on the Gamarala's field also took betel and the equipment needed to munch them. Perhaps, feeding a young calf with the betel creeper could be connected to the idea of strength.

All in all, there are striking resemblances between the representation of betel in the folkloric imaginations and the scientific discourse. This finding reminds us of the folklorist Dundes's assertion of folklore as the "autobiographical ethnography...people's own description of themselves" (2007). Further research is needed to fully understand this connection and the present work, as mentioned earlier, is the beginning of such an effort.

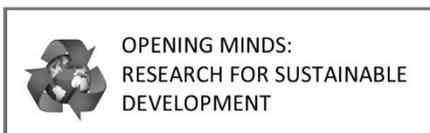
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Super Heroes, Mutants, Minorities and Marginalization: A Critical Review of the 2016 Hollywood Movie, “Logan”.

Sameera Tilakawardana*

The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: sthil@ou.ac.lk

1 INTRODUCTION

In a time where democracy is believed to be the most accepted form of governance, the issues of minorities, their discriminations and marginalization are also on the rise. The effects of democratic decisions by the nations on minorities can be witnessed in their collective decision making. One of the most commonly observed reactions by the minorities in the USA in times of political turmoil is to migrate to Canada, a country with friendlier approach to minorities and migrants. *The Guardian* reported that Canadian citizenship application numbers show definite spikes in some politically significant years: 2001, when Bush was elected president; 2003, when the US invaded Iraq; and 2007, during the US housing market crash and recession (Schwab, 2017).

When Donald J. Trump won the U.S. presidency, the number of people considering moving to Canada is again on the rise. As a result, the Canadian government’s immigration website crashed during the election because it received so many queries from Americans. With reference to this incident *The Vancouver Sun* reported that it also happened earlier same year as British voters unexpectedly voted to leave the European Union (Lee, 2016).

The movie *Logan* and the X-men films in general raise questions associated with

minorities. This X-Men film has strong statements on contemporary matters like the controversial promise of Donald Trump to “build the wall” and the urge of American minorities to migrate to Canada. Asked about the film’s political reading before the American presidential election, James Mangold the director of *Logan* said he couldn’t have predicted how the presidential election would shake out. But he noted, “I think we’ve all felt what’s going on in the country right now, for several years... I’ve felt it for a long time” (www.comingsoon.net). In his interview with *vulture.com* Mangold stated, “to me, the sense of nationalism and anxiety of people who are Other seemed to fit very well into an X-Men idea (Riesman, 2017).

2 OBJECTIVE AND METHODOLOGY

This paper looks at how *Logan* a movie from a comic book genre, with its futuristic fantasy setting, attempts to create a discourse about the real issues faced by real people.

The research approaches the film from a symptomatic perspective. The narrative of the film, its characters and genre in addition to its dialogues and the uses of objects are analysed for their metaphorical meaning. The research explores how the filmmaker uses this symbolic content to



link the fantasy created in the film with the real that exists and is experienced by the audiences every day.

3 STORY AND THE NARRATIVE

Logan is a super hero, a mutant, also known as Wolverine. His genetic mutation has given him extraordinary healing abilities and three claws on each hand, which were later strengthened with the super alloy, Adamantium. His mutation has allowed him to stay in his prime for over 100 years. He never ages and cannot be killed. The character came in to existence with Marvel comic super heroes in 1974. The alternative version of “Old Man Logan” first appeared in a publication in 2010, and started its own series in 2015.

From the first Marvel Comic cinematic adaptation of Wolverine in 2000, the character is played by an Australian actor, Hugh Jackman. He appeared as the Wolverine in eight previous movies, and *Logan* is said to be his last (Dvorkin, 2017).

The film is set in the year 2029, a time when the mutant population has decreased to near extinction and without new mutant births for the past 25 years. When the movie begins, we see that Logan has aged, and he has lost his healing powers and immortality. He is suffering from the memories of his past and has become an alcoholic. He is trying to make a living as a chauffeur. It is a story about a retired super hero who has lost his super powers, but is yet called upon to save the day one last time. The dramatic need of Logan is to live a normal life, but his past keeps coming at him with new challengers.

It's visible during the opening scenes when Logan is chauffeuring a group of upper class young people in his limo, who seem to be high on alcohol and other substances, to a social event or gathering. When Logan drives his car past the Mexican border the passengers chant at

legal immigrants and Mexican travellers, “USA! USA! USA!” Failing to distinguish between legal and illegal entry, they likely can't tell much of a difference between desperate families and “rapists” either.

In the first act, Logan is persuaded by a stranger to drive a little girl named Laura to the Canadian border. Later it is found that Laura is also a mutant and shares Logan's genetic code. Further a group of mercenaries are tracking Laura on behalf of a corporate which is responsible for the annihilation of mutants.

At the end of the movie, Logan supports a group of young mutants, (a minority group, supposed to be the last of their kind) to cross the border into Canada, sacrificing his own life in the process. In his dying moment, he tells the girl who shares the same genetic code, “don't be what they made you”, and before his last breath he mutters “so this is what it feels like” referring to the feeling of death, something he observed many times over the period of 120 years, but never experienced.

4 CINEMATIC INFLUENCES

Even though the movie *Logan* as part of the X-Men series, belongs to the Super Hero genre, it shows considerable resemblance to American Westerns. The backdrops of open landscapes and untamed wilderness resonate with the scenic look and feel of the western genre. Further, as a character, Logan portrays many similarities with an aging gunslinger who stands between good and evil for one last time, calling to mind characters such as Will Kane in “High Noon” (Zinnemann, 1952) or the eponymous protagonist of the movie “Shane” (Stevens, 1953). The western genre itself is about the European migrants trying to settle down in the new world and their battles with the untamed wilderness and indigenous communities. With his



references to the western genre, Mangold reminds us of America's roots as a nation of immigrants.

The other most significant feature of *Logan* is, its breakaway from the PG13 rating of previous Wolverine movies in favour of an R-rating for strong language and brutal graphical violence throughout the film (Farokhmanesh, 2017). The magnitude of violence in *Logan* is so unbelievable that it would alienate the audience from the movie. This alienation (Verfremdungseffekt) from a Brechtian perspective, keeps the spectators conscious that they are in a cinema and distances them from emotional involvement. The audience's degree of identification with characters and events is presumably thus controlled, and it can more clearly perceive the "real" world reflected in the film. This ultimately helps the spectator to understand the complex nexuses of historical development and societal relationships. Early experimental works during the French new wave (Nouvelle Vague), with reference to Brecht, focus on the alienation and marginalization experienced by the protagonist as he (or she) moves through a dysfunctional world in which he or she has no place. These films often end with the death of the protagonist (Nouvelle Vague, 2017).

The violence in *Logan* and the alienation effect caused by it shows the potential of the movie to make the audiences ask questions about real life events and distance themselves emotionally from problems that demand intellectual solutions.

5 DISCUSSION

The idea of a weakening super hero clearly differentiates *Logan* from an average super hero movie. Furthermore, *Logan* has

disassociated itself from the melodrama of a typical super hero film and is trying to create a socio-political discourse on contemporary issues, with complex character arcs and narrative structure.

James Mangold has strengthened the synchronization of the two genres (western and super hero) by including few scenes from the western classic "Shane" inside *Logan*. We see Laura watching "Shane" on TV, where Shane after beating the bad guys, tells a little boy, "There's no living with a killing... Right or wrong, it's a brand, a brand that sticks. There's no going back". I believe throughout his life *Logan* tried to break away from this with no success. This is what *Logan* realized in his dying moment and this is what Laura understands at the end, that sometimes there is no redemption in the decisions you make or the actions you take. You have to live with who you are and what you have done. In a broader perspective, when you are born in to something you cannot get away from it. This notion of self-realization is strengthened in the final scene, where Laura turns the cross on *Logan's* grave to make it an 'X', reminding us that *Logan* is a mutant before anything else, it's not his choice but it's who he is, like all the people who are born in to different ethnicities, colours and cultures.

Even though the origin of *Logan* is rooted in the comics, its universe is more fantasy and fiction. The film has created a world in which every twist reminds us of our own socio-political dynamics. I believe that, James Mangold has created a critical political essay and released it in a comic book - pulp fiction package. In the process Mangold has deconstructed the stereotypical super hero and the super hero genre itself and created a discourse about self and the other. He has constructed a mirror that enables us to look closer at ourselves and our future.

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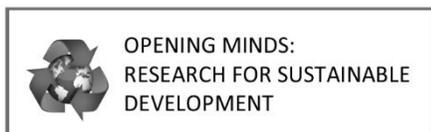
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Determinants of Merchandise Export Performance in Sri Lanka

L.U. Kalpage^{1*} and T.M.J.A. Cooray²

¹ *Central Environmental Authority, Battaramulla*

² *Department of Mathematics, University of Moratuwa*

**Corresponding author: Email: lkalpage@gmail.com*

1 INTRODUCTION

Development of a country depends on social and economic performances of that country. There are many variables that contribute to economic growth. Among them, Export is considered as one of the most important accelerator of economic growth.

There are two types of exports namely merchandise exports and service exports. Merchandise exports are tangible goods sent out of a country and service exports are selling of services from home country to a foreign country. This study concentrates on merchandise exports only.

Sri Lanka is ranked as the 83rd largest export economy in the world and known as a major exporter of tea, rubber, garment and textiles products. Despite several initiatives taken by the government to enhance the exports performance of Sri Lanka, only 8% cumulative average growth rate has been achieved for merchandise exports during the last fifteen years. Therefore analyses focusing on determinants of export are of critical importance and will be helpful to the government to solve bottlenecks and barriers in terms of export performance.

The objectives of this study are to investigate the pattern and behaviour of merchandise exports in Sri Lanka using

time series analysis and to predict future trends of merchandise exports by identifying the factors that significantly affect to the merchandise exports. Outcome of this study would help to make policy decisions and to predict short-term and long-term exports performances of the country.

2 METHODOLOGY

The annual time series data for the period 1978 to 2015 is used in this study. For the purpose of analysing the country's export performance, the export model was estimated using time series analysis techniques.

The time series data that is used in this study for Merchandise Exports in million LKR (MEX), Merchandise Imports in million LKR (MIM), Gross Domestic Product at current market price in million LKR (GDP) and Sri Lanka Rupee Exchange Rates against the US Dollar (ER) were collected from "Central Bank Annual Report 2015". Data for Crude Oil Price in LKR (COP) was collected from "inflationdata.com website" and data for Foreign Direct Investment net inflow in million LKR (FDI) was collected from "The World Bank website". The statistical software, EViews 7 was used for the analysis of the data.



Multivariate time series analysis was used to identify the significantly effective factors to the merchandise exports in Sri Lanka. Time series plot and Augmented Dickey-Fuller (ADF) test were used to observe the stationary properties of the series. Johansen co-integration test was used to test the co-integration of the variables. Since variables are co-integrated and individually non-stationary Vector Error Correction Model (VECM) was used to fit a model for merchandise exports.

When time series models are used it is important to check whether the model residuals are independent, identical and normally distributed with mean zero and constant variance. In this study, Autocorrelation and Partial Autocorrelation Functions (ACF and PACF) and Box-Pierce statistic (Q-stat) were used to test whether the error terms are related to each other. Breusch-Godfrey Serial Correlation Lurange Multiplier (LM) test was used to test the serial correlation among error terms of a model. Heteroskedasticity test was used to test the constant variance and Jarque-Bera test is used to check the normality of error series. Finally Mean Absolute Percentage Error (MAPE) is used to measure the prediction accuracy of the fitted model.

3 RESULTS AND DISCUSSION

Before carrying out the advanced analysis it is important to get a better idea about the background of merchandise exports in Sri Lanka. The sample is composed of data obtained from national level for 38 year period from 1978 to 2015.

Merchandise exports with the unit of rupees in million from 1978 to 2015 by annual basis were plotted against the year and shown in Figure 1. According to Figure 1, there is an increase in total earnings from merchandise exports from 1978 to 2015 while declines were

apparent in the period 2009 and 2015. Slow increment can be identified from 1978 to 1990, and after 1990, earnings from merchandise exports increased rapidly. Therefore, in order to stabilize variance fluctuation Box-Cox transformation test is used. Suggested transformation is ln(MEX). Similarly, other explanatory variables such as MIM, GDP, FDI, GD, ER and COP are also transformed according to Box-Cox transformation test results. First difference of each transformed series is stationary

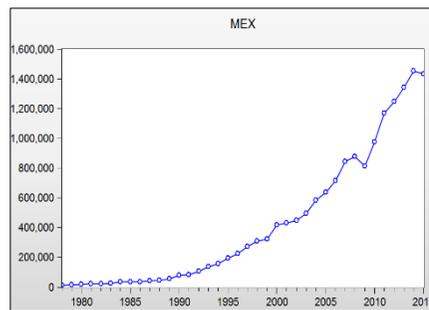


Figure 1: Time series plot of MEX

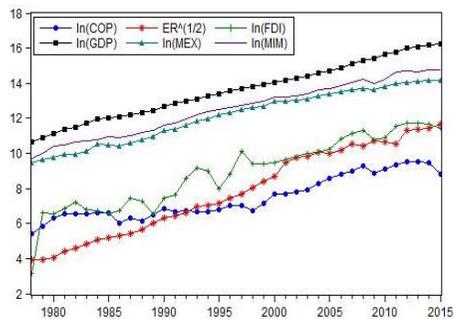


Figure 2: Graph of transformed series

Table 1: ADF test results

Series	P value		Order of integration
	Original	First difference	
ln(MEX)	0.4015	0.0000	I(1)
ln(MIM)	0.4262	0.0000	I(1)
ln(FDI)	0.7436	0.0000	I(1)
ln(GDP)	0.4454	0.0004	I(1)
ln(COP)	0.6404	0.0005	I(1)
(ER) ^{1/2}	0.9588	0.0000	I(1)



According to Figure 2, it can be concluded that the data are correlated and the series is non-stationary according to the ADF test. As shown in the Table 1, each series is in the same order of integration I (1). Then the Johansen co-integration test was applied to identify co-integration between them.

According to Table 2, Maximum Eigen value test shows that there is one co-integrating equation while trace statistic shows there are two co-integrating equation indicating long run relationship among variables, but lag selection criterion recommended that optimum lag is 1. Therefore VECM of lag 1 has performed.

Table 2: Johansen co-integration test result

Hypothesized No. of co-integration equations	Eigen value	Maximum Eigen value (λ_{Max})		Trace Statistics (λ_{Trace})	
		Critical Value	Prob.**	Critical Value	Prob.**
None	0.6816	40.0775	0.0372*	95.7537	0.0026*
At most 1	0.5813	33.8769	0.0974	69.8189	0.0450*
At most 2	0.4360	27.5843	0.3001	47.8561	0.2586

* Rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis p-value

Equation 1: Fitted Vector Error Correction Model

$$D(TMEX)=C(1)*[TMEX(-1)-0.1644*TMIM(-1)+0.6835*TCOP(-1)-0.1070*TFDI(-1)-0.6499*TGDP(-1) - 0.3169*TER(-1) - 2.9063] + C(2)*D(TMEX(-1)) + C(3)*D(TMIM(-1)) + C(4)*D(TCOP(-1)) + C(5)*D(TFDI(-1)) + C(6)*D(TGDP(-1)) + C(7)*D(TER(-1)) + C(8);$$

Where; TMEX=ln(MEX), TMIM=ln(MIM),TFDI=ln(FDI),TGDP=ln(GDP),

$$TCOP = \ln(COP), TER = (ER)^{1/2}$$

Table 3: Fitted VECM results

Variable	Coefficient	Std. Error	t-Statistic	Probability
Error correction model	C(1) = -0.3948	0.1275	-3.0956	0.0044
D(TMEX(-1))	C(2) = -0.0902	0.2145	-0.4206	0.6772
D(TMIM(-1))	C(3) = -0.1030	0.2135	-0.4825	0.6362
D(TCOP(-1))	C(4) = 0.1585	0.1140	1.3907	0.1753
D(TFDI(-1))	C(5) = -0.0163	0.0253	-0.6470	0.5229
D(TGDP(-1))	C(6) = -0.6020	0.4274	1.4085	0.1700
D(TER(-1))	C(7) = -0.0718	0.0989	-0.7256	0.4741
Constant	C(8) = 0.0616	0.0622	0.9902	0.3306
Model diagnostics criterion				
R-squared	0.2633	Mean variance dependent	0.1262	
Adjusted R-squared	0.0791	S.D. variance dependent	0.1035	
S.E. of regression	0.0994	Akaike info criterion	-1.5871	
Sum squared residual	0.2764	Schwarz criterion	-1.2353	
Log likelihood	36.5688	Hannan-Quinn criterion	-1.4643	
F-statistic	1.4297	Durbin-Watson stat	2.0773	
P value	0.233			



According to the Table 3, there is no short run causality from all explanatory variables to the MEX. But coefficient of the error correction model (C(1)) has the correct negative sign, and it is a significant indication that there is long run relationship. Since there is no short run causality from all explanatory variables to the MEX and R-square is too small VECM is not suitable for forecast MEX.

So this study proposed the lag regression model.

According to Table 4, TER and TMEX lag 1 is positively significant while TCOP lag 1 value is negatively significant to the current year TMEX. Also TGDP is positively significant while TGDP lag 1 value is negatively significant to the current year TMEX.

Table 4: Fitted lag regression model with dependent variable of TMEX

Variable	Coefficient	Std. Error	t-Statistic	Probability
TER	0.0411	0.01364	3.0114	0.0050
TCOP(-1)	-0.1853	0.0369	-5.0233	0.0000
TGDP	1.2949	0.2185	5.9271	0.0000
TGDP(-1)	-1.0166	0.2117	-4.8018	0.0000
TMEX(-1)	0.7696	0.0690	11.1529	0.0000
Model diagnostics criterion				
R-squared	0.99816	Mean dependent variance	12.18772	
Adjusted R-squared	0.99793	S.D. dependent variance	1.47509	
S.E. of regression	0.06712	Akaike info criterion	-2.43974	
Sum squared residual	0.14414	Schwarz criterion	-2.22205	
Log likelihood	50.13523	Hannan-Quinn criterion	-2.36299	
Durbin-Watson stat	2.37221			

Residual Analysis

Table 5: Residual Autocorrelation

lag	ACF	PACF	Q-stat	P-value	lag	ACF	PACF	Q-stat	P-value
1	-0.209	-0.209	1.7495	0.186	6	-0.089	-0.225	4.7498	0.576
2	-0.075	-0.124	1.9820	0.371	7	0.080	-0.042	5.0586	0.653
3	0.043	-0.001	2.0598	0.560	8	0.091	0.003	5.4746	0.706
4	-0.224	-0.237	4.2470	0.374	9	0.041	0.019	5.5629	0.783
5	-0.055	-0.174	4.3821	0.496	10	-0.025	-0.084	5.5958	0.848

According to Table 5, all Box-Peirce statistics are not significant. Therefore we can conclude that the model is adequate.

(P-value = 0.1062)) for residual series indicate the normality and constant variance of error terms respectively.

LM test statistic (2.9533 (P-value = 0.2284)) indicates no serial correlation among error terms. Jarque-Bera statistic (0.9292 (P-value = 0.6284)) and Heteroscedasticity test statistic (20.8239

After considering all the tests and criteria, it can be conclude that the following model is most suitable model for forecast the merchandise exports in Sri Lanka (MAPE = 0.305%).

$$TMEX_t = 0.041 TER_t + 1.2949TGDP_t - 1.0166TGDP_{t-1} - 0.1853TCOP_{t-1} + 0.7696TMEX_{t-1}$$



4 CONCLUSIONS AND RECOMMENDATIONS

This study considers the performance of merchandise exports in Sri Lanka from 1978 to 2015. To determine the performance of merchandise exports in Sri Lanka, this study focused on finding significantly affected factors to the merchandise exports and also to find the suitable model for forecasting the merchandise exports.

Since all original variables are non-

stationary due to trend and variance fluctuation, variables were transformed. MEX, MIM, FDI, GDP and COP were transformed in to natural logarithm of the original series and ER was transformed in to square root of the original series.

There is upward trend for merchandise exports in Sri Lanka and merchandise exports in Sri Lanka can be forecast using following time series model.

$$TMEX_t = 0.0411ER_t + 1.2949TGDP_t - 1.0166TGDP_{t-1} - 0.1853COP_{t-1} + 0.7696TMEX_{t-1}$$

The result suggests that an increase of current year exchange rate and gross domestic product at market price cause an increase of current year merchandise exports. Previous year gross domestic product at market price and crude oil price negatively affect the current year merchandise exports while previous year merchandise exports positively affect the current year merchandise exports. Merchandise imports and Foreign Direct Investment net inflow were found to be

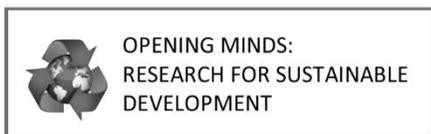
statistically insignificant to determine merchandise export performance.

The conclusion also reveals that the gross domestic product should continually grow in order to increase the earnings of merchandise exports for the year compared to that of the previous year. Therefore, it is recommended to formulate a policy for continuous growth of the gross domestic product of the country.

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Exploring Pro-Social Moral Reasoning of Sri Lankan School Children Using Eisenbergian Dilemmas

U.P. Miriyagalla* and B.D.D.Pathirana

Department of Psychology, University of Peradeniya, Sri Lanka

**Corresponding author: Email: upekhz@gmail.com*

1 INTRODUCTION

According to Eisenberg (1991), prosocial behaviour is “voluntary behaviour intended to benefit another...there are different kinds of prosocial behaviours, for example, helping, sharing and comforting.” However, a more important distinction among prosocial behaviours revolves around the actor’s motive for his or her behaviour. Prosocial behaviours can be motivated by a variety of factors including “egoistic concerns (the desire for reciprocity, a concrete reward, or social approval), practical concerns (e.g. the desire to prevent damage to an object), other-oriented concern (e.g. sympathy) or moral values (e.g. the desire to uphold internalized moral values)”. Prosocial moral reasoning is a zone that is supported through past research as having gender, age and cultural variations (Abdullahi, I., and Kumar, P., 2016; Chadha, N., and Misra, G., 2004; Eisenberg, N., 1991). However, it has not been studied extensively in the Sri Lankan context. The present study explores the prosocial moral reasoning of Sri Lankan school children using Eisenbergian dilemmas (acquired as a result of correspondence between the researcher and Eisenberg) by taking age and gender as the independent variables. The primary objectives of the study are to explore the pro social behaviours of Sri Lankan school children and look into the possibility of applying Nancy Eisenberg’s

stages of moral development application in developing a moral framework for Sri Lanka. The significance of this study is that it looks at this conceptualization of morality in regard to the local Sri Lankan context and tries to critically analyse the application and usage of western theories in a non-western setting. The prominent feature of this study is that no similar research has been conducted in the Sri Lankan setting prior to this. Therefore this is the first step in conceptualizing a moralistic framework for Sri Lanka.

2 METHODOLOGY

2.1 Participants and Materials

The participants of this study were 86 school children representing grades five (n = 32; Girls = 20; Boys= 12), eight (n = 25; Girls=11; Boys=14), and eleven (n = 29; Girls =12; Boys=17). Four stories from Eisenberg’s original study were culturally adapted based on WHO standards (Process of translation and adaptation of instruments, n.d.) and were administered as a paper-pencil measure to the participants. The final tool consisted of 4 stories that described different scenarios that ultimately require the reader to decide whether the protagonist should help the



character in need of help or not. Additionally, the reader was asked to give reasons for his/her decision. It was important to emphasize to the students that in the stories they only had the options of either helping the protagonist or not and that there was no middle path option. It should be noted that to promote gender neutrality the gender of the protagonist of the stories matched that of the participant. A data sheet accompanied the stories to collect demographic details of the school children.

2.2 Data analysis

The responses of the stories consisted of three variations such as 'helping, not helping and rejected (responses that had chosen both the alternatives of helping the protagonist and completing one's own business). The story responses were coded as, Helping = 1, Not helping = 0, Rejected = 2.

Secondly, the reasons that the participants provided for either helping or not helping the story's protagonist were coded into categories. CATEGORY 1 = 1 (Hedonistic reasoning), CATEGORY 2 = 2 (Needs-oriented reasoning), CATEGORY 3 = 3 (Stereotyped / approval oriented reasoning), CATEGORY 4 = 4 (Empathy oriented reasoning), CATEGORY 5 = 5 (Strongly internalized stage)

After assigning a category for all the reasons, scores were calculated for the five categories using a scale of 1-5 where 1=no use of reasoning, 2=use in 1 story, 3=use in 2 stories, 4=use in 3 stories, 5=use in 4 stories. A composite index for each and every individual was obtained for the five categories in order to get a clear understanding on where each participant stood on the different levels. The composite index was analysed to obtain the dominant category and lowest category for each individual.

Composite index = x/y

x = that particular reasoning type's total for the individual

y = total scores for all categories of reasoning

After procuring all the needed scores, chi-square analysis was run to look at the relationship between the independent and dependent variables. A comparison was made between the findings of the present study and the original study of Eisenberg.

3 RESULTS AND DISCUSSION

Helpful behaviour was used by the majority of the sample across all stories except for the third story where 'helping' would result in losing a cash prize. Many of the participants had chosen the 'not helping' option and had given the losing of the cash prize as the reason for the decision.

Results conveyed that there was a cultural difference in the development of prosocial reasoning. Majority of the participants were in level 3 of Eisenbergian dilemmas (e.g. -approval seeking and stereotyped orientation). Similar to the original study, participants showed a gradual increase in their level of morality with age but in fewer numbers. No significant relationship was found between the responses of the four stories with that of age and gender. When comparing the categories of the stories with gender and age, data conveyed a significant relationship between the stories 2 and 3 categories with age. The second story relates the encounter with a bully and it may be speculated that with age we develop the courage to deal with bullies. In story three, the relative importance posed by the cash prize to the different age groups may vary. This may be the reason behind the significant relationship observed between story 3 and age.

Similar to the original study, not one



single category of reasoning was used by individuals in all 4 stories. The categories changed from story to story for all individuals. Even though the researchers were able to determine a dominant category for each of the participants, none of the participants had used that particular type of reasoning in all the four stories.

As shown in table 1 the participants, irrespective of gender and age differences, are dominated by category 3 reasoning. According to Eisenberg (1986) the three age groups should be dominated by needs oriented, approval oriented and empathy-oriented type of reasoning. But in the study, all age groups were dominated displaying approval oriented/stereotyped orientation.

Table 1: Comparison between the original study and the present study

		Eisenberg’s Model	Present Study
Dominant Category	Grade 5	Category 2 Needs-Oriented Orientation	Category 3 Approval/Stereotyped Orientation
	Grade 8	Category 3 Approval/Stereotyped Orientation	Category 3 Approval/Stereotyped Orientation
	Grade 11	Category 4 Empathic Orientation	Category 3 Approval/Stereotyped Orientation

4 CONCLUSIONS AND RECOMMENDATIONS

The inability to replicate the original study implies the significance of cultural variables in shaping the prosocial moral reasoning of children in Sri Lanka.

Further studies are required to decide the generalizability of the results.

All these differences highlight the need to develop a separate theoretical model for non-western cultural settings for prosocial behaviour.

Future studies should focus on the cultural implications of pro-social morality of Sri Lankan children. Sri Lankan children’s tendency for approval seeking and stereotypical reasoning should also be explored.

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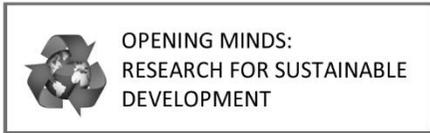
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The Need to Identify the Right to a Healthy Environment under Constitutional Reforms

K.M.C.R. Karunatilaka^{1*}

¹*Department of Law, University of Peradeniya, Sri Lanka*

**Corresponding author: Email: chetanakarunatilaka@yahoo.com*

1 INTRODUCTION

The emergence of a new generation of human rights, known as ecological/environmental rights has become a focal point of interest among the global community. “Environment” means the natural, cultural and social systems, economic and human activities and their components and the interactions and interrelationships between these components (Belbase, 2009). Freedom of living in a clean and healthy environment is an essential realization of human rights norms. Every individual has a right to enjoy the highest attainable standard of the living environment.

There are two types of environmental rights identified by countries, i.e. substantive and procedural environmental rights. The right to a clean and quality environment is a substantive ecological right, whereas the right to participate in environmental decisions and right to environmental information are procedural ecological rights. Even though more than ninety (90) countries have guaranteed substantive ecological protection, only around thirty-fourty (30-40) countries have recognized procedural rights (Daly, 2012). Thus substantive and procedural environmental rights are being identified for the sake of protecting natural and environmental heritage. These environmental rights are still in the process of development and are being shaped and moulded in international as

well as domestic socio-legal systems. A growing number of international human rights instruments have acknowledged that the right to live in a clean and healthy environment is a basic human right. Further, some national constitutions have set forth ecological rights of the people. According to Alan Boyle, in the absence of constitutionally protected environmental rights, many jurisdictions have allowed the liberal use of other constitutional rights and public interest litigation for environmental cases (Boyle, 2009).

Chapter III of the Sri Lankan Constitution has failed to give due recognition to any of the ecological rights. Therefore the main objectives of this paper are to recognize the recent environmental pollution and degradation incidents that adversely impacted the community and to evaluate the possibility of resolving such chaos by the inclusion of environmental rights into the Fundamental Rights chapter of the Sri Lankan Constitution in the light of other jurisdictions.

2 METHODOLOGY

This research study is solely based on a literature review with special reference to foreign jurisdictions in order to understand the significance of the right to a healthy environment for the citizens of



Sri Lanka. Therefore attention is drawn to a comparative analysis with some other jurisdictions. Reference is made to a huge collection of secondary sources such as published text books, local and foreign journal articles, recent international and local judgments with regard to the research issue and electronic based resources, on the following lines.

- Identification of the significance of the right to clean and healthy environment in the society
- Lack of provisions to address ecological rights in the existing Fundamental Rights Chapter under the Constitution of 1978.
- How the Sri Lankan Courts have identified the significance of the right to a healthy environment through judicial activism.
- Analyzing the paramount interest given to this right in the International documents and National legislations
- Whether improvements need to be in place for introduction of the ecological Fundamental Rights in Sri Lanka.

3 RESULTS AND DISCUSSION

Before globalization and industrialization, human desires were relatively narrow; therefore the drafters of the 1978 Constitution had focused only on civil and political rights and there was no paramount necessity of guaranteeing environmental rights. Since then, the standard of the global environment has degraded where a healthy environment is at stake. Environmental degradation such as deforestation, rising of temperatures, rising of sea level, climate change and depletion of ozone layer has become major issues to every nation. Due to the lack of Constitutional protectionism, ecological rights were protected through a process of judicial activism.

According to the opinion of the Supreme Court of Sri Lanka in the case of

Bulankulama and others v. Secretary, Ministry of Industrial Development and others (2000), “the principles set out in the Stockholm and Rio de Janeiro Declarations are not legally binding in the way in which an Act of our Parliament would be. It may be regarded merely as “soft law”. Nevertheless, as a Member of the United Nations, they could hardly be ignored by Sri Lanka. Moreover, they would, in my view, be binding if they have been either expressly enacted or become a part of the domestic law by adoption by the superior Courts of record and by the Supreme Court in particular, in their decisions” In this meticulous judgment, the Supreme Court endorsed that environmental rights held in common by all citizens can be vindicated through other provisions of the Constitution. Since this judgement, the right has been directly and indirectly accepted by the superior Courts of Sri Lanka, in a collection of recent reported cases. (*Heather Therese Mundy v Central Environmental Authority* (SC Appeal 58/2003))

The first international instrument to acknowledge the right to a healthy environment was the Universal Declaration of Human Rights (1948). International Covenant on Economic, Social, and Cultural Rights (1966) also set forth this right as a human right that should be protected. Outputs of the landmark environmental law conferences held in 1972 and in 1992, Stockholm Declaration and Rio Declaration, adopted the right to live in a healthy environment as a basic human right.

When it comes to national legislation, Portugal was the first country to guarantee that “*everyone shall possess the right to a healthy and ecologically balanced human living environment....*” (The Constitution of Portuguese Republic, 1976). Article 24 of the South African Constitution protects the Right to healthy environment of the present as well as future generations. Since 1976 the world had witnessed a rapid growth in the recognition of the right



to clean and healthy environment as a fundamental right. More than ninety five (95) countries in the world had specifically recognized ecological rights such as live in a clean and healthy environment, access to justice to environmental justice, participation in decision-making and access to environmental information. (Daly, 2012)

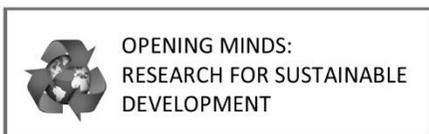
4 CONCLUSIONS AND RECOMMENDATIONS

The right to healthy environment is a universally accepted norm, which is guaranteed by the constitutions of civilized nations. Therefore, recognition of ecological rights under the Sri Lankan Constitution has become a well-timed requirement. The fundamental rights chapter of our Constitution is neither comprehensive nor up to date and it guarantees only a small number of rights. Due to the rapid improvement of the environmental education, the amount of Petitions filed in the superior Courts concerning environmental matters are dramatically increasing. Therefore, inclusion of the right to healthy environment as a fundamental right would be a significant milestone in the development of Constitutional rights in Sri Lanka, which would also create a bilateral benefit to both present and the generations yet unborn.

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The Impact of Training and Development on Job Performance; with Special Reference to an Audit Company in Sri Lanka

K. P. Nishantha*

The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: nishantha.kalupathirana@gmail.com*

1 INTRODUCTION

XYZ Associates is a local audit firm which was incorporated under the Companies Act, No. 17 of 1982 and practicing as defined in the Institute of Chartered Accountants Act, No 23 of 1959, and Section 24. It provides professional services such as Auditing, Accounting, Tax and Advisory services to the clients. XYZ Associates has 3 partners and over 70 staff made up of Managers, Supervisors, (Audit and Accounting) Seniors, Trainees and Human Resource and Administrative staff. The audit firm provides services based on the respective standards, rules and regulations.

In the financial year 2014, a client company has treated operating lease as a finance lease and has recorded this in financial statements accordingly. It is contradictory to the guidelines issued by Sri Lanka Accounting Standards (LKAS) 17. The Auditors have pointed out those serious errors and rectified them as it does not disclose accurate information in financial statements. The Audit seniors and other staff in the said Audit Company regularly get the required training and re-training. The success of any organization, especially service oriented organizations, depends on the accuracy and reliability of work and the quality of employees. Employees should have the relevant skills,

knowledge, values, attitudes and competencies to carry out the job satisfactorily. According to Gamage and Imbulana (2013), training has a significant positive relationship with employees' productivity, job satisfaction and a negative relationship with employee absenteeism. Naveed, Nadeem, Maryam and Zeeshan (2014) studied the impact of training and development on employee performance in a case study from different banking sectors in North Punjab. The study showed that training and development has a positive effect on employee performance. Muhammad Imran (2015) suggested that training is a continuous process. Whatever scheme may be presented by various scholars and trainers, the steps such as training needs assessment, formulation of training objectives, designing and implementation of training, evaluation of training and qualities and the competencies of trainers are very important for any well-designed training programme. The effectiveness of training programmes have been studied in relation to different organizations and industries. However, no proper investigation has been conducted on audit companies in Sri Lanka.

Therefore, it is vital to study how training and development provided by audit firms influence the on the job performance of its



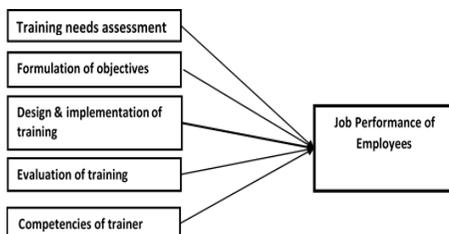
workers. Hence, this research study focuses on the extent to which employee training influences the on the job performance of the accounting division of the audit firm. The study aims to achieve the following objectives to respond to the research problem.

- To analyse the influence of training needs assessment on job performance
- To analyse how the formulation of training objectives influences on the job performance.
- To analyse how the designing of content and the implementation of training influence on job performance.
- To analyse the extent to which the evaluation of training influences on job performance.
- To analyse the influence the competencies of trainers have on job performance

2 METHODOLOGY

The total population of Accounting Seniors of XYZ Associates were Twenty-Five (25). The total population of 25 seniors were selected as the sample. The respondents' response to a questionnaire constitute the primary data for this study. Additionally, semi-structured interviews were conducted with the selected accounts seniors and supervisors. The collected data was analyzed using descriptive statistics.

2.1 Research Frame Work



2.2 Hypotheses

1. The conduct of a training needs assessment is positively related to the performance of employees
2. The Formulation of training objectives is positively related to the performance of employees
3. The designing and implementation of training is positively related to the performance of employees
4. The evaluation of training is positively related to the performance of employees.

3 RESULTS AND DISCUSSION

This study proposed that training and development would affect performance of employees in XYZ Associates. To determine to what extent training and development would affect performance of employees, a regression test was conducted.

According to the Table 1, there is a significant positive relationship between all the independent variables and the dependent variable as indicated by the P value being less than 0.05. The most influential factor is the qualities and competencies of the trainer; second an effective training needs assessment, and third, the evaluation of training etc.

3.1 Hypothesis 1 (H1) – Training need assessment is positively related to job performance in XYZ Associates.

As the table above shows, the regression results interpret the value of coefficient 0.738 which indicates a 1% change in training needs assessment can result in 73.8% change in performance and also the results indicate a positive relationship



significant p value, i.e. $p < 0.05$ (0.000). The R^2 explains how much of the variation in the dependent variables is explained by the independent variable.

Here, R^2 is 0.544 which reveals training need assessment accounts to 54.4% of the variation in performance.

Table 1: The regression analysis of the influence of training on the performance of employees

	Multiple R	R Square (R^2)	Adjusted R Square	Standard Error	Change Statistics	
					F. Change	Sig. N. Change
TNA	0.738	0.544	0.525	1.58347	27.475	0.00000
Formulation	0.624	0.389	0.363	1.83321	14.659	0.00086
Design and Implement	0.576	0.331	0.302	1.91824	11.394	0.00261
Evaluation	0.668	0.446	0.422	1.74558	18.535	0.00026
Trainer	0.793	0.629	0.613	1.42875	38.998	0.00000

Table 2: Summary of hypotheses testing

No.	Hypotheses	Correlation (Multiple R)	R Square (R^2)	Sig. F	Results
H1	Training need assessment has positive impact on job performance	0.738	0.544	0.00000	Accepted
H2	Formulation of objectives has positive impact on job performance	0.624	0.389	0.00086	Accepted
H3	Designing and Implementation of training has positive impact on job performance	0.576	0.331	0.00261	Accepted
H4	Evaluation of training has positive impact on job performance	0.668	0.446	0.00026	Accepted
H5	Qualities and competencies of trainer has positive impact on job performance	0.793	0.629	0.00000	Accepted

3.2 Hypothesis 2 (H2) – Formulation of training objectives is positively related to job performance in XYZ Associates.

As shown in the table above, the value of coefficient of 0.624 indicates that a 1% change in formulation of objectives can result in 62.4% change in performance and p value is significant (0.000), i.e.: $p < 0.05$ which indicates a positive and significant relationship. R^2 is 0.389 which reveals that the formulation of objectives accounts to 38.9% of the variation in performance.

3.3 Hypothesis 3 (H3) – The design and Implementation of training is positively related to job performance in XYZ Associates.

As the table above shows, the value of coefficient of 0.576 indicates that a 1% change in the design and implementation of training can result in 57.6% change in performance and also p value is 0.003, which is less than $p < 0.05$. It indicates that performance of employees is positively and significantly influenced by the design and implementation of the training. R^2 is 0.331 which reveals that the design and implementation of training account to 33.1% of the variation in performance.

3.4 Hypothesis 4 (H4) – Evaluation of training is positively related to job performance in XYZ Associates.

As shown in the above table, the regression results interpret the value of coefficient is 0.668 which indicates that a 1% change in evaluation of training can result in 66.8% change in performance and also the results indicate a positive relationship and significant p value, i.e. $p < 0.05$ (0.000). Here, R^2 is 0.446 which reveals that the effective evaluation of training accounts to 44.6% of the variation in performance.

3.5 Hypothesis 5 (H5) – Competencies of the trainer is positively related to job performance in XYZ Associates.

The table above shows that the value of coefficient is 0.793 which indicates that a 1% change in qualities and competencies of trainer can result in 79.3% change in performance. p value is 0.000, which is less than 0.05 significance level, $p < 0.05$. Therefore, it is indicated that the qualities and competencies of the trainer has a positive and significant influence on job performance by. Furthermore, R^2 is 0.629 which reveals that the evaluation of training accounts to 62.9% of the variation in performance.

4 CONCLUSIONS AND RECOMMENDATIONS

The study started by highlighting the importance of training and development for business organizations. Evidence from previous research indicates that the training of employees is very important for all the organizations irrespective of their nature, size, and scope. Based on the study, it clearly shows that training has a positive and significant influence on the employee's performance. All the hypotheses were accepted and according to the hypothesis testing, qualities and competencies of the trainer have the most influence on job performance. Secondly, conducting a proper training needs assessment also influences job performance. Furthermore, the evaluation of training, the formulation of training objectives and the design and implementation of training significantly influence on job performance. These findings are very important practically for the designers of training programmes. All the steps of the training cycle or training process are very important and they directly influence the effectiveness of training programmes. Effective training

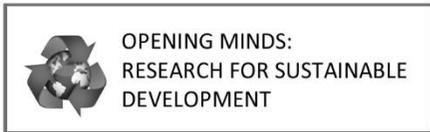
programmes lead to better job performance.

The conduct of systematic training needs assessments periodically to identify training requirements of staff is recommended. Based on the correct identification of training needs it is recommended to correctly formulate the training objectives in terms of job-related knowledge, job-related skills and job-related attitudes.

Once training needs are formulated, it is recommended to design the content of training programmes properly with the right training techniques and learning activities as well as to hire highly competent and experienced resources persons as trainers. Further, all the steps in the training cycle need to be properly implemented and post-training evaluations need to be conducted to assess the overall success of the training programmes.

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The Role of Entrepreneurs' Personality, Characteristics of Organizational, Social Influence for Organizational Change in Construction Industry in Eastern Providence, Sri Lanka.

K. Kirushanthi*

The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: nishantha.kalupathirana@gmail.com*

1 INTRODUCTION

Rapid and continuous changes are inevitable aspects of the prevailing business world and every organization has to deal with the demands of its environment, forcing the organizations to change accordingly in order to survive (Wischnevsky and Damanpour, 2008). It is not an easy task to adopt changes in the business based on the demands. A lot of research suggests that most of these change projects fail due to the underestimation of the central role that individuals play in this process (Greenhalgh *et al.*, 2004).

Individuals, the employees or entrepreneur of the organization, in fact, play this crucial role because the change is often targeted at them as employees and they may feel that the change would increase insecurity and by extension be a cause for conflicts (Robertson, Roberts, and Porras, 1993; Greenwood and Hinnings, 1996). These feelings eventually may lead to stress, a decrease in job satisfaction or resistance (Balogun and Johnson, 2005; Brown and Cregan, 2008; McConnell, 2010).

The contribution made by Small Medium businesses (SMEs) to economic growth and social development in Sri Lanka is significant. Government policy makers and economist place a high priority on the development of SMEs in Sri Lanka due to considerations of the significance of the sector.

Though it is considered as a strategic sector, the failure rate of SMEs has continuously been recorded in Sri Lanka. Scholars identified several causes for the failure of SMES. One important factor that has been identified is the resistance to change by entrepreneurs in Sri Lanka. Therefore, this study intends to study the role of entrepreneur' personality, social influence and organizational change characteristics towards organizational change.

Most of the studies in organizational change include personality traits that seem to influence individual attitudes towards organizational change (Bareilet *et al.*, 2007). A majority of models discuss the relationship between attitude towards change and change characteristics in a technological innovation context (e.g.



Moore and Benbasat, 1991; Zhou, Lu and Wang, 2010). In addition to the change characteristics, some of these technology acceptance models include social influence as it is suggested that individuals are likely to adhere to others. Individuals do so because they are influenced by the perception of how they will be viewed by others if they do not adopt an innovation (Venkatesh *et al.*, 2003). These theories have been applied across industries and countries to explain attitudes towards technological innovation (Svensen *et al.*, 2007), yet to my knowledge these models have not been applied to explain attitudes towards organizational change.

The integration of the two streams of research can broaden the understanding of an individual's attitude towards organizational change. The change characteristics are then applied to an organizational change setting rather than to a technological innovation context. This is possible due to the similarities in the definition of both organizational change and innovation concepts. An innovation is defined as an object, practice or an idea that is new to the individual it is aimed at (Rogers, 2001), while change is defined as "an act or process through which something becomes different" (Oxford Dictionaries, n.d.). An organizational change, therefore, involves practices or ideas that are new to the employees they are aimed at. In an attempt to combine these two fields of study and to further explore determinants of an individual's attitude towards change; this research studies the relationship between personality traits, organizational change characteristics and social influence in an organizational change context. This deductive research was conducted in Small and Medium business in the Eastern

province in Sri Lanka based on the following research question

"To what extent does organizational change characteristics, social influence and personality traits influence an individual's attitude towards organizational change?"

Organizational change has been considered as a dependent variable and organizational characteristics (performance expectancy, effort expectancy, facilitating conditions), social influence, and personality traits (perception of ability, control, and innovativeness) are considered independent variables.

In order to carry out this research, there are six hypothesis have been formulated

H1: Higher performance expectancy will lead to a more positive attitude towards organizational change

h2: Higher effort expectancy will lead to a more negative attitude towards organizational change.

h3: Higher perceived volume of available facilitating conditions will lead to a more positive attitude towards organizational change.

h4: A perceived positive attitude towards the change among co-workers and access to information about the change will lead to a more positive attitude towards organizational change.

h5: A higher perception of ability and control will lead to a more positive attitude towards organizational change.

h6: A higher level of innovativeness will lead to a more positive attitude towards organizational change



2 METHODOLOGY

This study, which is of a deductive nature, was conducted among the owners of the construction institutions in Eastern Province, Sri Lanka. Convenience sampling has been chosen for the sample selection. There are 60 construction institutions selected from three districts and their responses were obtained from the questionnaire which constitute 30% of the total population. The questionnaire consisted of 45 items. Correlation analysis and Hierarchical Multiple Regression have been used as statistical techniques.

3 RESULTS AND DISCUSSION

The study shows that, positive attitudes towards change are crucial to the success of change programs. Moreover, entrepreneurs are required to improve their ability to support for or acceptance of change initiatives (Choi, 2011). The focus of this study is therefore on the conditions under which entrepreneurs support organizational change. The model as described in this research takes both personality traits and organizational change characteristics into account as well as social influence. These three groups of concepts were proposed to be related to an Entrepreneur's attitude towards organizational change.

The attitude towards organizational change is a multidimensional concept consisting of attitude towards change and attitude towards specific change. Most research in the organizational behaviour field does not specifically separate these two constructs from one another, however "as is widely acknowledged, it is important to separate general attitudes

from specific attitudes" (Choi, 2011). The question on which this research is based:

'To what extent does organizational change characteristics, social influence and personality traits influence an individual's attitude towards organizational change?'

The researcher found that attitude towards change and attitude towards specific change is indeed two different dimensions that form an individual's attitude towards organizational change. The attitude towards organizational change was found to be influenced by factors on three levels 1) the often studied personality traits, 2) the less applied social influence, 3) and the organizational change characteristics. Attitude towards organizational change correlates strongly with the organizational change characteristics, social influence and perception of ability and control. Both the organizational change characteristics and social influence were more strongly related to the attitude towards specific change than in the general attitude towards change. The personality trait perception of ability and control was however more strongly related to the attitude towards change in general than to the attitude towards specific change. For all three attitudes towards change constructs no relation was found to personality trait innovativeness.

To the best of my knowledge the organizational change characteristics had not been studied in the organizational change context yet. In this current study it was found that these organization change characteristics are in fact positively related to attitudes towards organizational change and can therefore be very well applied to an organizational change

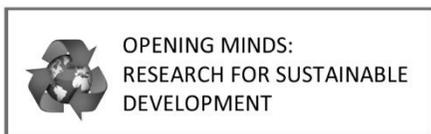


context. The findings from the model as a whole indicates that the interplay of organizational change characteristics, social influence and personality traits explain 50.2% of an individual's attitude towards change. This also suggests that the complete model as proposed in this study is applicable to an organizational change setting.

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The Disciplining Mechanism of Power in Selected Literary Works by Albert Camus and Franz Kafka

M.N. De Costa *

Department of English and Linguistics, Faculty of Humanities and Social Sciences, University of Sri Jayewardenepura, Sri Lanka

**Corresponding author: Email: mn.decosta@gmail.com*

1 INTRODUCTION

Power is dispersed and pervasive, operating within all structures and institutions which govern, monitor and control the individual subject. Michael Foucault, the prominent French Modernist thus challenges the idea of power being wielded by people or groups by ways of 'episodic' or 'sovereign' acts of domination or coercion. He identifies that, 'power is everywhere' and 'comes from everywhere' (Foucault, 1998: 63).

Power operates within the structures and institutions of administration, authority and bureaucracy within the society. These institutions can be identified as the government, prison, school, church, factory, office, hospital and so forth. Foucault particularly focuses on how they help to discipline the individual.

In his *Discipline and Punish* Foucault identifies discipline as "an art of rank, a technique for the transformation of arrangements. It individualizes bodies by a location that does not give them a fixed position, but distributes them and circulates them in a network of relations" (Foucault, 1979: 146). This discipline can transform individuals into 'docile bodies' which are spatially enclosed, partitioned, and ranked so as to maintain order and discipline. "The notion of 'docility', which joins the analyzable body to the

manipulable body" (Foucault, 1979: 136) can be regulated and controlled according to the power dynamics which are pervasive within social institutions. Thus, a body which is docile "may be subjected, used, transformed and improved" (Foucault, 1979: 136) according to the rules and regulations in place within social institutions.

According to Foucault individuals are transformed into 'docile bodies' because they normalize these rules and regulations which seek to control them by self-disciplining themselves. He thus utilized the concept of the 'panopticon' in his *Discipline and Punish*, as a metaphor for modern "disciplinary" societies and their pervasive inclination to observe and normalize the individual.

Jeremy Bentham came up with the idea of a Panopticon (an institutional building) in the late 18th century to watch all the prison inmates, without them being able to know whether they are being watched. Consequently, Foucault developed 'Panopticism,' as a governing method to depict how the power within the social institutions control and govern the individual through means of surveillance and assessment. He identified these means of surveillance as an invisible disciplining gaze. This disciplining gaze can serve as a regulatory model to enforce self-



regulation by making individuals abide rules, regulations and cultural constraints propagated by the society.

This study examines the disciplining mechanisms of power which operate within the institutions of selected works by Franz Kafka (1883-1924) and Albert Camus (1913-1960). It also gives an in-depth analysis of how social institutions exercise their overbearing authority to transform individuals into 'docile bodies' to control, normalize and suppress them. In addition to that, this study focuses on resistance to perceive how individuals who resist and rebel against these institutions are treated.

2 METHODOLOGY

This study is based on a textual examination and comparison of selected works by Kafka and Camus. These include Kafka's novel *The Trial* (1925) and his two short stories "The Judgment" and "A Hunger Artist" from *The Completed Short Stories of Franz Kafka* (1971). These also include Camus's novel *The Outsider* (1942) and his two short stories "The Renegade or A Confused Mind" and "The Guest" from *Exile and the Kingdom* (1957) which includes six influential short stories by Camus.

In order to theoretically substantiate my study, I am primarily analysing Michael Foucault's theoretical text *Discipline and Punish* (1975) to depict how the social theory "Panopticism," developed by Foucault as a form of governance, operates in Camus's and Kafka's stories. This is done by focusing on the "disciplining gaze," of the institutions of power which enables the controlling of individuals. I am also focusing on Foucault's concept of 'docile bodies' which are developed due to the disciplining mechanisms of the institutions of power in Camus's and Kafka's stories.

I am also using the philosophical essay "The Myth of the Sisyphus" (1942) by Albert Camus from the text *The Myth of Sisyphus and Other Essays* (1991) to study how Camus's heroes deal with the absurd. This is done by struggling and revolting against the institutions of power which determine their fates. Along with this I am also analysing Kafka's "Letter to my Father" (1966) from the text *Dearest Father* (2008) to analyze how Kafka's heroes react when faced with overwhelming power and authority. When Camus's heroes struggle and revolt against their existential crises, Kafka's heroes succumb to its devastating authority. I want to explain, compare and contrast this correlation.

3 RESULTS AND DISCUSSION

The devastation, massive destruction and loss of lives during the two world wars, led to a shattering of faith, religion and the belief on God. People started questioning the meaning of life and the purpose of living. The lead to the development and popularity of existential and absurd philosophies during the 19th and 20th century. These philosophical doctrines regarded the world as irrational and absurd. They offered individuals means of finding meaning in life, during a chaotic time where essentialist views of humans being offered a predestined fate by God was questioned and problematized.

Kafka was a German writer who was born into a middle-class, German-speaking Jewish family in Prague. He was very much motivated to write existential and absurd heroes in literature as a response to the mass destruction during World War I, the sheer oppression of totalitarian regimes and his own psychological trauma of feeling powerless under the overwhelming authority of his father. Kafka's father was psychologically abusive to him during his childhood and governed his entire life. As a result, the fates of the characters in his work mirror



that of a victim under an authoritative system, institution or family just as Kafka felt powerless under the overwhelming power of his father – who was a “huge man” who wields “ultimate authority” over him (Kafka, 2008: 23). He thus feels a sense of powerlessness and shame often losing himself in despair. (Kafka, 2008: 23-24).

The French writer Camus was a leading writer for the anti-German resistance movement during World War II. He developed his philosophy of the absurd during the wartime in Paris as a response to the mass anxieties of losing the meaning in life during such a violent and chaotic time. In his “The Myth of Sisyphus” Camus says that, even when life has lost all meaning man should not seek escape in suicide. By incorporating the Greek legend of Sisyphus Camus says that, when faced with a tragic fate the absurd hero will struggle and revolt against it, instead of despairing with resignation. He says this gives the absurd hero his dignity: “The struggle itself toward the heights is enough to fill a man’s heart. One must imagine Sisyphus happy” (Camus, 1991: 78).

Power is exercised in such a way that, the disciplining of individuals assures their position of being ‘docile bodies’ under the power and authority of social institutions. The social institutions normalize this disciplining to an extent where the individual self-disciplines himself. In order to be exercised, power has to be given “the instrument of permanent, exhaustive, omnipresent surveillance, capable of making all visible, as long as it could itself remain invisible.” (Foucault 1979: 214) Power is thus a “faceless gaze that transformed the whole social body into a field of perception: thousands of eyes posted everywhere, mobile attentions ever on the alert, a long, hierarchized network.” (Foucault, 1979: 214). Foucault further identifies that, the disciplining gaze of power operates within every social institution. He says that, “Is it surprising

that prisons resemble factories, schools, barracks, hospitals, which all resemble prisons?” (Foucault, 1979: 228).

Existential and absurd heroes can be found in both Camus’s and Kafka’s books. They experience and deal with the existential crises as they face life experiences in different ways. Though Camus refuses to be called an existentialist, his narratives offer heroes who are entangled in an existential crises. However Kafka and Camus have different interpretations on how to deal with this crisis. As all existential philosophers they see the world as absurd. In this absurd world they perceive their heroes are being restricted, suppressed and controlled by social institutions, power structures and governing mechanisms that are deeply entrenched within the society.

In Kafka’s *The Trial* the reader is presented with the absurdity of modern bureaucracy and the power and authority wielded by the institutions of a totalitarian state. From the very first chapter Josef K. the protagonist is condemned for reasons that are never explained within the narrative. “Somebody must have made a false accusation against Josef K., for he was arrested one morning without having done anything wrong.” (Kafka, 2015:1) Through the perspective of Josef K. Kafka presents the overbearing power which is wielded by a totalitarian government. This power is so overwhelming that K. completely and utterly succumbs himself to the authority wielded by the “faceless gaze” (Foucault, 1979: 214) of the institutions. K. in the story exposes the great faceless organization within the judicial system which seek to manipulate and transform individuals into ‘docile bodies’ so that they obey all the rules and regulations imposed by the judicial institution. K. exposes the purpose of this great organization: “To arrest innocent persons and start proceedings against them which are pointless and mostly, as in my case, inconclusive.” (Kafka, 2015: 36-37). However K. still self-disciplines



himself in such a manner that, he normalizes this treatment and allows himself to be controlled under the power of the judicial institution.

However the protagonist in Camus's *The Outsider* does not accept such a defeatist ideology. Though he also perceives the absurdity of the institutions just like K. in *The Trial* he refuses to merely succumb to the fate which is imposed over him. Instead, Meursault the protagonist, rebels against the power and authority wielded by corrupted institutions by struggling and revolting against the disciplining mechanisms of the government. Meursault refuses to be transformed into a 'docile body' where he has to self-discipline himself to fulfill the moral duties and obligations of the society and the religious expectations of the church. Instead he confronts and rebels against the expectations which are imposed upon him by the overbearing power dynamics within the social institutions. "Why should the death of other people or a mother's love matter so much? Why should I care about his god, the lives, the destinies we choose when one unique destiny had chosen me" (Camus 2013: 109). This struggle and revolt gives Meursault dignity as an absurd hero in literature.

When the narrator of the short story "The Judgment" by Kafka says that "[m]y father is still a giant", (Kafka, 1983: 105) it heightens the narrator's lower rank as the father's overwhelming authority renders him to the position of powerless 'docile body.' Though the narrator has become an adult while his father has become old, frail and bedridden, the father's power is such that when he says, "I condemn you to death by drowning" (Kafka, 1983: 113) the narrator succumbs to the command and drowns himself. He is thus unable to break away from the domineering control of his father. The father's authority over the son can symbolically represent the overbearing and disciplining power of social institutions over the individual.

In the short story "The Guest" by Camus the school teacher Daru is ordered by the government to take a prisoner, an Arab to the police headquarters in Tinguit. However Daru frees the prisoner and gives him a choice to escape his fate or turn himself into the police. However in Daru's dilemma of his inability to take a decision himself, he seals his own fate as a warning is written on his blackboard which says, '[y]ou turned in our brother. You will pay' (Camus, 2006: 55). Daru is expected to self-discipline himself and obey the order which comes from the "faceless gaze" (Foucault, 1979: 214) of the government. However he resists against it. This resistance gives him dignity as he makes a choice, however he is still condemned to a tragic fate.

The artist in Kafka's "A Hunger Artist" practices his art by fasting. Even when the audience lose interest and forgets his presence he still continues to self-discipline himself and fast till his tragic death. His decision to fast is not out of his own choice but because of his involuntary rejection of life as life did not provide him the "food" he "liked." (Kafka, 1983: 309). As life did not offer him this fundamental need to survive, his art of fasting is the result of developing a 'docile body' which actually conforms to the "constraints, prohibitions or obligations" (Foucault, 1979: 136) imposed upon him by the society.

In Camus's "The Renegade or A Confused Mind" the absurd hero embraces the absurdity of his existence by abandoning all reason and logic. Camus in this story focuses his attention on the overbearing power of the institution of religion which condemns the renegade to a tragic death. The renegade in the story is indoctrinated by the church and goes as a Christian missionary to convert those of the closed city of Taghaza. However he forsakes his religion and is manipulated and disciplined to become a 'docile body' through violent means of torture until he finally becomes a loyal and obedient



follower of the power of ‘fetish’. He declares “[y]es, the fetish alone has power, he is the only god of this world, and hatred his commandment, the source of all life” (Camus: 2006, 27). Camus thus exposes the absurdity of the institutions of power which disciplines the renegade simply to condemn him to death at the end of the story.

4 CONCLUSIONS

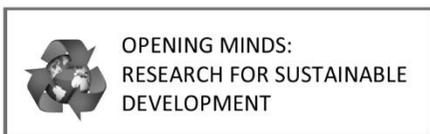
Both Kafka and Camus criticize the disciplining mechanisms of overwhelming power structures such as bureaucracy, judicial authority, administration and religion. In my study I examined how the pervasive power within societal institutions disciplines, controls and manipulates individuals into ‘docile bodies’ who self-discipline themselves according to rules and regulations imposed upon them by the society. I conclude by suggesting that, both Kafka and Camus expose the absurdity, corruption and injustice of the pervasive power within social institutions and how they marginalize and victimize the individuals. Both writers deal with the disciplining mechanisms of power in different ways, as Kafka believes in succumbing to a tragic fate while Camus believes in struggling and revolting against a tragic fate before accepting it giving the absurd hero dignity, as modes of resistance. However both writers

expose how these disciplining mechanisms of power seek to self-discipline and conform the individual subject according to the rules and regulations of the society. Through this both Kafka and Camus make a powerful critique against the social institutions which oppress and control the individual.

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“Tourists’ Satisfaction Towards Destinations in Jaffna Peninsula, Sri Lanka: With Special Reference to Beach Holiday”

S. Kalimuththu^{1*}, Nalin Abeyssekara² and L.P.S. Gamini²

¹University of Vocational Technology, University College of Jaffna, Sri Lanka

²Department of Management Studies, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: k.shan@ucj.ac.lk

1 INTRODUCTION

Jaffna Peninsula was affected by thirty years of war and the aftermath of the war, and the tourism sector has been growing very fast (Mathivathani and Sasitharan, 2010). There are eight beaches in Jaffna, namely Catty beach, Casuarina beach, Mathagal beach, Delft beach, Thondamanaru beach, Manalkattu beach, Roogam beach and K.K.S beach. Further, many local and foreign tourists visiting these beaches in the evening. But, only a few beaches were found with areas for tourists’ leisure and entertainment and most of the beaches had many issues like poor quality of bathrooms, lack of clean drinking water, safety, shopping facilities, food, beverages, and accommodation (Kirusika *et al.*, 2017). According to Martin (2004) there are many factors which affect the quality of the beaches such as attraction, quality of sands, fresh air, sun bathing and water sports.

In addition, the quality of the swimming pool, road facilities, entertainment for children, conflict level, boat services and water sports, hazards, environmental pollution, toilets and bathing facilities, walk ways and shopping facilities also influence on tourists’ positive or negative perceptions on the beaches (Martin, 2004). Casuarina beach and K.K.S beaches were found with a good quality of sands, clean water, water sports,

entertainment for children, fresh air, warning signs therefore, these factors motivated the tourists² to revisit. At the same time, factors such as the boisterous behaviour of youth, use of alcoholism, rocks under water and the accessibility to swimming pools affect the tourists’ satisfaction (Kirusika *et al.*, 2017). In addition, failure to implement proper disposal of garbage affects the tourists’ perception and satisfaction (Thanal, 2005) and when the tourism developers plan to develop beach destinations, critical focus on the negative impacts of fishing community is extremely important. Further development can be carried out in such a way that it does not affect the livelihood of the local community (Biju, 2006).

1.1 Research Objectives

Based on the above problems and literature reviews, the objectives of the study are as follows;

1. To describe factors affecting tourists’ satisfaction in holidays at the holidays in the Jaffna Peninsula
2. To recommend possible strategies to enhance the value of attraction and perception of beaches



1.2 Research Questions

1. What are the factors affecting tourists' perception of beaches?
2. What are the possible strategies applicable to enhance tourists' satisfaction of beaches?

2 METHODOLOGY

This is a **descriptive** and **quantitative** research.

2.1 Sampling:

Convenience sampling technique was used. Five beaches were selected out of eight beaches found in the Jaffna Peninsula for the study. One hundred and twenty five foreign tourists who were above 18 years old from each destination were selected for the study. Further, the foreign tourists were selected because there is a limited study on foreign tourists' satisfaction in beach holidays in Jaffna Peninsula.

2.2 Data collection:

Self-administered questionnaire method was used for data collection and there was an open ended question to allow the tourists to freely explain their views about the particular beach and the five point Likert scale was used to get the opinion of tourists' satisfaction level varying from 5=very highly satisfied, 4= highly satisfied, 3= satisfaction, 2=low satisfaction and 1=dissatisfaction/not satisfied.

2.3 Data analysis:

Further, data was analysed in SPSS version 20 to find the tourists' satisfaction levels and the mean values of the data were displayed in figure 1 and was used to analyse the results. In addition, the percentage of the tourists' satisfaction levels were found through the calculation

of the mean values of variables out of the total variables (18).

3 RESULTS AND DISCUSSION

Based on the evaluation criteria $\{(0 < x_i \leq 2) = \text{low}, (2 < x_i \leq 3) = \text{moderate}, (3 < x_i \leq 5) = \text{high}\}$, the data was analysed. The result was revealed that more than 44% of the tourists had perceived the beaches as high quality and that they were highly satisfied with the quality of sea water and they also felt that the safety and security level at the beaches were at a high level. In addition, the tourists enjoyed and were highly satisfied with the atmosphere of the beaches. Notably, tourists' perception on the behaviour of the youth was positive and they were highly satisfied about the quality of sand in the beaches. However, figure 1 shows that tourists did not enjoy the aforementioned at a maximum satisfaction level (Mean value is 0.42). Further, more than 22% of the tourists viewed that the beaches were of moderate quality and the tourists were not highly satisfied with many attributes of the beaches. As per the evaluation criteria $(2 < x_i \leq 3)$, basic needs such as drinking water and toilet facilities failed to ensure the tourists' satisfaction. The tourists also felt that they were not very satisfied with the shopping choices offered at the beaches. Moreover, as per the result of the data analysis, tourists also felt that the rocks under the water were a risks for their bathing and also they were not highly satisfied with the accessibility to the swimming pool. Finally, more than 33% of the tourists assessed the beaches as low quality and they had observed that there were no warning signals and signs at the beaches. Tourists further felt that there was no facility for water sports and that there was a lack of facilities for relaxation



and entertainment. Consequently, tourists also felt that sunbathing at the beaches was difficult due to the poor conditions and the parents viewed that there was a lack of

places for entertainment for children and some tourists felt that there were some threats from birds and stray animals in the beaches.

Table 1: Tourist opinion on the beach holiday in Jaffna Peninsula

Descriptive Statistics						
	N	Minimum	Maximum	Sum	Mean	S.D
Water quality	125	3.00	5.00	539.00	4.3120	.74505
Security	125	3.00	5.00	539.00	4.3120	.68880
Basic needs	125	2.00	3.00	289.00	2.3120	.46517
Pollution	125	2.00	5.00	415.00	3.3200	.93843
Waste Management	125	2.000	5.000	400.000	3.20000	.823055
Shopping facility	125	2.00	3.00	279.00	2.2320	.42381
Use of alcohol	125	2.00	5.00	496.00	3.9680	.87930
Warning Signs	125	1.00	5.00	236.00	1.8880	1.17237
Boisterous behaviour of Youth	125	3.00	5.00	484.00	3.8720	.42075
Watersports	125	1.00	5.00	244.00	1.9520	1.21719
Sunbathing	125	1.00	2.00	168.00	1.3440	.47695
Fresh air	125	3.00	5.00	548.00	4.3840	.68136
Quality of sand	125	2.00	5.00	388.00	3.1040	.82133
Rocks	125	2.00	3.00	273.00	2.1840	.38904
Stray animals	125	1.00	3.00	185.00	1.4800	.61696
Relax	125	1.00	2.00	181.00	1.4480	.49929
Swimming pool	125	1.00	4.00	275.00	2.2000	1.12163
Places of Leisure for children	125	1.00	5.00	231.00	1.8480	.91630
Valid N (list wise)	125					

4 CONCLUSIONS AND RECOMMENDATIONS

Based on the results found through the data analysis, it is concluded that in the Jaffna Peninsula, there is a lot of potential in the beaches and that tourists are highly satisfied in many attributes of the destinations such as clean sea water, safety and security, fresh air and atmosphere, pure sand and the behaviour of the youth. However, since the tourists did not perceive the beaches as high quality, some additional attentions is needed to improve

the above factors. There were limited places for relaxation for the tourists therefore destination developers should develop and implement relaxation facilities. Consequently, the parents viewed that these beaches are not suitable for the enjoyment of their children and therefore, one can perceive the beaches as low quality in that aspect. Therefore, further development and improvement should be carried out to ensure that families can enjoy at the beaches. Stray animals like cattle and dogs were found at the beaches and the tourists did not feel safe with these animals around them.

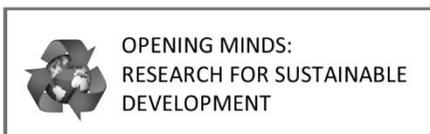


Therefore appropriate actions should be taken by the local authorities to out this issue to ensure high quality. Further, sunbathing and water sports facilities are not available in many beaches or if they are available, they are of low quality and these facilities are expected by foreign tourists. Therefore, destination developers should extend the beach facilities and the local authorities or tourism related organizations can encourage private partners to develop the water sports and sunbathing facilities. In addition, basic needs like toilet, drinking water need immediate attending to as tourists were only moderately satisfied with what was offered. This includes the shopping facilities available to the tourists. The tourists mention the rocks under water which poses a risk when bathing in the sea. Funds need to be allocated remove these rocks or stones. The beaches at the Jaffna peninsula are places to enjoy as many tourists rated the quality of sea water, security and safety at a high level. Further, fresh air and the atmosphere achieved a high rating from the tourists. Finally, the study recommends that the destination developers to carry a deeper study in all beach destinations to identify the tourists' satisfaction and to prepare the feasibility report and master plan for beach development in the Jaffna Peninsula. In addition, a suitable development committee should be nominated and they should review some model beaches in Sri Lanka and other countries to prepare and implement the long term sustainable plan to ensure sustainable beach development.

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Tourists Satisfaction towards Heritage Tourism in Jaffna Peninsula: Sri Lanka

S. Kalimuththu^{1*}, Nalin Abeyssekara² and L.P.S. Gamini²

¹University of Vocational Technology, University College of Jaffna, Sri Lanka

²Department of Management Studies, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: k.shan@ucj.ac.lk

1 INTRODUCTION

Countries should preserve their cultural heritage for the sustainability of the tourism industry. Cultural heritage contributes to the social, cultural and economic wellbeing of a country. Therefore, an effective sustainable development plan is crucial to any country. In addition, failing to plan to safeguard one's cultural heritage, can result in the loss of the country's prosperity—(Norhasimah, *et al.*, 2014). Cultural heritage attributes such as museums and galleries increase the income of a region and requires them to compete with other tourism products (Brent, *et al.*, 1993). According to Pushparatnam (2014) there are many historical and archaeological sites found in the Jaffna Peninsula such as the Nallur Temple, the Selvasannithi temple, the Keerimalai temple, the Nainadivu amman, the Nagavigarai temple, the Kantharodai Buddhist temple, the ruins of the Buddhist temple in the Delft island, the Jaffna fort, museums, the Jaffna library, Manthirimanai, Sankiliyan thoppu, the Kopai Sankiliyan fort, the old statue of Bandaravanniyan, the Portuguese Fort in Delft, the Dutch barracks at in Delft, Historical churches and light houses. As a result of the 30 years of war which ravaged the Jaffna peninsula, most of these destinations are now abandoned. These heritage sites vital to the future

generations to study and understand the history, cultural reality and the cultural continuity of the society (Pushparatnam, 2014). Even though, Jaffna is rich with cultural heritage, studies conducted on these sites were sparse. (Mathivathani and Sasitharan, 2010) Additionally, many multicultural heritage sites have been damaged in Jaffna during the long war in Sri Lanka. (Mandawala 2012 Mathivathani *et al.*, 2013). Although, there is an urgent need for the development of the cultural heritage sites like Jaffna Fort, the tourism development activities are moving extremely sluggish in the Jaffna Peninsula (Douglas, 2015). "Because of the irreplaceability and non-renewability of the historical and cultural heritages, they should be conserved and managed in proper ways to preserve the values" (Comer, 2012; Timothy and Boyd, 2003). Further, many factors such as tour guides, enjoyments/entertainments, leisure and relaxation, photography, quality of architecture, preservation of sites, cleanliness, good distinct signs, first impression, crowding, carvings, historical aspects, archaeological remains/ruins, stone work, masterpieces, items of wonder/exotics works of art and the quality of service affects the heritage sites (Mohammad, 2014). Moreover, heritage sites were also affected by garbage, damages and environmental pollutions



which led to the negative impacts in sustainable heritage tourism development (Timothy and Boy 2006).

1.1 Research Objectives

The objectives of the research are as follows,

1. To find the factors affecting tourists' satisfaction.
2. To identify the level of tourists' satisfaction in historical and archaeological destinations.
3. To make recommendations for the development of historical and archaeological tourism.

2 METHODOLOGY

Research type: This is a descriptive and quantitative research.

2.1 Sample:

Convenience sampling method was used and six locations of the Archaeological and historical destinations were selected out of 18 destinations such as the Jaffna Fort, Sankiliyan Thoppu, the Kantharodai Buddhist temple, the Ruins of Buddhist temple in the Delft, the Portuguese Fort at in Delft, the Jaffna Fort and Dutch barracks in Delft by means of convenience sampling method and it was planned to gather data from 150 foreign tourists but data was obtained from only 110 tourists.

2.2 Data collection:

Primary data was collected through self-administered questionnaires in which the tourists were required to select their satisfaction level by ticking numbers varying from 5 to 1. 5 being very highly agreeable to 1 being a low level of satisfaction. Further, the secondary data was collected through books, previously conducted research and newspapers.

2.3 Data analyses:

Five Likert scale data were analysed in SPSS version 20 to find the tourists' satisfaction level and the mean values of the data were displayed in figure 1 and was used to analyze the results. Further, the percentage of the tourists' satisfaction levels were found through the calculation of the variables to the mean values out of total variables (18).

3 RESULTS AND DISCUSSION

Based on the evaluation, the criteria is as follows $\{(0 < x_i \leq 2) = \text{low}, (2 < x_i \leq 3) = \text{moderate and } (3 < x_i \leq 5) = \text{high}, \text{ data was analyzed. Accordingly, fifty percent of the tourists viewed that (mean values of nine variables out of eighteen variables,) the cultural heritage sites did not impress them at first sight and the attributes such as atmosphere/signs, tour guides, information about the destinations, potential for leisure and relaxation, preservation of the sites, carvings, damages and quality of service were perceived by the tourists as poor. 16.6% of tourists found that the transport facilities to the destinations were satisfactory but the facilities did not achieve a high level of satisfaction.}$

Further, the quality of architecture was rated as moderate. In addition, tourists also viewed that cultural heritage sites were good places for photography but not excellent. The cultural and archaeological sites were viewed as clean areas and the crowd density was assessed at a highly significant level. 33.33% of the tourists had a high level of satisfaction in the historical aspects of the sites and they expressed their high satisfaction about the stone work of the sites. The tourists were highly satisfied with the archaeological remains at the historical and archaeological sites.



Table 1: Survey results tourists' levels of satisfaction in the cultural heritage of Jaffna

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Transport facilities	110	1.00	4.00	2.9909	1.00909
Tour guides	110	1.00	2.00	1.6091	.49019
First impression	110	1.00	2.00	1.5636	.49820
Leisure and relaxation	110	1.00	3.00	1.7091	.69527
Cleanliness	110	2.00	4.00	3.0818	.83646
Quality of architectures	110	1.00	4.00	2.7545	.92057
Preservation of sites	110	1.00	3.00	1.8182	.65219
Items of Wonder and exotic works of art	110	3.00	5.00	4.2182	.75882
Historical aspects	110	4.00	5.00	4.4818	.50196
Atmosphere	110	1.00	3.00	1.5545	.64376
Stone works	110	4.00	5.00	4.7545	.43233
Photography	110	1.00	4.00	2.8091	1.10458
Archaeological remains	110	3.00	5.00	4.0818	.85812
Level of damages	110	1.00	3.00	1.8545	.72740
Carvings	110	1.00	2.00	1.2364	.42679
Information on sites	110	1.00	2.00	1.3455	.47769
Quality of service	110	1.00	3.00	1.6091	.60723
Crowds	110	2.00	4.00	3.2273	.72516
Valid N (list wise)	110				

4 CONCLUSIONS

There is great potential for cultural heritage tourism in the Jaffna Peninsula. But, many tourists indicated low levels of satisfaction due to many issues at the destinations such as first impression, tour guides, quality of service, and leisure and relaxation, preservation of the sites, atmosphere/signs, damages, carvings and information about the destination. These low levels of satisfaction will affect the sustainability of the cultural heritage sites, because dissatisfied tourists will not come again to the destinations and also they will not recommend these destinations to other tourists. Consequently, these cultural sites may be further damaged or destroyed

because of a lack of maintenance of by the local authorities and relevant institutions. Therefore, an immense amount of attention is required by the destination developers on the above factors which affect the heritage sites. In addition, transport facilities, cleanliness of the sites, and the quality of architecture and environmental attraction were given moderate satisfaction. However, destination developers have already taken some initiatives to develop and improve the cultural heritages sites. But, new strategies should be implemented since the tourists showed moderate satisfaction and this should be converted into high

levels of satisfaction. Finally, tourists wondered about the historical and archaeological destinations and also they were highly satisfied about the many attributes of the cultural heritages sites such as the historical aspects, stone works and archaeological attributes. However, according to figure 1, the tourists did not assess them with a maximum level of satisfaction. Therefore, constructing a sustainable cultural tourism development plan is an urgent requirement to the tourism developers. In brief, the Jaffna Peninsula has great potential for heritage tourism but a master development plan is required to iron out the many challenges which hinders the sustainable cultural tourism and to ensure the long term sustainability of the destinations. In addition, an effective steering committee is also recommended to carry out a feasibility study and to refer the cultural heritages sites of other countries to implement the sustainable cultural tourism development plan in the Jaffna Peninsula.

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Major Determinants of Intend to Leave among Operational Level Employees in a Manufacturing Facility

V. Sivalogathan¹ and N.A. Mudannayake²

¹Department of Management Studies, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Ceylon Electricity Board, Sri Lanka

*Corresponding author: Email: vsiva@ou.ac.lk

1 INTRODUCTION

Research focused on “Intent to Leave” (IL) among operational level employees (factory supervisors (superintendents), skilled and un-skilled labour) at the main factory facility of Nemsuji (Pvt) Ltd located in Nittambuwa, Western province, Sri Lanka. The production facility mainly

focuses on the manufacturing of PVC pipes and fittings, polythene films, agro hoses, water tanks, importation and wholesale distribution of power tools, water pumps and PVC plumbing accessories and motors. The employment structure is given in Figure 1.

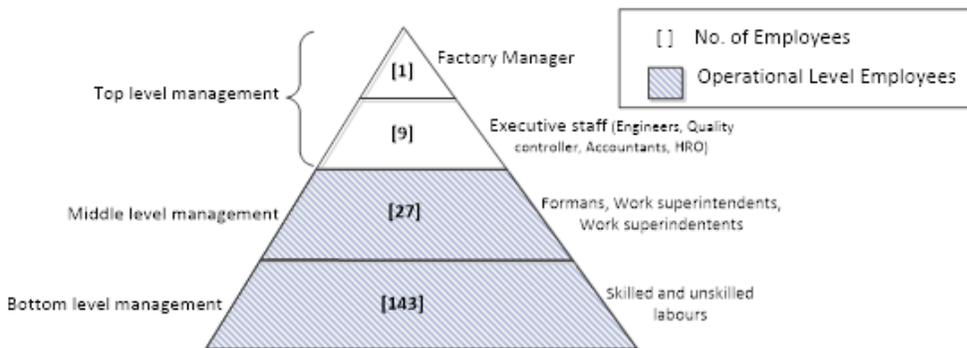


Figure 1: Company's employment pyramid

1.1 Problem Statement

Company observed that most of their skilled and experienced work-hands frequently leave the company. The severity of the problem and root causes are yet to be identified.

1.2 Research Objectives

Identify the major determinants of employees' IL the company. Evaluate each determinant both in qualitative and

quantitative manner and prepare recommendations for corrective measures.

2 METHODOLOGY

The research adopts two research strategies, case study and survey method, (Bhattacharyya, D.K., 2003). During the inception, the company's Human Resource (HR) and production data were analysed to track possible correlations

(Catherine, (2002). Possible initiatives (internal and external) of IL based on a rigorous literature survey was then listed out (Branham, 2005; Campbell *et al.*, 2012; Kirschenbaum and Weisberg, 2002; Armstrong, 2006; Mudannayake, 2017). The most critical determinants for the case study were selected from the list based on primary and secondary data that was gathered as well as findings from two interviews, one with top and middle management and the second with the target group. As a result, four determinants were identified as critical and the conceptual framework that was then formulated is given in Figure 02 (Catherine, 2002).

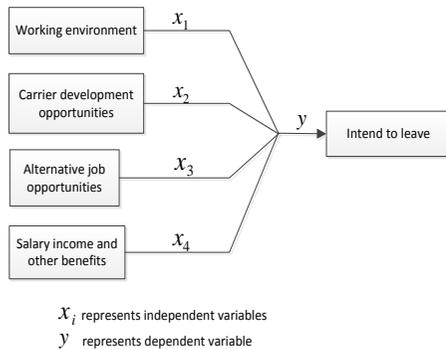


Figure 2: Conceptual framework

Researchers were personally involved in all data gathering activities and educated the target group on survey objectives so as to increase the reliability of results and maximize participation (Catherine, 2002). A structured, unbiased questionnaire was prepared based on these critical factors. The questionnaire consisted of three parts (Krishnaswami and Ranganatham 2007). The first part represented the demographic data. Second part was to collect feedback data for five variables (one dependent and four independent variables).

The third part focused on the general feeling of respondents on IL. Dependent and independent variables were operationalized using “Five Point Likert Scale” range from, ‘Strongly Disagree’ to ‘Strongly Agree’. The unit of analysis was

the individuals at operational level. Completed questionnaires were then used for a pilot survey (Catherine, 2002). Based on the respondents’ feedback to the pilot survey, the original questionnaire was corrected and modified. The refined questionnaire was used for the main survey. Owing to time limitations and resource scarcity, a representative stratified random sampling was used. The sample consisted of proportional allocation for each department representing size of strata (Krishnaswami and Ranganatham 2007). As depicted in Figure 01, the population was 170 and the calculated sample at 95% confidence level was 118 [22]. Null hypothesis of the hypothesis test prepared as,

H1₀: Significant relationship between IL and Working Environment (WE) exists

H2₀: Significant relationship between IL and Carrier Development Opportunities (CD) exists

H3₀: Significant relationship between IL and Alternative Job Opportunities (AJ) exists

H4₀: Significant relationship between IL and Salary Income and Other Benefits (SI) exists

Then, the relationship between each of the independent variables to the dependent variables was evaluated using the significance of the correlation. In addition, Cronbach’s Alpha reliability analysis conducted for each set of data (Glien and Glien, 2003). Additionally, linear regression analysis conducted and calculated for the best-fit lines. Finally, multiple regression was conducted to investigate the composite effect of each independent variables to the dependent variable (Aiken and West, 1991). Two software programs, MS Excel and IBM SPSS version 22 were extensively used for the analysis work (Field, 2009; IBM Corp., 2011).



3 RESULTS

The Pearson correlation between the staff availability (Cadre) and the production

yield was found to be as high as 0.943 and graphical representation is given in Figure 03 [23].

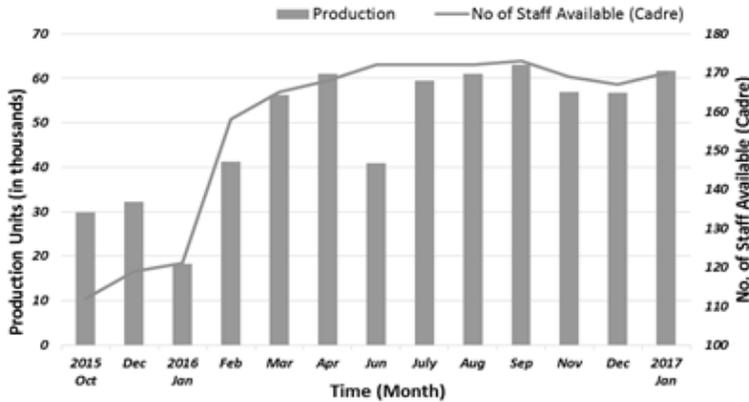


Figure 3: Relationship between production and staff

The main survey received a 100% response rate. According to the results received under part – 1 of the main survey, the majority of work force were males (92%) and nearly 96% of respondents were either young or early matured. The majority of respondents were married (58%) and most of employees were found to have less than 1 year of service. About 80% of employees were educated up to A/L and 78% possessed some kind of vocational or professional qualification. In addition, about 59% had previous work experience (Mudannayake, 2017). The reliability test for each set of variables ranged from 0.7 to

0.9 and the summary of results is given in Table 01. SPSS results of correlation and linear regression (part 2 of the survey) for each independent variable against the dependent variable are shown in Table 02. Coefficient indices of variables for multiple regression are given in Table 03. Multiple regression equation was $IL = 4.501 - 0.363WE - 0.113CD + 0.191AJ - 0.241SI$ and the R^2 value found 0.587. The findings from part – 3 of the survey revealed the order of the critical reasons for IL as WE, SI, AJ and CD. About 2.5% of respondents found, no IL and about 25% confirmed the IL.

Table 1: Cronbach’s Alpha test results

Variable	Items	Cronbach’s Alpha	Remarks
Working Environment (WE)	Q1.1 – Q1.6	0.871	Very Good
Carrier Development Opportunities (CD)	Q2.1 – Q2.6	0.794	Good
Alternative Job Opportunities (AJ)	Q3.1 – Q3.6	0.906	Excellent
Salary Income and Other Benefits (SI)	Q4.1 – Q4.6	0.846	Very Good
Intend to Leave (IL)	Q5.1 – Q5.6	0.704	Good

Table 2: Summary of Correlation and Linear Regression analysis

Independent variable	Correlation	R ² value	Sig. (2-tailed)	Linear Regression Line
Work Environment (WE)	-0.669**	0.448	0.000	IL = 4.763 – 0.591WE
Carrier Development opportunities (CD)	-0.406**	0.165	0.000	IL = 4.107 – 0.334CD
Alternative job opportunities (AJ)	0.508**	0.258	0.000	IL = 1.999 + 0.384AJ
Salary income and other benefits (SI)	-0.542**	0.294	0.000	IL = 4.598 – 0.558SI

** Correlation is significant at the 0.01 level (2-tailed)

Table 3: Coefficient indices of variables for the Multiple Regression

Model	Unstandardized Coefficients		Standardized Coefficients	t – value	Sig.
	B	Std. Error	Beta		
Constant	4.501	0.308		14.599	0.000
WE	-0.363	0.066	-0.411	-5.536	0.000
CD	-0.113	0.054	-0.138	-2.106	0.037
AJ	0.191	0.050	0.252	3.808	0.000
SI	-0.241	0.072	-0.235	-3.347	0.001

4 DISCUSSION

As depicted in Figure 02, staff availability of the company had a high correlation (94.3%) with the production yield. This implies a high turnover rate (initiated mainly by IL) which will severely affect the production yield of the company and highlights the usefulness of the research. According to Table 01, all grouped questions ranged from good to excellent and therefore data gathered can be considered to be significantly reliable and consistent. It is worth emphasising the advantage of using a pilot survey before commencing a social survey (Krishnaswami and Ranganatham 2007). A detailed investigation of demographic survey results depicted that the majority of young and early mature aged male employees declare their IL This

demographic data represents a typical manufacturing environment of this nature in the Sri Lankan context [11]. However, some deviations were observed from experiences elsewhere (Loch and Stephens 2004; Foon *et al.*, 2000)

SPSS analysis indicated a strong negative relationship for independent variables WE, SI and CD against IL. Results interpret poor WE, low SI and less CD as leading to an increase in the IL. A strong positive relationship between the AJ against IL indicates that the higher the AJ, the higher the risk of IL. Therefore, all null hypothesis H1₀, H2₀, H3₀ and H4₀ are accepted and all respective alternative hypothesis rejected. Based on R² values the ascending order of critical determinants was found to be WE, SI, AJ



and CD. Multiple regression study confirmed a strong dependency of composite effect of all independent variables with 58.7% representation of IL. In summary, the most critical determinant was the poor WE. SI was ranked second. AJ and CD took the third and fourth places respectively. However, all variables represent a significant correlation to IL. According to the literature, all selected determinants play a significant role in similar case studies (Hissom, 2009; Arms, 2010). Remedial action should incorporate physical measures as well as psychological approaches (Firth *et al.* 2004; Mobley *et al.*, 2001). WE, SI and CD are external factors and relatively easier to address. AJ is an external factor and therefore a SWOT analysis may need to be conducted before launching corrective actions. Ample research is available for managing and controlling IL pertaining to the four determinants (David, 2008); James and Mathew, 2012; Steel, *et al.*, 2001). Drive factors for worker motivation by addressing WE, SI and CD properly are one of most effective methods to enhance effective worker participation (Herzberg, 1959).

In the later part of the questionnaire, respondents were allowed to rank the four determinants based on the impact severity on IL. The order was found to be WE, SI AJ and CD in the ascending order. This perfectly matched the results from part -2 of the questionnaire. The research also investigated the respondents' general feeling on IL. Results indicate that the majority (about 70%) are still in a floating state but more biased to IL. This a clear indication that company still has the opportunity to retain its majority employees through prompt and proper remedial actions.

5 CONCLUSIONS AND RECOMMENDATIONS

The research concluded that employee IL has a severely impact on production yield.

Short term and long-term measures are required to uplift the WE, which is the most critical root cause to IL. The research recommends conducting a detailed research on methods to improve the present WE and also on SI with a second priority, in general. Consideration of method improvements for AJ and CD was also found to be significant. The research concludes that proper remedial actions (by incorporating them in strategic and operational plans of the company) will help to reduce the employee IL and eventually boost the level of productivity.

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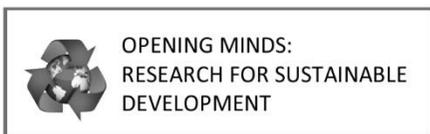
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LIFE SCIENCES



Rice Varieties Suitable for Machine Transplanting in Rajanganaya

R.M.U.S. Bandara*, Y.M.S.H.I.U. De Silva, H.M.M.K.K.H. Dissanayaka

Rice Research and Development Institute, Batalagoda, Sri Lanka

*Corresponding author: Email: rmusbandara@gmail.com

1 INTRODUCTION

The yield performance of lowland rice varieties depends on the method of crop establishment. However, yield of transplanted rice is generally believed to be higher than that of dry-seeded rice (Balasubramanian *et al.*, 2003). Broadcasting is the most widely practiced establishment method by Sri Lankan paddy farmers. Under Korea Project on International Agriculture (KOPIA) and Yaya II program launched by Department of Agriculture, Sri Lanka machine transplanting method of crop establishment was introduced to farmers. Under KOPIA project farmers of Yaya 09 tract, Rajanganaya were encouraged to practice machine transplanting. At the time of introduction of machine transplanter to Sri Lanka no research studies have been done on machine transplanting in Sri Lanka. Thus, there was a necessity to evaluate how different rice varieties perform under machine transplanted conditions. A study was conducted to show how different rice varieties perform under machine transplanting establishment methods. The problem with the transplanting machine at the moment is its inter-row spacing of 30cm which is a fixed value. Due to this wider spacing only varieties enabling to cover ground by faster tillering are suitable for machine transplanting method of establishment. Among those faster

tillering varieties, varieties showing number of filled grains can give a higher yield at the end.

2 METHODOLOGY

A farmers' field experiment adopting RCBD with 03 replicates was conducted in Rajanganaya KOPIA Project site during the *Maha* 2015/2016 and *Yala* 2016 season. 06 varieties were tested namely BW367, AT362, BG359, BG310, BG360 and BG370. Plot size was 18m² (3mx 6m).

Machine transplanting method of crop establishment was adopted (Spacing = 30 cm x 15 cm, Depth of planting= 1.5 cm, No. of plants per hill =05 seedlings). All crop management practices were done according to the recommendations of Department of Agriculture, Sri Lanka. Herbicide; Pretilachlor 170 g/L + Propanil 300 g/L EC were sprayed at the rate of 2l/ha within 6-10 days after establishment. Only grain yields were recorded during *Maha* 2015/2016 season. Total number of tillers, number of productive tillers, number of filled grains, number of unfilled grains and final grain yield were recorded during *Yala* 2016 season.

Data was analyzed adopting GLM using SAS Software package. Counts data were square root transformed prior to SAS analysis.



Table 1: Attributes of tested rice varieties (Source: RRDI, Batalagoda)

Variety	Age (days)	Yield Potential (t/ha)	Grain Type	Special Characteristics
<i>Bg310</i>	92	7	White Intermediate Bold	Salinity Tolerant, Medium Resistant to Brown Plant Hopper and Rice Blast
<i>Bg359</i>	105	7	White Intermediate Bold	Iron Toxicity Tolerant, Medium Resistant to Brown Plant Hopper and Rice Blast
<i>Bg360</i>	105	6.5	White Short Round	Medium Resistant to Brown Plant Hopper and Rice Gall Midge
<i>At362</i>	105	10	Red Long Medium	Medium Resistant to Brown Plant Hopper Resistant to Rice Blast
<i>Bw367</i>	105	7.4	White Short Round	Iron Toxicity Tolerant, Medium Resistant to Brown Plant Hopper, Rice Blast and Rice Gall Midge
<i>Bg370</i>	99	7.5	White Short Round	Resistant to Brown Plant Hopper and Rice Blast

3 RESULTS AND DISCUSSION

Bw367 showed the highest grain yield of 10.53 and 7.70t/ha during *Maha* 2015/2016 and *Yala* 2016 respectively. The yield of BW367 was comparable with AT362 during *Maha* 2015/2016 season.

The yield of BW367 was comparable with the grain yields of AT362, BG359 and BG370 during *Yala* 2016. BW367 showed the highest number of filled grains per panicle.



Table 2: Number of Tillers, Number of Productive Tillers, Number of Filled Grains, Number of Un-filled Grains and Final Grain Yield of Different Establishment Methods

Treatment	No. of Tillers (yala2016)	No. of Productive Tillers (yala2016)	No. of Filled Grains per panicle (yala2016)	No. of Un-filled Grains per panicle (yala2016)	Grain yield (t/ha)	
					maha 2015/16	yala 2016
Bw367	15 ab	15 a	302 a	47 a	10.53 a	7.70 a
At362	14 ab	13 a	131 ab	37 ab	9.56 a	6.09 ab
Bg359	17 ab	17 a	137 b	32 ab	8.92 b	7.04 ab
Bg310	12 b	11 a	170 ab	21 b	8.66 b	5.70 b
Bg360	18 a	17 a	201 b	27 b	7.43 c	5.91 b
Bg370	13 ab	12 a	241 ab	32 ab	7.06 c	6.37 ab
CV	20.25	20.93	35.44	42.90	5.5	6.92

** Means within same column with the same letter are not significantly different ($\alpha=0.05$)

4 CONCLUSIONS

BW367, AT362, BG359 and BG370 were better varieties to be grown in machine transplanter in the Rajanganaya area.

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J.A.A.P. Jayasooriya^{1*}, I.A.U.N. Gunatilleke², C.V.S. Gunatilleke² and P.M.S.A. Ruwan¹

¹*Department of Statistics and Computer Science, University of Peradeniya, Peradeniya, Sri Lanka*

²*Department of Botany, University of Peradeniya, Peradeniya, Sri Lanka*

*Corresponding author: Email: pathumapsara@gmail.com

1 INTRODUCTION

The neutral theory of biodiversity provides a powerful framework for modelling macro-ecological patterns such as species-area-relationships (SAR) (Hubbell, 2006; Hubbell, 2001; Hubbell, *et al.* 1997). Species-area curves explain the relationship between area sampled and the number of species found. The classical niche theory (Hutchinson, 1957) and Hubbell's unified neutral theory are two well-known theories that can be used to explain the SAR. According to the niche theory species differences are important to explain the SAR. Therefore, niche theory expects that the shape of the species area curve to depend on the spatial arrangement of species, habitat fragmentation, and species interactions. In contrast, the neutral theory assumes all species in a community have the same competitive ability and have identical birth, death, growth and speciation rates. Therefore, it assumes that the species differences are irrelevant to explain the SAR. This theory emphasizes "zero-sum ecological drift" and dispersal limitation (m) alone can explain the species richness of a local community (Hubbell, 2001). Hubbell assumes a fundamental biodiversity number ($\theta = 2J_M \nu$) controls the meta-community species richness at an equilibrium between speciation (ν) and extinction. Further, Hubbell (2006) assumes that species

interactions are weak in species rich forests (called species dilution effect). In tropical forests, species are well mixed and neighbourhood diversities are inconsistent (Hubbell, 2006). If the neutral theory is true, SAR under the neutral model should closely follow the empirical SAR. Deviations are expected when processes such as habitat association, dispersal limitation and species interactions are important for the spatial arrangement of the species. This study compares the shape of the empirical SAR of the 25-ha, fully mapped Sinharaja Forest Dynamics Plot (FDP) in Sri Lanka (Gunatilleke, *et al.* 2006) with the SAR under fully neutral model which has only two parameters, θ (biodiversity number) and m (dispersal limitation which indicate the probability of immigration) that coupled local community and meta-community. Additionally, we calculated the θ and m values for nine other forest plots (25-50ha) in different countries. This will be useful for constructing the SAR under neutral model for the considered forest plots. (Summarized details about these plots are included in Table 1)

2 METHODOLOGY

2.1 Study area

The area studied is the Sinharaja Forest Dynamic Plot (FDP). It is a 25-ha FDP and located in the lowland rain forest of the

Sinharaja which is an UNESCO World Heritage Site at the centre of the ever-wet south-western region of Sri Lanka (6° 21-26'N, 80° 21-34'E). It was established in 1993 by the University of Peradeniya and the Forest Department of Sri Lanka. Sinharaja FDP spans the elevational range of 424 m to 575 m above sea level. In Sinharaja 18,065 adults were found (trees with diameter of breast height ≥ 10 cm), belonging to 188 species. (Census year-1996)

2.2 Data set

The empirical SAR was constructed using data from Sinharaja FDP which was initiated in 1996. The data set contains 20 variables but only few of them are considered for this study (species name-sp, spatial coordinates (gx, gy), diameter of breast height-dbh).

Hubbell (2001) assumes that the neutral theory works for the adult trees. In his seminal work he used trees with diameter at breast height (dbh) 10 cm as adult trees. Therefore, we also used all the trees with dbh 10 cm in the Sinharaja FDP as adult trees. Although this threshold value is crude it is useful for cross site comparisons.

θ and m values for nine other forest plots were calculated using freely available data from the Centre for Tropical Forest Science/ Smithsonian Institution Global Earth Observatory network (<http://www.sigeo.si.edu/>). Each data set contains two sets of data for diameter of breast height (dbh) ≥ 1 cm and dbh ≥ 10 cm. For this study, only the trees with dbh ≥ 10 cm were considered from the latest census of each FDP.

2.3 Neutral model and species area curve for 25ha Sinharaja forest plot

We simulated neutral communities (see Etienne, 2009; Hubbell, 2001; Hubbell, 1996) for various θ and m combinations. The number of individuals in the neutral

community (J) was fixed and it was the community size of the Sinharaja FDP. For each θ and m combination species richness (S_n) was calculated. The neutral theory assumes that community is saturated. Thus, number of individuals in a local community (J) is proportional to the area (A) sampled (i.e. $J = \rho A$).

Species richness versus area sampled was plotted for the best θ and m combination. (This is the graphical representation of SAR). We constructed empirical SAR and SAR based on the neutral model. (1) Empirical SAR was constructed by throwing a quadrat 99 times randomly and calculating the average species richness. (2) Step-1 was repeated 99 times (99 simulations) to construct the simulation envelope for the empirical SAR. (3) Size of the quadrat was changed to increase the area sampled. Correction to the edge effects was also used. The statistical analysis was conducted using R software (R Core Team, 2014).

3 RESULTS AND DISCUSSION

Figure 1 shows the species richness (S) for various θ and m combinations with fixed local community size ($J=18,065$). We found that when $\theta = 36$ and $m=0.14$ species richness of the neutral community (187) is very close to the species richness of the Sinharaja forest plot (188). Figure 2 shows species richness vs. community size (J); sampled for Sinharaja forest plot ($J = \rho A$) (black line) and its 95% simulation envelope (shaded gray). We noticed that SAR under the fully neutral model (red line in Figure 2) is inside the 95% confidence interval of the empirical SAR. This indicates that the neutral model can explain empirical SAR of the Sinharaja forest.

We considered species abundance tables (for trees with dbh 10 cm) for nine other large forest plots (Web: Smithsonian Tropical Research Institute-<http://www.forestgeo.si.edu/> and



estimated θ and m values for these forest plots (Table 1). When species richness is low θ and/or m is low. Mudumalai (in

India) and Yasuni (in Ecuador) show lowest and highest θ values respectively. (Table 1)

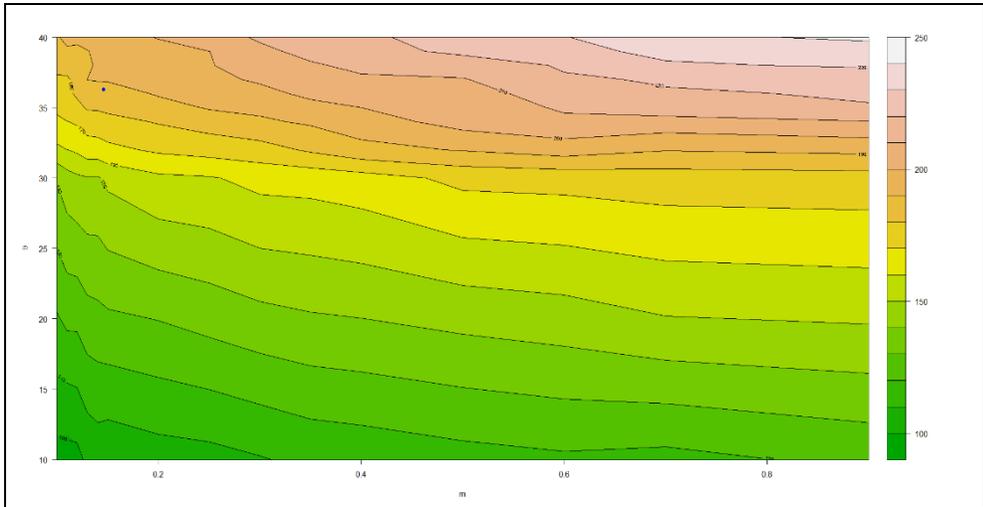


Figure 1: Species richness for various θ and m combinations with fixed local community size ($J=18,065$). J = All the trees, dbh ≥ 10 cm, in the Sinharaja FDP. Blue solid dot represents the species richness of Sinharaja (188) and its $\theta=36$ and $m=0.14$.

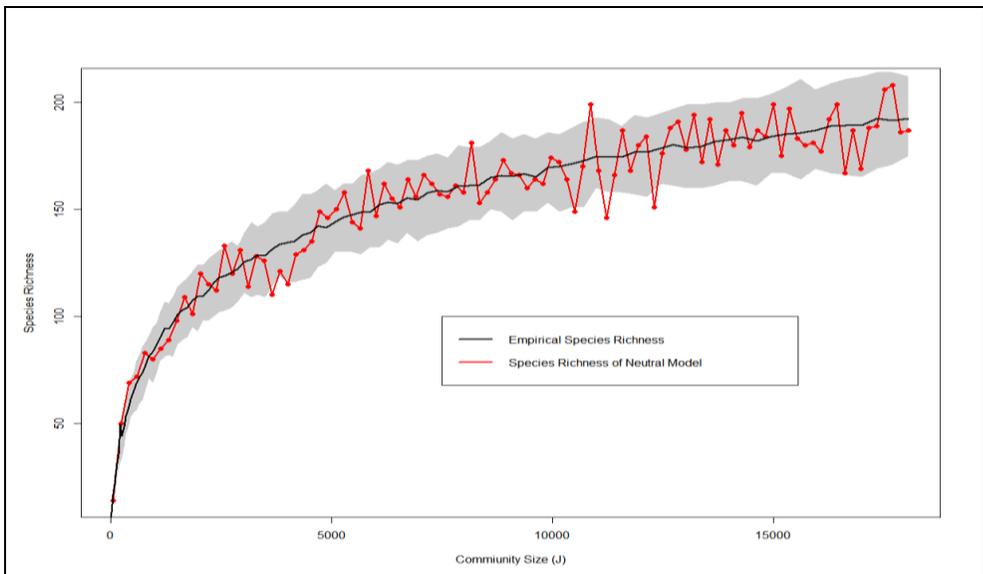


Figure 2: Species richness vs. community size (J); sampled for the 25-ha Sinharaja FDP ($J = \rho A$) (black line), its 95% simulation envelope (shaded gray). SAR under the neutral model (red line).

Table 1: θ and m combination for 10 forest dynamic plots in Centre for Tropical Forest Science (CTFS).

Study Plot (Country)	Study area (ha)	Community Size (yr.) (J)	Species Richness (S)	θ	m
BCI (Panama)	50	20848 (2005)	227	50	0.10
EDORO (Africa)	10×2	9382 (2000)	207	52	0.12
FUSHAN (Taiwan)	25	19270 (2002)	77	15	0.03
KORUP (Africa)	50	24591 (1998)	308	66	0.12
LAPLANADA (Colombia)	25	15013 (2003)	173	35	0.14
LENDA (Africa)	10×2	7300 (2000)	213	58	0.13
MUDUMALAI (India)	50	12579 (2000)	61	14	0.02
PASOH (Malaysia)	50	28279 (2000)	671	180	0.10
SINHARAJA (Sri Lanka)	25	18065 (1996)	188	36	0.14
YASUNI (Ecuador)	50	17434 (2003)	819	259	0.15

We observed that the neutral model with $m=0.14$ and $\theta=36$ can explain the species richness of the Sinharaja FDP. Hubbell (1997) found that, $m=0.1$ and $\theta=50$ for Barro-Colorado Island (BCI) in Panama and $m=0.15$ and $\theta=180$ for Pasoh forest in Malaysia. It was found that the m value of the Sinharaja forest ($m=0.14$) is higher than the BCI value ($m=0.1$) and smaller than Pasoh value ($m=0.15$). Perhaps, trees in the Sinharaja forest are taller than trees in the BCI forest but shorter than the trees in the Pasoh forest. This should be the reason for the above result. However, we could not construct the empirical SAR for these nine forest plots since the spatial arrangement (gx,gy coordinates) of these forest plots were not available.

4 CONCLUSIONS AND RECOMMENDATIONS

Our findings indicate that the neutral model (which does not consider the habitat association, dispersal syndrome of species, Janzen-Connell effects, species interactions and their joint effects) can explain the SAR of the Sinharaja forest plot. This emphasizes that the spatial

arrangement of species are not important to describe the large scale patterns. Also the estimated θ and m values proved that, when species richness is low θ and/or m is low.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Effect of Crude Methanolic Extracts of *Emblica officinalis* on Cholesterol Induced Wistar Albino Rats (*Mus norvegicus albinus*)

D.M.L.C. Dissanayaka¹, S.R. Weerakoon^{1*}, S. Somaratne¹,
N. Nilakarawasam², C. Ranasinghe³

¹Department of Botany, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Department of Zoology, The Open University of Sri Lanka, Nugegoda, Sri Lanka

³Department of Chemistry, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: shyamaweerakoon@gmail.com

1 INTRODUCTION

Hypercholesterolemia, elevated serum cholesterol levels in the body, is a serious health condition affecting a large population of the world today (Yadav *et al.*, 2014). Medications used at present to reduce body cholesterol levels are associated with unwanted side effects. Therefore, there is a growing interest in search of hypocholesterolemic plant metabolites of herbal origin (Maruthappan and Sakthi, 2010). The plant family Euphorbiaceae is a systematically complex family but consists of plants with various medicinal properties (Asha *et al.*, 2006, Chauhan *et al.*, 2010 and Maruthappan and Sakthi, 2010). *Emblica officinalis* is one of the species of this family that exhibits various therapeutic properties. In Ayurveda, a class of drugs derived from *E. officinalis* is believed to promote health and longevity by improving defense against diseases (Deshmukh *et al.*, 2010 and Fatima *et al.*, 2014). Studies of *E. officinalis* on anti-ulcer activity, anti-cancer activity, anti-inflammatory activity, hypoglycemic activity, blood cholesterol reduction etc. have been reported by Jain *et al.*, 2015). Few studies

of *E. officinalis* on hyperlipidemia are available using an Ayurvedic powder at the concentration of 540 mg/kg (Santoshkumar *et al.*, 2012) and fresh fruit juice (Mathur *et al.*, 1996). Compared to the water extract of plant materials, methanolic extract results in the highest extraction yield with maximum presence of phytoconstituents (Azwanida, 2015). Studies on hypocholesterolemic activity of *E. officinalis* using the crude methanolic extract of fruits are lacking and its dose-dependent response and effective dose has not been established. Hence the present study was carried out to explore the potential of the use of crude methanolic extract as an alternative to fresh *E. officinalis* fruit juice in a rat model and to determine its effective dose.

2 METHODOLOGY

2.1 Plant collection and Extraction

Fresh fruits of *Emblica officinalis* were collected from Gampaha district. Seeds were removed and the fruits dried in the shade for three weeks. Dried fruits were powdered mechanically and samples were



subjected to Soxhlet extraction with 80% methanol at 64°C for 6-8hr. Extracts were evaporated at 40°C using a rotary evaporator. Evaporated samples were dried in vacuum oven until attaining constant weight.

2.2 Experimental animals

Wistar albino rats were used in this study as they have similarities with humans in terms of physiology, anatomy, nutrition, pathology, and metabolism and according to published literature, they are the most common animal model used in cholesterol studies.

Only male rats were used as they are less affected by reproductive hormonal changes. Ethical approval for the study was obtained from the Ethical review committee, Institute of Biology, Sri Lanka. Male Wistar albino rats (*Mus norvegicus albinus*) weighing 180-200 g were purchased for this study from the Medical Research Institute, Colombo 08. They were kept under standard animal house conditions (photoperiod: approx. 12h natural light per day, temperature: 28-30°C, RH: 55%-60%) and given water and standard diet *ad libitum* throughout the experimental period. Rats were acclimatized for 7 days.

2.3 Experimental design

Rats were divided into groups (n=06/group) of six animals each. Except the rats of negative control group (NCG), hypercholesterolemia was induced in rats in treatment groups and the positive control group (PCG), by feeding a mixture of cow ghee, butter and egg yolk (1:1:2 by weight) orally once a day throughout the experimental period in addition to the standard diet given *ad libitum*. When induced total cholesterol levels were significantly higher ($p \leq 0.05$) than normal total cholesterol level in blood (75 ± 10 mg/dL reported by Samaranyaka, 2005) treatments started.

Crude methanolic extract of *E. officinalis* (EO-CME) was given orally once a day to rats of treatment groups at the dosage of 400 mg/kg (EO-CME400), 800mg/kg (EO-CME800) and 1200mg/kg (EO-CME1200). Rats in the NCG and ECG were given distilled water as the vehicle.

2.4 Evaluation of blood parameters

Animals were anesthetized and held in a rat holder to collect blood samples from tail vein. Samples were centrifuged within one hour after collection, at 3500 rpm for 30 minutes to obtain serum. Total cholesterol (TC), Triglyceride (TG), HDL Cholesterol (HDL-C) and LDL Cholesterol (LDL-C) were measured using standard kits (Biolabo reagents-Maizy, France). Blood parameters were evaluated at the beginning, 14th, 28th and 42nd days of the experiment.

2.5 Statistical analysis

Descriptive statistics such as means and standard deviations were calculated. The significance of difference between the controls and treated groups were determined using one-way analysis of variance (ANOVA) using SPSS Ver. 20. The acceptable level of significance was $p < 0.05$.

3 RESULT AND DISCUSSION

Increasing EO-CME concentrations resulted in dose dependent negative responses ($p < 0.05$) with total cholesterol, triglyceride and LDL-C along with a dose dependent positive response ($p < 0.05$) with HDL-C. When compared with cholesterolemic untreated group (PCG), the levels of total cholesterol, triglyceride and LDL-C were lowered significantly and HDL-C the response increased significantly ($p < 0.05$) by all three doses ($p < 0.05$) of the crude methanolic extract of *E. officinalis*. These trends increased with time.



There was a significant decrease ($p < 0.05$) in total cholesterol in rats for all three doses of EO-CME throughout the experiment (Figure 1a). By the 42nd day of the experiment EO-CME1200 treated group reached the normal total cholesterol level of the group NCG, making the total cholesterol levels insignificant ($p \geq 0.05$) in these two groups.

Although the TGL levels were insignificant ($p \geq 0.05$) at 14th day of the experiment between EO-CME-400mg/kg treated group and PCG, all three doses of EO-CME treated groups indicated significant decrease ($p \leq 0.05$) throughout the experiment. At 42nd day of the experiment, TGL level of rats in EO-CME-1200mg/kg treated group became insignificant ($p \geq 0.05$) with NCG (Figure 1b)

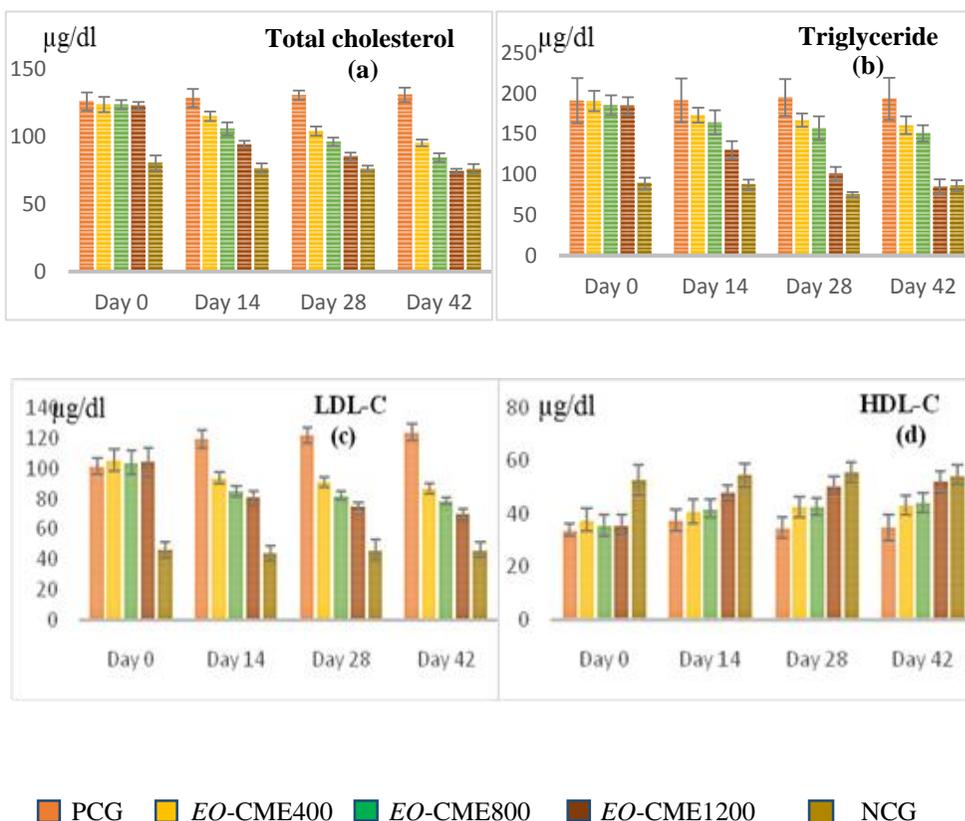


Figure 1: Mean variation of Total Cholesterol (a), Triglyceride (b), LDL-C (c), HDL-C (d) in EO-CME treated groups and control groups.

4 CONCLUSIONS AND RECOMMENDATIONS

The crude methanolic extract of *E. officinalis* was able to reduce levels of total cholesterol and triglyceride and increase of HDL-C in rats up to normal level within 42 days. The most effective dose was found to be 1200mg/kg body weight.

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Evaluation of Growth and Yield Performance of Selected Lines of Yard Long Bean (*Vigna unguiculata* sub spp. *Sesquipedalis*) during Off Season in Mid Country Wet Zone

T.W.G.F.A. Nijamdeen¹, P.K.J.de Mel*¹ and P. Malathy²

¹Department of Agricultural and Plantation Engineering, Open University of Sri Lanka, Nugegoda, Sri Lanka

²Horticultural Crop Research and Development Institute, Gannoruwa, Sri Lanka

*Corresponding author: Email: pkmel@ou.ac.lk

1 INTRODUCTION

Yard Long Bean (*Vigna unguiculata* sub spp. *sesquipedalis*) belongs to the family Fabaceae is a widely cultivated vegetable crop throughout the subtropical and tropical countries including Sri Lanka. Immature Yard long bean pods are one of the very low calorie vegetables containing large quantities of fiber, protein, vitamin C and A. They also contain minerals such as iron, copper, manganese, calcium, and magnesium (USDA nutrient data base, 2009).

Yala and *Maha* are the two major cultivating seasons of Sri Lanka when the climatic conditions are favorable for crop growth and production. However vegetables including Yard long bean are cultivated to a lesser extent between these two major seasons. During this season the climatic conditions are said to be adverse for vegetable cultivation due to high temperature and low rain fall. Therefore, this season has been identified as a less suitable season for vegetable cultivation which is referred to as the off seasonal cultivation (Department of Agriculture, 1994). Most often during this season, the Yard long bean cultivation fields lie abandoned. This results in a decreased

income for farming families. At the same time the consumers have to pay higher prices for Yard long bean due to the low supply in the market. Increase in temperature and water stress during the off season results in poor growth and final pod yield in Yard long bean. Cultivation of appropriate varieties during off season is one of the best strategies to overcome the above problems. Therefore, the present study was conducted with the objective of identifying suitable Yard long bean varieties for off seasonal cultivation in the mid country, wet zone of Sri Lanka.

2 METHODOLOGY

The experiment was carried out by planting six locally developed varieties of Yard long bean, variety 32-5, variety 32 – 14, variety Hordi Kola, variety Hordi Red, variety Gannoruwa A9 and variety Gannoruwa Hawari in 18 plots in 2 rows system in the field belonging to the Horticultural Crop Research and Development Institute (HORDI), Gannoruwa in the mid country wet zone during February to May 2016. Each plot consisted of 40 plants. The evaluation was carried out in a Randomized Complete



Block Design (RCBD) with 3 replicates. All cultural practices from land preparation to harvesting was carried out as recommended by the Department of Agriculture (DOA). Germination percentage one week after planting, total number of leaves per plant, internodes length (cm), leaf area (cm²) and Chlorophyll content were used as growth parameters to evaluate growth performance of different varieties. Fresh weight of pods (g) after harvest was recorded to calculate the final yield and then evaluate the yield performance of different varieties. In this study fifteen harvests were taken. The data collected were analyzed by using Minitab 17 statistical package.

3 RESULTS AND DISCUSSION

The present investigation focused on the evaluation of six Yard long bean varieties for their growth and yield performance in the off seasonal cultivation.

3.1 Seed germination percentage

Table 1: Seed germination percentage

Variety	Seeds germination %
32-5	91.67 ^a
32-14	80.83 ^a
Hordi Kola	84.17 ^a
Hordi Red	68.75 ^a
Gannoruwa A9	88.33 ^a
Gaannoruwa Hawaii	80.00 ^a

Drought has negative effects on yard long bean production (Burton, 1997). Therefore the drought conditions in the off seasonal cultivation play an important

role in seed germination. In this study, the highest seed germination rate was recorded in the variety 32-5 (91.67%) while the lowest seed germination rate was observed in the variety Hordi Red (68.7%). No significant difference in seed germination was noted among varieties (Table 1).

Means that do not share a letter are significantly different by the LSD at $p=0.05$

3.3 Leaf Area

Leaf area is critical for crop light interception and thereby has an influence on crop yield (Sinclair, 1983). Leaf area is an important component of growth. (Potter et al., 1977). In this study a significant difference was observed in leaf area among the varieties except the varieties 32-5 and Hordi kola (Table 2). The highest leaf area was observed in Hordi red (150.48 cm²) while the lowest leaf area was recorded in the variety Gannoruwa hawari (93.86 cm²).

Table 2: Variation in leaf area in different varieties

Variety	Leaf Area (cm ²)
32-5	126.39 ^c
32-14	112.97 ^d
Hordi Kola	130.70 ^c
Hordi Red	150.48 ^a
Gannoruwa A9	139.70 ^b
Gaannoruwa Hawaii	93.86 ^e

3.2 Total number of leaves

Total number of leaves plays an important role in growth and yield of plants. The highest total number of leaves in all varieties was achieved in the fifth week after planting (Figure 1).



The highest total number of leaves was recorded in the variety, Hordi Kola. After six weeks of planting a gradual decrease in the total number of leaves was observed in all varieties. In the seventh week after planting, the variety Gannoruwa hawari showed more defoliation than the other

varieties. In the ninth week after planting the highest total number of leaves was recorded by the variety Hordi Red (25.0) while the lowest was recorded by the variety Gannoruwa hawari (7.41). All other varieties did not show any significant difference.

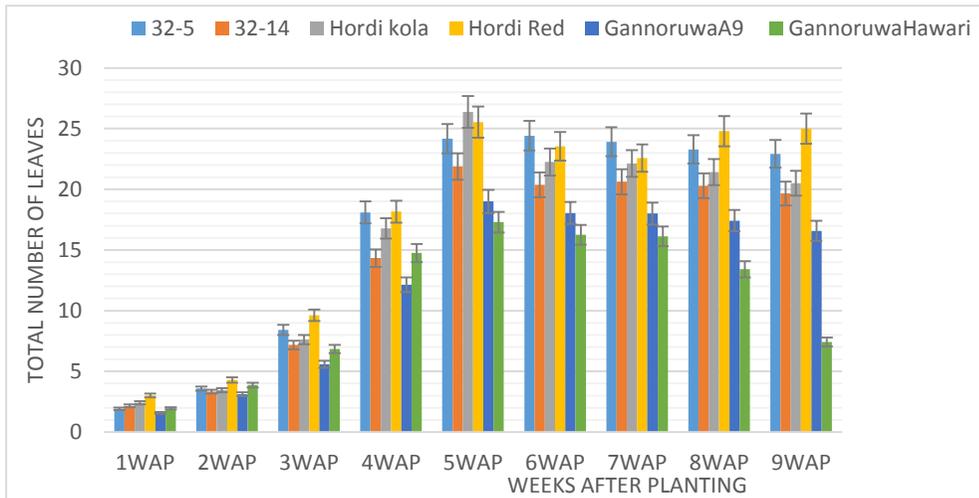


Figure 1: Variation in number of leaves with time (weeks after planting – WAP)

3.3 Internode length

Table 3: Variation in the internodes length with time (weeks after planting – WAP)

Variety	2WAP	4WAP	6WAP	8WAP	10WAP
32-5	14.12 ^b	15.83 ^b	15.9 ^b	16.12 ^b	16.16 ^b
32-14	16.0 ^{ab}	23.58 ^a	23.5 ^a	24.04 ^a	24.04 ^a
Hordi kola	16.66 ^{ab}	18.45 ^{ab}	18.45 ^{ab}	18.50 ^{ab}	18.58 ^{ab}
Gannoruwa A9	22.16 ^a	21.29 ^{ab}	21.63 ^{ab}	22.68 ^{ab}	22.68 ^{ab}
Gannoruwa Hawari	18.42 ^{ab}	18.25 ^{ab}	18.66 ^{ab}	18.70 ^{ab}	18.54 ^{ab}

Internodes length plays an important role in growth of plants. It influences the shoot length depending on growth conditions when it is formed, and shortly thereafter (Quinlan and Weaver, 1970). In this study after the second week of planting the highest internode length was recorded in the variety Gannoruwa A9 (22.16 cm) while the lowest was recorded in the variety 32-5 (14.12 cm). The other

varieties did not show any significant differences. Four weeks after planting the highest internodes length was recorded in the variety 32-14 (23.58 cm) while the lowest was recorded in the variety 32-5(15.83 cm) (Table 3).

3.4 Chlorophyll content

Healthy plants with large amounts of chlorophyll are expected to have



maximum growth compared with unhealthy ones (Campbell and Reece, 2005). Further Hesketh *et al.*, (1981) demonstrated a positive correlation between leaf photosynthesis rate and chlorophyll content. In this study after the second week of planting, the highest chlorophyll content was recorded in variety 32-5 (54.02 cm²) while the lowest was recorded in the variety, Gannoruwa hawari (46.67 cm²). In the fourth and

sixth week after planting there was an increase in chlorophyll content of all varieties. At the eighth week all varieties showed a high rate of chlorophyll content and the highest rate recorded in the variety Hordi red (74.61 cm²) and the lowest in the variety Gannoruwa hawari (61.76 cm²). There was no significant difference in the chlorophyll content among varieties (Table 4).

Table 4: Variation in Chlorophyll content with time (weeks after planting – WAP)

Variety	2WAP	4WAP	6WAP	8WAP	10WAP
32-5	54.05 ^a	56.13 ^a	58.06 ^{abc}	69.93 ^a	56.22 ^{abc}
32-14	53.45 ^{ab}	56.07 ^a	58.43 ^{ab}	67.96 ^a	58.74 ^{ab}
Hordi kola	49.56 ^{abc}	54.26 ^{ab}	55.77 ^{abc}	68.34 ^a	56.71 ^{abc}
Hordi Red	53.92 ^{ab}	56.08 ^a	62.45 ^a	74.61 ^a	60.36 ^a
Gannoruwa A9	48.73 ^{bc}	51.75 ^b	53.54 ^{bc}	66.04 ^a	53.61 ^{bc}
GannoruwaHawari	46.67 ^c	53.30 ^{ab}	50.65 ^c	61.76 ^a	51.93 ^c

3.5 Total yield

Total yield plays an important role in determining the overall performance of the crop in off seasonal cultivation. The total yield ranged from 19012 g/ha to 6252 g/ha. The highest total yield of the

trial was recorded in the variety Hordi red (19012 g/ha) while the lowest was recorded by variety Gannoruwa hawari (6252 g/ha).The other varieties did not show a significant difference (Figure 2).

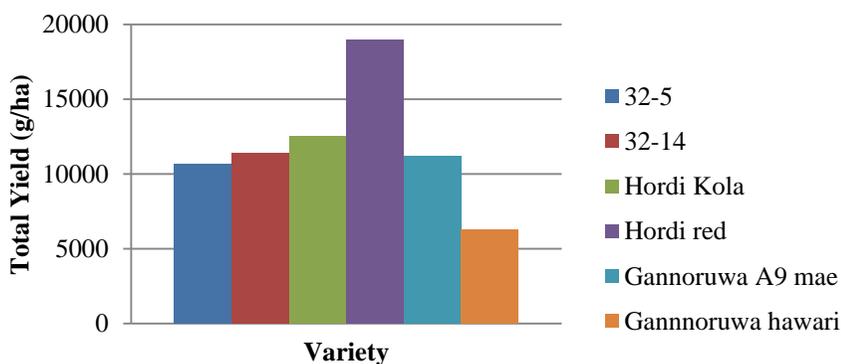


Figure 2: Variation in total yield in different varieties.



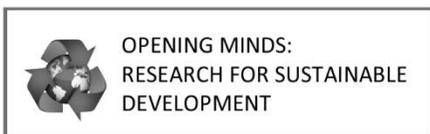
4 CONCLUSIONS AND RECOMMENDATIONS

It can be concluded that the Hordi Red is the most suitable variety for off seasonal cultivation in the mid country wet zone since it provides higher yield. Some of the varieties, variety 32- 5, Hordi Kola and Gannoruwa A9 showed interesting characteristics such as the highest germination percentage, highest total

number of leaves after the fifth week of planting and the highest internode length after two weeks of planting respectively which can be further improved for off seasonal cultivation. It is recommended testing these results at least for two consecutive seasons before using these varieties in the farmer's fields.

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Prevalence and Bionomics of Anopheles Species in a Gem Mining Area in Moneragala District of Sri Lanka

H. M. P. Hewavitharane^{1*}, G. R. Ranawaka², M. D. J. S. Saparamadu³, R. G. Premaratne⁴ and H. T. R. Jayasooriya²

¹Anti Malaria Campaign, Ministry of Health, Sri Lanka

²Department of Zoology, The Open University of Sri Lanka, Nugegoda, Sri Lanka

³Department of Chemistry, The Open University of Sri Lanka, Nugegoda, Sri Lanka

⁴World Health Organization, South East Asian Regional Office

*Corresponding author: Email:mihirini_ph@yahoo.com

1 INTRODUCTION

Sri Lanka has been well known for its gem stones for more than 2500 years and the main gem mining areas of the country are Eheliyagoda of Ratnapura District, Elahera of Matale District and Okkampitiya of Moneragala District. The gem fields when abandoned after use contribute to mosquito breeding and there are records of past malaria outbreaks in gem mining areas due to the potential of malaria vector breeding in the gem pits (Wickremasingha, 1981).

Malaria was a major public health problem in Sri Lanka in the past and it was endemic in the Dry zone and epidemic in the Intermediate and Wet zones. Since the interruption of indigenous malaria transmission in the country in October 2012 and being certified as malaria-free in 2016, the biggest threat to the malaria elimination efforts is the risk of resurgence due to imported malaria cases and the continuing receptivity in several parts of the country due to the persistence of malaria vectors (Premaratne *et al.*, 2014). Previous studies in the Kaluganga gem mining area of Matale District show that changes in the environment due to gem mining have caused the emergence of

Anopheles subpictus and *An. varuna* as significant vectors of malaria (Yapabandara and Curtis, 2004).

Moneragala District in the Intermediate zone of the country currently has a land area of 5636 km² with abandoned and active gem mining pits. It is also an area where indigenous malaria transmission has been reported even in 2012. Gem mining pits and the associated aquatic habitats in the Moneragala District may pose a significant threat to increase malaria vector breeding. Hence this study was designed to investigate the prevalence of *Anopheles sp* in Moneragala, their indoor resting habits, adult feeding habits and breeding habits.

2 METHODOLOGY

2.1 Study site and duration of data collection

Monthly entomological investigations were carried out over a two year period from April 2015 to March 2017 in three gem mining localities namely Minipuragam, Niyadella and Rathreewewa of Buttala MOH area.



2.2 Sampling methods of *Anopheles* mosquitoes

Adults vector mosquitoes were collected in monthly intervals by Cattle baited trap collections - CBTC (95 trap collections), indoor hand collections –IHC (1143 man hours), indoor and outdoor human landing catches partial and full night -HLC (631 man hours), using WHO recommended procedures.

Immature Anophelines were collected in monthly larval surveys (LS) carried out in all potential breeding sites present in the study area. All the collected *Anopheles* mosquitoes were identified to species with the use of standard mosquito taxonomic keys.

The study was approved by the ethics review committee of the Faculty of Medicine, University of Kelaniya.

3 RESULTS AND DISCUSSION

3.1 Abundance of *Anopheles* mosquitoes

A total of 41,919 *Anopheles* mosquitoes belonging to 16 species were caught from all sampling techniques. Table 1 shows the number and percentage of each vector species caught using different collection techniques. In addition to the main malaria vector, *An. culicifacies* 10 other potential vectors of malaria incriminated by ELISA method (Kondradsen *et al.*, 2000) were observed in this study. Further five species, namely *An. aitkeni*, *An. elegans*, *An. maculatus*, *An. jamesii* and *An. pseudojamesii* known as non-vectors of malaria were also observed (Table 1). Sixteen *Anopheles* species were encountered in larval surveys in the study area and a total of 7530 larvae collected. The most abundant species was *An. varuna* (35.7%) followed by *An. culicifacies* (17.8%) as shown in Table 1.

Table1: Number and percentage abundance of *Anopheles* species caught from different collection techniques

Species	Number of different <i>Anopheles</i> collected (%)			
	CBTC	IHC	HLC	LS
<i>An. aconitus</i> ^b	1633 (4.83)	0	0	54 (0.72)
<i>An. annularis</i> ^b	35 (0.10)	0	5 (0.8)	27 (0.36)
<i>An. barbirostris</i> ^b	629 (1.86)	0	1 (0.2)	940 (12.48)
<i>An. culicifacies</i> ^a	63 (0.18)	6 (13)	350 (62)	1340 (17.8)
<i>An. nigerrimus</i> ^b	4023 (11.91)	0	1 (0.2)	523 (6.95)
<i>An. pallidus</i> ^b	66 (0.19)	0	1 (0.2)	19 (0.25)
<i>An. peditaeniatus</i> ^b	7460 (22.08)	0	3 (0.5)	523 (6.95)
<i>An. subpictus</i> ^b	43(0.12)	39(84.8)	16 (2.7)	40(0.53)
<i>An. tesellatus</i> ^b	1355(4.01)	0	129 (21.9)	60(0.8)
<i>An. vagus</i> ^b	2763(8.18)	0	20(3.4)	156(2.07)
<i>An. varuna</i> ^b	3669(10.86)	1(2.2)	15(2.5)	2642(35.09)
Non vectors	12039 (35.64)	0	6(1.06)	1205(16.06)
Total	33778	46	566	7529

^a -major malaria vector, ^b- potential vectors, CBTC-Cattle Baited Trap Collections, IHC-Indoor Hand Collections, HLC-Human Land Collections, LS-Larval Surveys



3.2 Indoor resting behavior of *Anopheles* mosquitoes

Among the 16 species recorded in the study only *An. subpictus* (84.8%), *An. culicifacies* (13%) and *An. varuna* (2.2%) were found resting inside human dwellings in the study area.

3.3 Human Biting behavior of *Anopheles* mosquitoes

In the partial night and full night human landing catches carried out, all 11 vector species were encountered in the study area along with the three non-vector species *An. jamesii*, *An. maculatus* and *An. pseudojamesii* (Table 1). Five species among the 11 species showed both indoor and outdoor human biting behavior and they were the major malaria vector *An. culicifacies* and other potential vectors *An. subpictus*, *An. tessellatus*, *An. aconitus* and *An. peditaeniatus*. A significant feature is that highest proportion of human biting vectors was from *An. culicifacies* (62%). Moreover, *An. culicifacies* showed high outdoor biting rates compared to indoor biting rates.

The higher incidence of human biting among the *Anopheles* vector and potential vector species indicates the possibility of malaria transmission in the gem mining areas due to presence of many anthropophilic vectors and also their outdoor biting habit will be significant in gem mining industry since workers spend long hours outdoors in this industry.

3.4 Breeding site preference of *Anopheles* mosquitoes

There were 17 different larval breeding habitats in this gem mining area. Of these breeding sites, river bed pools and margin of the Kumbukkan Oya contributed to the highest *Anopheles* larval breeding while abandoned gem pits was in third place for

larval breeding (Figure 1). Irrigation canals, paddy fields, domestic wells and rain water collections in rainy season contributed for the next highest breeding potential, respectively, throughout the study period.

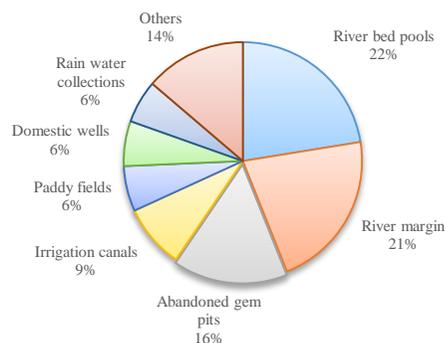


Figure 1: Breeding sites of *Anopheles* in Gem mining area of Moneragala District

In river bed pools *An. culicifacies* was the most abundant species while in the river margins it was *An. varuna* (Figure 2).

In abandoned gem pits the most abundant species was *An. jamesii* which is considered a non-vector species. This is comparatively a different finding from previous studies conducted in Kaluganga gem mining area of Matale district (Yapabandara and Curtis, 2004.).

In Kaluganga gem mining area, gem pits contributed to breeding of *An. culicifacies*, *An. varuna* and *An. subpictus* than the other species. In irrigation canals and rain water collections *An. varuna* was abundant and *An. peditaeniatus* was the most abundant in paddy fields. *An. varuna* was present in almost all major *Anopheles* breeding habitats while *An. culicifacies* also occupied a variety of breeding habitats in the present study.

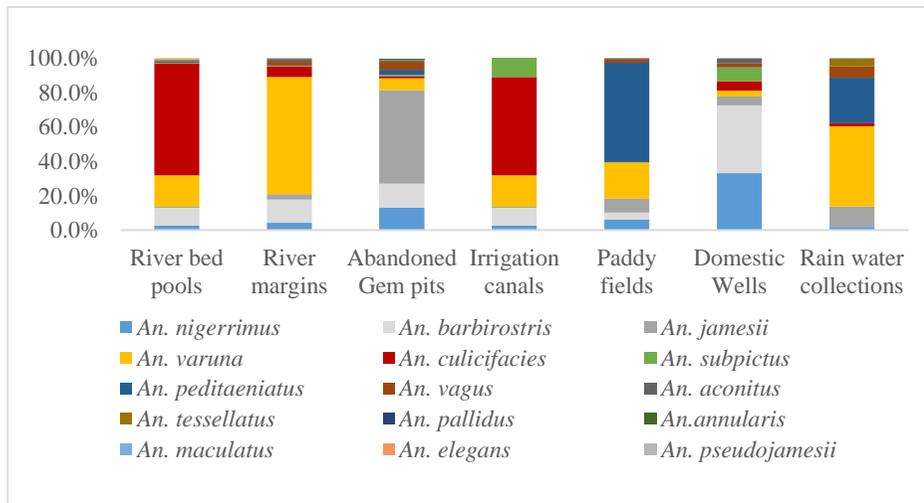


Figure 2: Breeding habitats of different *Anopheles* species found in gem mining area of Moneragala District

4 CONCLUSIONS

In the gem mining areas of Niyadella, Rathreweva and Minipuragama of Buttala MOH Area of Moneragala District the malaria vector *An. culicifacies* is abundantly breeding in the river bed pools and in the margin of Kumbukkan oya which is flowing throughout this area. Abandoned gem pits are in the third place contributing to the *Anopheles* mosquito breeding and it contributed to breeding of *An. jamesii* than other species. Therefore, abandoned gem pits are not a significant malaria vector breeding site when compared to the previous study in Kaluganga gem mining area in Matale District. However, the high human biting rates of the major vector and anthropophilic behavior of other potential vectors in the study area have contributed to increased receptivity. Hence, the high receptivity in this gem mining area has to be considered as a malaria transmission risk factor even in the absence of malaria transmission to increase vigilance and evidence based vector control to keep the area malaria free.

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Preliminary Study on Impact of Induced Temperature and Water Stress on Yield Parameters of Tissue Cultured *Ananas comosus* (Pineapple) – Variety Kew

K.I.C. Amarasinghe¹, P.T.N.Dishani², C.S De Silva^{2*} and L.K.R.R. Jayakody¹

¹Department of Botany, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Department of Agricultural and plantation Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: csdes@ou.ac.lk

1 INTRODUCTION

Growth and development of plants are affected by increase in temperature and decrease in rain fall due to temperature and water stress imposed on them (Hatfield *et al.*, 2015). These stresses would have an impact on the growth and yield of the crop plants. Rosen-zweig and Hillel, (1995) have reported that when the temperature exceeds the optimum that is required for biological processes, the plants respond negatively showing a sharp decline in growth and yield. Dishani and De Silva, (2013) and Gunawardana *et al.* (2011) have reported that temperature plays a main role in growth and development of tomato plants. It is further reported by Gunawardana *et al.*, (2011) that fruit setting of tomato was minimum under the temperature stress due to pollen sterility. In okra, quality of fruits was poor and pods mature quickly at high temperatures. The same authors have reported that there has been a reduction in yield of chilli and if the plant is not under water stress this reduction could be managed.

Pineapple is a tropical plant and grows best in a moderately warm climate (16° to 33°C). For optimum growth pineapple

need at least 50mm rainfall per month. Pineapple cannot tolerate frost and temperature above 40°C. This plant has developed a specialised metabolic system (CAM) for capturing carbon dioxide at night for use during the day. This mechanism greatly reduces water loss which is an adaptation to drought from its epiphytic ancestry (epiphytes grow above the ground on other plants for support). (Sideris and Krauss, 1955) Low number of stomata and the leaf shape and texture allow, to a certain extent for drought condition (Krauss, 1949).

Pineapple is a popular fruit among people in Sri Lanka as well as in the world. It is the third most important fruit in the world, after banana and citrus (Bartholmew *et al.*, 2015). This fruit is used as a dessert and syrup is canned and exported. The residue is used as cattle feed and fertilizer. The fibre of the leaves is used in weaving textiles.

In vitro propagation of *Ananas comosus* (L.) Merr is not a novel technique to Sri Lanka (Fernando, 1984). *In vitro* propagated pineapple is very popular among farmers due to the beneficial characteristics such as early fruiting and



high yield. The variety Kew offers a better value for commercial purposes compared to the type Mauritius when cultivated in Sri Lanka, for processing and fresh fruit market (Gamage *et al.*, 1995).

Since there is a high demand for the *in vitro* propagated pineapple plants, especially variety Kew, among farmers in Sri Lanka, this paper intends to determine how the predicted temperature and water stress due to climate change would have an impact on the vegetative growth and yield parameters of *A. comosus*. The yield parameters measured are time duration from fruit initiation to harvesting, weight and length of fruit with and without crown, diameter of the fruit, firmness of the peel and the flesh, total soluble solids and the pH of the fruit juice.

2 METHODOLOGY

The study was carried out in the premises of the Open University of Sri Lanka in two locations in a poly-tunnel type plant house where the maximum day temperature was set to 35 °C, and in a plant house where the ambient temperature was maintained, from June 2015 to May 2017. *In vitro* propagated pineapple plants were planted, one plant each, in pots having the diameter of 0.5 m, in a potted medium of coir dust, top soil and compost in 1:1:1 ratio. These divided into four sets each having three replicates. Two sets were maintained under ambient temperature in the plant house, and the other two sets at maximum of high temperature (35°C) in the poly-tunnel. Of the two sets of plants in the poly tunnel one set was watered daily, to the field capacity and the other set to half of field capacity soil moisture. The plants in the plant house were also treated similarly. Plants were manured according to the recommendations of the CIC seed farm Pelwehera, Dambulla. Four treatments used in this study are as follows:

T1-35°C inside the Poly Tunnel (TS) with watered to field capacity (NWS)

T2-35°C inside the Poly Tunnel (TS) with watered to 50% field capacity (WS)

T3-32°C Ambient Temperature (NTS) without water stress as moisture at field capacity (NWS) (Control)

T4-32°C Ambient Temperature (NTS) with water stress as moisture at 50% field capacity (WS)

The plants were maintained in completely randomized design. The dates of fruit set and harvesting were recorded.

The ripe fruits were picked and their weights and lengths with and without the crown were recorded. The diameter at the maximum point was measured using a venier calliper. Firmness of peel and flesh was measured by penetrometer.

After extracting the juice, the pH was measured using a pH Consort C830. The total soluble solids were also measured with digital refractometer Digit-032 at 20°C respectively. Total soluble solids were reported as degrees Brix (Salome, Laurent, Pierre, Patrice, Hilaire, 2011).

An analysis of variance (ANOVA) of the result was performed using the statistical program Minitab (version 14, Minitab Inc.).

3 RESULTS AND DISCUSSION

3.1 Time taken for harvesting from fruit set

Time taken to harvest from the day of fruit set is shown in Figure 1. According to the results the time taken for the fruit to harvest from the day of fruit initiation was only 73 days when the plants are not under water or temperature stress, indicating that the temperature and the water stress have a negative impact on the fruit growth and ripening. This treatment (T3) is significantly different from other treatments. The plants were exposed to either temperature and water stress or both stresses made longer period to mature.



Highest duration was 98 days in plants grown under 35°C high temperature stress with no water stress condition (T1). Although pineapple has many very efficient moisture conserving systems and has one of the highest water use efficiencies among cultivated crops and can survive severe drought, they still benefit from “good” rainfall/irrigation. Under moisture stress plant growth and yields are significantly reduced. During extended dry periods the plant ‘closes down’ and crop schedules are upset (Salomé *et al.* 2011).

3.2 Fruit diameter

Figure 2 indicates that the diameter of the fruit is maximum when the plants are under water stress and temperature stress. However the diameter of the fruit was lowest in no temperature and no water stress which is significantly different from other treatments. High diameter observed with pineapple fruits seems to indicate a gain of flesh. It would mean that fruits contain more juice, when fruits were grown under temperature and/ or water stresses. However, this disagrees with the results of Black, (1962).

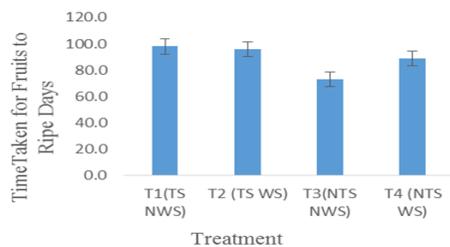


Figure 1: Time taken to harvest from the fruit set

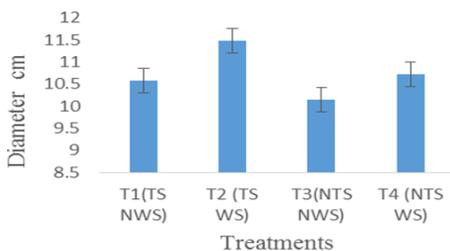


Figure 2: Effect of Temperature and Water Stress on Fruit Diameter

3.3 Firmness of flesh

According to Figure 3, the lowest firmness of flesh of the fruits was obtained in treatment 2 (T2) indicating that fruit is soft when the plant is under temperature and water stress. When firmness of flesh is low or when fruit is soft, it is preferred over the hard flesh fruits. Firmness of fruit is determined by the cell wall structure and cuticle properties (Chaib *et al.* 2007). When the fruit is ripening there is cell wall degradation and remodeling of cell wall which causes softening of the flesh of the fruits. (Matas *et al.* 2009).

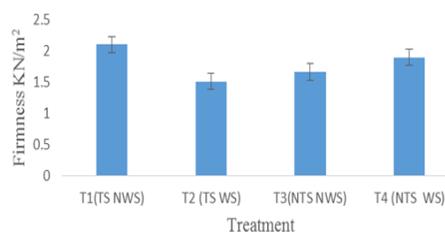


Figure 3: Impact of Temperature and Water Stress on Firmness of Flesh

3.4 Total Soluble Solids

Figure 4 shows the total soluble solids in the fruit. The total soluble solid is an indication of the amount of sugars present in the fruit. Significantly highest total soluble solid was obtained in fruits grown under no temperature and no water stress (Treatment 3). This value is the highest among the fruits, when the plant is not under stress, indicating that the plant produce fruits which are more palatable if the plant is not under stress. However May (1993) has observed that low water stress resulted in products with best soluble solids in tomatoes. High water stress has resulted in, high soluble solids.



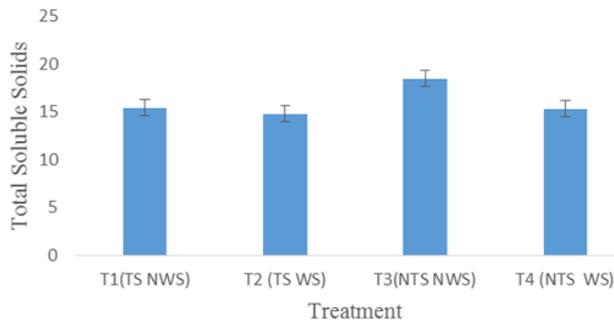


Figure 4: Effect of Temperature and Water Stress on Total Soluble Solids of Fruit

The pH of these fruits ranged from 3.1 to 4.53. Lowest pH was observed in T3. Microorganism has a minimal and an optimal pH required for its growth.

The excellent storing qualities of fruits are related to their respective pH, such as fruits with low pH value are usually not really spoiled by bacteria.

Table 1: pH of juice of Pineapple fruits under different Treatments

Treatment	T1	T1	T1	T2	T2	T2	T3	T3	T3	T4	T4	T4
pH	4.23	4.3	4.53	3.99	3.92	3.96	3.1	3.2	3.1	3.71	3.8	3.82

4 CONCLUSIONS

Plants grown under no temperature and no water stress (T3) took less time for fruit set and maturation. Further significant results were obtained in total soluble solids in no temperature and no water stress treatment (T3). Thus, it is observed that the

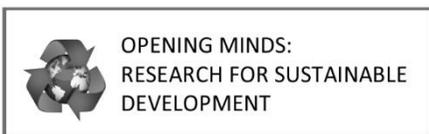
temperature and water stress has a negative impact on some quality parameters of pineapple fruits. However, further investigations are required to confirm the results.

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Comparative Study of Growth Performance of F₁ and F₂ Rice Hybrids Cultivars in Sri Lanka

W.S. Priyantha*, D.D. Witharana, R.P.D.H. Hemachandra and D.M.O.K.B. Dissanayake

Rice Research and Development Institute, Batalagoda, Ibbagamuwa, Sri Lanka

*Corresponding author: Email: rrdihybridrice@gmail.com

1 INTRODUCTION

The enhancement of rice production is an important requirement to meet increasing demand for rice in the future. The development of high yielding varieties with multiple resistance to biotic and abiotic stresses is important to cater to the present and future changing environment. The introduction of hybrid rice has had a dramatic influence in increased crop production (Duvick, 1999) and minimization of unrealistic crop yield. Hybrid rice technology assures the rice farmers with increased yield over improved conventional varieties, thereby enhancing field incomes. Hybrid rice area is now rapidly increasing outside China ever since the release of the first set of hybrids in 1976 (Yaun, 1998). Presently, many countries other than China like Vietnam, India, Indonesia, Iran, Philippines, United States of America, Bangladesh, Sri Lanka, Myanmar and Egypt are currently engaged in developing hybrid rice technology to suit their local conditions (Dorosti, 2014). In Sri Lanka, the research and development (R and D) program on hybrid rice began in 1983 (Pathinayaka, 1985) at the Central Rice Breeding Centre, Batalagoda. Under this program several hybrids have been identified with 1.0 -1.5 t ha⁻¹ yield advantage over the best inbred grown under similar environments (Iqbal, 2009) and the first hybrid rice variety, Bg 407H was released in 2005. F₁ seed production

of hybrid rice is very important to enhance the seed paddy availability among farmers. Therefore seed production technology of hybrid rice was introduced to farmers. The low yield of F₁ hybrid was the main obstacle to limit the cultivation of hybrid rice in the country. Some farmers adopted the cultivation of the seeds of F₂ generation and obtained satisfactory grain yield. In general F₂ generation of hybrids was not recommended to cultivate because decreasing of heterosis. Hence this study was conducted to identify the performance of (F₂) rice hybrids of Bg 407H and HR-10.

2 METHODOLOGY

This experiment was conducted at the Rice Research and Development Institute (RRDI), Batalagoda, Low Country Intermediate Zone (IL1a) in Sri Lanka. Two promising hybrids of Bg 407H (120 days) and HR-10 (105 days) were included in the experiment and F₂ generation of respective hybrids. Inbred rice varieties; Bg 357 (105 days) and Bg 403 (120 days) were included as standard checks for respective age groups. Sixteen days old seedlings of all treatments were transplanted in a well prepared field one plant per hill basis. Spacing within two plants were 15x 15 cm and spacing between two rows were 20 x 20 cm. All



the other agronomic and plant protection practices were adopted according to the department of agriculture (DOA) recommendations. Randomize Complete Block Design (RCBD) was adopted with four replicates in this experiment. Plant growth parameters and yield parameters were recorded. Mean separation was done by Duncan Multiple Range Test (DMT) by using SAS statistical software package 9.1. Standard heterosis (SH) of F1 and F2 hybrids and inbreeding depression of F2 hybrids were calculated for yield separately.

$$SH = \frac{(F1 - SC)}{sc} \times 100$$

SH = Stranded Heterosis, F1 = Value of tested traits of hybrid, SC = Value of stranded check

$$\text{Inbreeding depression (\%)} = \frac{(F2-F1)}{F1} \times 100$$

F2 – value of respective trait of F2 generation, F1 - value of respective trait of F1 generation

3 RESULTS AND DISCUSSION

Results showed that regardless of the varieties and age groups F2 generation significantly reduced yield over both F1 generations and inbred varieties except in Yala season. Inbred varieties showed higher yield over the F2 hybrids but not significantly different. The number of productive tiller/hill (NPT/H) of all F1 and F2 hybrids did not show a significant difference. However Bg 403 showed a significantly higher NPT/H over F1 and F2 hybrids of Bg 407H, Although no such significant effect was recorded in F1 and F2 hybrids of HR-10 compared with Bg 357 in Yala. F1 hybrid of HR-10 showed significantly higher NPT/H over its F2 hybrid in Maha season. The number of unproductive tillers per hill (NUPT/H) of F1 and F2 hybrids did not show a significant difference among them in both seasons. Meanwhile NUPT/H recorded

no significant effect regardless to the varieties and age groups in Yala season but such effect did not appear in Maha season. Thousand grain weight (TGW) of F1 and F2 hybrids of Bg 407H was not significantly different over seasons but TGW of F1 and F2 hybrids of HR-10 showed significant difference over seasons. Results showed that no Cytoplasmic genetic Male Sterile (CMS) plant count was recorded in 105 and 120 days old inbred rice varieties. In both seasons highest significant CMS plant count was recorded in F2 hybrids of Bg 407H and HR-10. Crop uniformity was observed in both F1 hybrids and two inbred varieties but such uniformity was not observed in the plots of F2 hybrids due to segregation of the respective alleles. The results revealed significant yield reduction in F2 generations due to loss of hybrid vigor. Segregation of respective alleles reduces heterozygosity of F2 generation by 50% and it generates different phenotypes which have poor and various vigor levels in F2 population. Considerable amount of CMS plants could be identified in the generation of F2 hybrids with unfilled grains caused yield reduction irrespective of varieties and age of F2 hybrids.

The inbreeding depression (Fehr, 1987) was calculated for F2 hybrids and results showed a negative effect for all selected traits of F2 hybrid. Maximum inbreeding depression (IBD) was showed by F2 hybrid of Bg 407H (-37.16%) in Yala season (Table 2.). However, less IBD was obtained by all F2 hybrids in Maha compared to Yala season. Stranded heterosis (SH) was estimated for selected traits for both F1 and F2 hybrids and results revealed that negative heterosis for F2 hybrids. In Yala season maximum negative heterosis recorded by F2 of HR-10 (-27.15%) while in Maha season maximum negative heterosis recorded by F2 hybrid of Bg 407H (-27.25%). Meanwhile positive SH was showed by F1 hybrids of Bg 407H 34.14% and HR-10 9.69% in Yala season. Those two hybrids showed (-4.11%) and 16.07% SH



respectively for Maha season. It indicated that F₂ hybrids of both varieties cannot be

recommended for cultivation. But only F₁ hybrids of Bg 407H better to be cultivated in Yala and HR-10 for only Maha season.

Table 1: Mean of morphological and reproductive traits

Treatments	TGW(g)		CMSPC		GY(t ha ⁻¹)	
	Yala	Maha	Yala	Maha	Yala	Maha
Bg 407H (F ₂)	28.8a	29.10a	35.40b	60.33b	2.79b	4.78c
Bg 407H	29.53a	29.03a	3.61c	2.33c	4.44a	6.30a
Bg 403	25.13bc	25.43c	0.00d	0.00d	3.31ab	6.57a
HR 10(F ₂)	24.03c	26.53b	50.69a	87.67a	2.63b	4.63c
HR 10	25.36b	25.43c	1.16c	2.67c	3.96a	6.21a
Bg 357	21.56d	23.70d	0.00d	0.00d	3.61ab	5.35b
CV	1.32	1.85	0.85	16.73	1.13	5.12
LSD	2.28	0.89	17.52	1.01	18.09	0.52

Treatments	NPT/H		NUPT/H		PH(cm)	
	Yala	Maha	Yala	Maha	Yala	Maha
Bg 407H (F ₂)	8.24c	8.24b	12.19a	1.04a	117.27b	24.33ab
Bg 407H	8.01c	8.64b	1.51a	0.92a	123.2a	25.73a
Bg 403	12.04a	12.46a	1.90a	0.09b	107.93c	25.13ab
HR 10(F ₂)	11.83ab	12.04a	2.16a	0.86a	106.00c	23.73b
HR 10	11.28ab	9.30b	2.06a	0.30ab	107.00c	23.73b
Bg 357	10.24b	8.64b	0.96a	0.04b	92.93d	20.23c
CV	0.26	6.51	0.83	44.47	5.24	4.07
LSD	4.49	0.37	34.44	0.54	2.64	1.77

NPT/H - No. of Productive Tiller/hill, NUPT/H - No. Unproductive Tiller/hill, PH-Plant Height, TGW-Thousand Grain Weight, CMSPC- CMS Plant Count, GY- Grain Yield

Table 2: Inbreeding depression and standard heterosis of F₁ and F₂ hybrids for grain yield

Treatments	IBD (%)		SH (%)	
	Yala	Maha	Yala	Maha
Bg 407H (F ₂)	-37.16	-24.12	-15.71	-27.25
HR 10 (F ₂)	-33.59	-12.01	-27.15	-13.46
Bg 407H(F ₁)	-	-	34.14	-4.11
HR 10(F ₁)	-	-	9.69	16.07

IBD- Inbreeding Depression, **SH-** Stranded Heterosis

Grain yield of two F₁ hybrid showed high yield compared to respective standard check varieties except Bg 407H(F₁) and it showed -4.11% SH compared to its check variety Bg 403 in *Yala* season. Meanwhile all F₂ hybrids showed poor SH compared to respective check varieties.

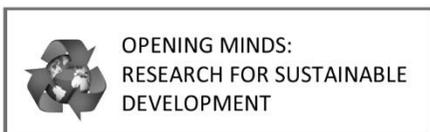
4 CONCLUSIONS AND RECOMMENDATIONS

The study concluded that the use of F₂ hybrid varieties was not suitable to cultivate because of their high inbreeding depression and poor grain yield compared to F₁ hybrid as well as inbred varieties. However F₁ hybrids have better standard heterosis for grain yield so that can obtain high yield.

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Impact of Excessive Use of Phosphorus Fertilizer on Soils in the Central Highlands of Sri Lanka and Possible Health Hazards

Partlee Samarakody, C.S. De Silva*

The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: csdes@ou.ac.lk*

1 INTRODUCTION

Phosphorus (P) is one of the nutrients essential for plant growth. The total amount of P in an average mineral soil is much lower than nitrogen, potassium, calcium or magnesium and is in the range of 0.02 to 0.15% P (Mengel and Krik, 1982). However it is a fact that most of the phosphorus present in the soil is not immediately available to plants. When a soluble source of this element is supplied to soils in the form of fertilizers, phosphorus is often fixed or rendered insoluble, and may not be available to higher plants, even under the most ideal field conditions (Brady, 1990). Plant roots take up nearly all phosphorus as either the primary or secondary orthophosphate anion ($H_2PO_4^-$, HPO_4^{2-}). Primary orthophosphate is the form that is dominant in acid soils and is taken up about 10 times as readily as the secondary orthophosphate form.

Long term continuous application of P fertilizers and other P sources such as organic wastes and manure cause P accumulation in the surface horizon (Zhang et al., 2004). The majority of Sri Lankan farmers apply more than the recommended quantity of fertilizer (National Science Foundation, 2000) aiming for higher economical benefits. Therefore in agricultural soils when high quantities of phosphorus are received, available P content exceeds the critical P

for fertilizer response in this situation. Soil P has become more of an environmental concern than an agronomic concern in areas with intensive cropping and livestock production (Central Environmental Authority, 1995; Sharply et al, 1995). High concentration of phosphorus has adversely affected the environment, animals, and humans. High concentrations of phosphorus in water cause "Eutrophication" leading to death of fish in water (Arnao, 1995). Therefore the aim of this study is to estimate the total, organic, inorganic and available phosphorus levels in the central high lands (Badulla, Bandarawela, Welimada and Nuwara Eliya) where intensive vegetable cultivation is taking place with the heavy use of organic and inorganic fertilizers and suggest possible mitigation measures to avoid health hazards.

2 METHODOLOGY

2.1 Sampling methods

Thirty four composite (34) soil samples, seventeen (17) from surface and seventeen (17) from sub surface representing four (Badulla, Bandarawala, Walimada and Nuware Eliya) vegetable growing soil series in up country wet zone and up country intermediate zones of Sri Lanka were collected. These sites were all in



vegetable holdings where fertilizer has been added for a long time. Surface soil samples were taken from the depth of 0-20cm and subsurface soil samples were taken from the depth of 20-40 cm from the same selected fields. Each composite sample was prepared after taking 34 samples from the four locations mentioned above. Soil samples were air dried at room temperature and crushed to pass through a 2-mm sieve to remove coarse fragments and then stored in tightly sealed plastic bottles until analyses were conducted.

2.2 Soil analysis

Seventeen surface soil samples and seventeen sub surface soil samples were analyzed for physical and chemical properties (Soil pH, Electrical conductivity, Available P, Exchangeable K, Organic matter (%) and total available phosphorus). Available P was determined by extraction with distilled water, Bray and Kurtz No. 1, Morgan' extraction, Olsen's, Mehlich 3 and Mehlich 1. Phosphorus in the extract was determined colorimetrically by the molybdenum blue method as modified by Murphy and Riley (1962). pH and electrical conductivity (EC) was measured by pH meter.

3 RESULTS AND DISCUSSION

3.1 Soil properties

Particle size analysis indicates that all the soils were sandy clay loam; all soils contained high amount of clay and low amount of sand (Table 1). The pH values for the up country vegetable growing soils ranged from 3.96 to 5.89 at soil depths (0 to 20 cm). The soil pH is generally influenced by several management factors including the crop grown, irrigation, and the type of fertilizer used. The soils were generally acidic. The EC values ranged from 69.3-800 μ s. All the soils were generally high in EC. The observed

organic matter values of the soils ranged from 0.82 – 11.40%. Badulla and Bandarawela soils showed the same pattern of the organic matter contents. Walimada and Nuwara Eliya soils showed the same pattern. But in Walimada and Nuwara.Eliya soils the organic matter content was higher than that of the Badulla and Bandarawella soils. Exchangeable K cations were generally high. This is due to the low clay and organic-matter contents (De Alwis and Panabokke, 1972-1973).

Particle size analysis indicated that the sub surface soils were generally sandy clay loam; some soils in Nuwara Eliya and Bandarawela were sandy clay. All the sub surface soils had a high amount of clay. The pH values for the up country vegetable growing soils ranged from 3.59 to 5.61 at soil depths (20 to 40 cm). The surface and subsurface soils were found to be generally acidic. The EC values ranged from 47.9-541 μ s. All the sub surface soils were extremely high in EC. But lower than the top soil. The exchangeable K values ranged from 60.79 – 486.32ppm. Exchangeable K was also high in sub surface soils, but lower than the surface soils. The observed organic matter values of the soils ranged from 0.25 – 7.05%. Organic matter contents were found to be higher in the 0-20 cm depth than in the 20-40 cm depth.

3.2 Available P

The observed available P values of the surface soil ranged from 25.48 – 429.8ppm. Available P in the surface soil of Nuwara Eliya ranged from 321-429 ppm which was extremely high and exceeded the safe limit of 30-40ppm of the World health Organization (WHO). Major plant nutrients, especially P content in poultry manure, were higher than in the other organic manures (Maraikar and Amarasiri, 1988). Farmers in Nuwara Eliya use large amounts of poultry manure together with high rates of chemical fertilizers. Wijewadana (1999) reported



that the combined use of organic and chemical fertilizer more effectively increased the major plant nutrients in the soils of the up country vegetable cultivations. This may be the reason for the higher available P in Nuwara Eliya soils. The observed available P values of the sub surface soil ranged from 19.07 – 306.54ppm. Available P contents were also higher in these soils but lower than that of the surface soils. Available P, exchangeable K and organic matter content of sub-surface soils from Nuwara Eliya were higher than those of the other soil series (19-306ppm) but lower than that of the top soil.

3.3 Total P

Total P content in the soils ranged from 1108.46 to 4587.31 ppm of the surface soils with mean values of 1302.82, 1455.21, 1364.26 and 2878.58 ppm in Badulla, Bandarawella, Walimada and Nuwara-Eliya soils respectively. The positive correlation of total P with organic carbon showed that organic carbon contributes significantly towards the total P content. Total P was correlated negatively with percentage sand but positively with percentages of silt, clay and organic carbon. This indicated that the P in soils is mostly concentrated in the

finer fractions of the soil, probably because of the high fixation of P and Fe and Al hydrous oxides and Kaolinite in the clay and silt fractions.

3.4 Organic P

Organic P content of the soil ranged from 133.29 to 1664.44ppm with mean values of 199.82, 332.93, 399.47 and 1051.93ppm in Badulla, Bandarawella, Walimada and Nuwara-Eliya soils respectively. These values exceed the safe limit of WHO. This constituted 20, 23, 29 and 36% of the total P in the four series of soils. Long term continuous application of P fertilizers and other P sources such as organic wastes and manure cause P accumulation in surface horizon. (Zhang et al, 2004). Total, inorganic and organic P was highest in Nuwara Eliya soil samples as shown in Figure 1.

3.5 Organic matter (%)

Soils in Nuwara Eliya has the highest Organic matter content and this may be due to the heavy use of poultry and organic manure for the-country vegetable cultivation. Organic matter percentage ranges in between 9 to 11.4ppm.

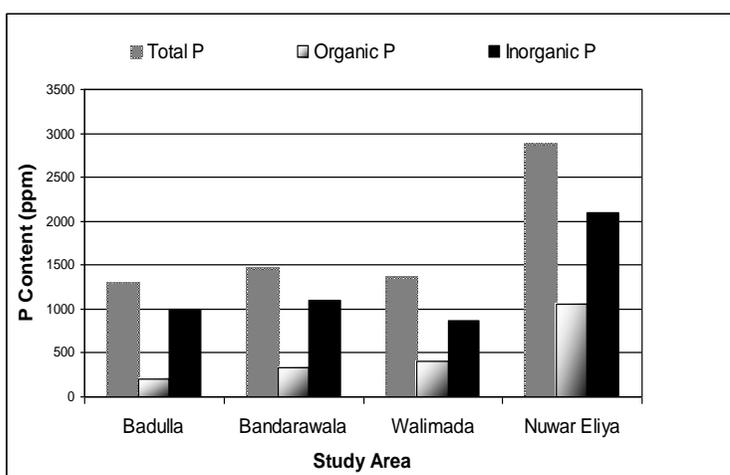


Figure 1: Distribution of Total, Organic and Inorganic P factions in four Study areas

Table 1: Physio chemical properties of soil (surface soil)

No	Name of the soil series	Texture	Soil pH	EC (µs)	OM (%)	Total P (ppm)	Organic P (ppm)	Inorganic P (ppm)	Available P (ppm)
1	Badulla	Scl	4.85	75	2.94	1338.0	133.3	1186.8	127.5
2	Badulla	Scl	3.96	69.3	2.35	1126.8	166.5	849.2	25.91
3	Badulla	Scl	5.24	80.1	1.19	1443.7	299.7	943.3	130.5
4	Bandarawella	Scl	4.81	243	3.49	1159.6	233.1	1204.9	180.3
5	Bandarawella	Scl	4.25	51.3	1.53	1313.1	332.9	962.1	151.2
6	Bandarawella	Scl	5.51	127.1	2.35	1892.9	432.8	1110.2	242.9
7	Walimada	Scl	4.25	237	1.65	1534.8	599.2	929.8	164.2
8	Walimada	Scl	4.12	107.6	2.94	1534.8	466.1	1016.2	125.5
9	Walimada	Scl	4.89	187.1	0.82	1126.8	166.5	663.1	25.48
10	Walimada	Scl	5.89	79.8	3.06	1347.2	532.6	794.2	145.7
11	Walimada	Scl	4.52	249	3.26	1108.5	299.6	683.1	153.4
12	Walimada	Scl	4.4	800	6.76	1534.8	332.8	1149.9	224.6
13	N.Eliya	Scl	4.05	89.3	9.92	1637.1	466.0	721.8	360.6
14	N.Eliya	Scl	5.72	289	5.17	3598.2	299.6	1606.1	338.0
15	N.Eliya	Scl	4.48	758	1.00	3785.8	1165.1	2597.7	429.8
16	N.Eliya	Scl	5.62	244	9.02	4570.3	1664.4	2877.2	321.8
17	N.Eliya	Scl	5.37	779	11.4	4587.3	1664.4	2706.9	360.6

Scl-Sandy Clay Loam

4 CONCLUSIONS AND RECOMMENDATIONS

The results of the study showed that soil supporting vegetable cultivations in up country of Sri Lanka were generally high in total as well as the organic forms of P. Nuwara-Eliya soils showed high total P and Organic P than other soils and exceeds the safe limit of 30-40 ppm according to World health Organization. Although soils of Badulla had lowest amounts of total P and organic P fractions other two series (Walimada and Bandarawella) showed moderate amounts. Therefore farmers are advised to do a soil test for available

phosphorus before fertilizer application in order to minimize the groundwater pollution. As of now the quick and easy method of a field tool kit is available to measure the phosphorus content in soil and farmers are strongly advised to contact the nearest Department of Agriculture.

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OPENING MINDS:
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Farmer's Perception on Climate Change and Coping Strategies; A Case Study in Major Irrigation Schemes of Puttlam District

P.T.N.Dishani and C.S. de Silva*

Department of Agricultural and Plantation Engineering, Faculty of Engineering Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: csdes@ou.ac.lk*

1 INTRODUCTION

Global climate change is one of the most critical challenges for food production. Climate change is expected to have serious environmental, economic, and social impacts on Sri Lanka. In particular, rural farmers, whose livelihoods depend on the use of natural resources, are likely to bear the brunt of adverse impacts. The extent to which these impacts are felt depends in large part on the extent of adaptation in response to climate change. Adaptation to climate change requires that farmers first notice that the climate has changed, and then identify useful adaptations and implement them (Maddison 2006). Agricultural change does not involve a simple linear relationship between changes in a farmer's decision making environment and farm-level change. One important issue in agricultural adaptation to climate change is the manner in which farmers update their expectations of the climate in response to unusual weather patterns.

Agriculture, especially crop production, is highly sensitive to both short and long-term changes. Agricultural production remains the main source of livelihoods for the most rural communities in Sri Lanka as it provides employment for 31 % of the population and contributes 11.1 % of Gross Domestic Production in the year 2012 (CBSL, 2012). Environmental stress is the primary cause of crop losses

worldwide, reducing average yields for most major crops by more than 50%. The climate change research community has identified different adaptation methods. The adaptation methods most commonly cited in literature include the use of new crop varieties and livestock species that are more suited to drier conditions, irrigation, crop diversification, mixed crop livestock farming systems, change of planting dates, diversification from farm to nonfarm activities, increased use of water and soil conservation techniques, changed use of capital and labour, and trees planted for shade and shelter (Bradshaw *et al*, 2004; Maddison 2006; Nhemachena and Hassan, 2007). Therefore the main objective of the study was to determine and describe the perception of farmers on climate change in the major irrigation schemes and their coping strategies. The study was conducted at Thabbowa, Sengaloya, Karawita which were categorized as major irrigation schemes in Puttlam district by the Irrigation department.

2 METHODOLOGY

Data were collected during 2015 through two complementary approaches, namely (i) focus group discussions (FGDs) and (ii) farmer interviews using semi-structured household questionnaires. An



FGD was held in each ward to collect qualitative information on the farming systems and farmer perceptions on climate variability, use of seasonal climate forecasts and on how they cope with variable climate. A total of 150 farmer households distributed in the major irrigation schemes in Puttlam district (Thabbowa, Sengaloya, Karawita) was interviewed to assess how farmers perceive the effects of changes in climatic variables, and how they have adjusted their farming practices to cope with the changes in climate. The questionnaire assessed perceptions of changes in rainfall, temperature and extreme weather events in the last 10 years, how changes in climate have affected crop production in the last 10 years. Data was entered using MS Excel for basic descriptive statistical analyses for this study; examines the farmers' perceptions of and adaptations to climate change in the Major irrigation schemes in Puttlam district (Thabbowa, Sengaloya, Karawita).

3 RESULT AND DISCUSSION

3.1 Basic Information of farmers in the study area

Average year of education in the study area is Grade 8. Higher level of education is believed to be associated with access to information on improved technologies and higher productivity (Norris and Batie 1987). The average age of the house hold in the study area is 43 years. Therefore, farmers with higher levels of education are more likely to adapt better to climate change. Male-headed households are more likely to get information about new technologies and undertake risky businesses than female-headed households (Asfaw and Admassie 2004). Age of the head of household can be used to capture farming experience. The average size of the household is 5

members. The influence of household size on use of adaptation methods can be seen from two angles. The first assumption is that households with large families may be forced to divert part of the labour force to off-farm activities in an attempt to earn income in order to ease the consumption pressure imposed by a large family (Yirga 2007).

3.2 Farmers' Perceptions about Changes in Climatic Variables

Nearly all the households (98%) interviewed had observed a change in the climate in the last 10 years. The percentage of households reporting that rain came late (52.3%) were nearly equal to those reporting rain to be coming early (46.4%). Twenty two percent reported that rain increased in amount and intensity while 18.6% perceive rain to be extreme (Figure 1). The highest proportion of farmers (41% households) perceived an increase in temperature in the last 10 years, while 16% of the households did not observe any change in temperature (Figure 2). Extreme climatic events like floods, drought/prolonged dry seasons were reported to have increased in the last 10 years (Figure 3). In general farmers feel the change in rainfall, temperature and extreme events.

3.3 Adaptation Options

The adaptation methods for this study are based on asking farmers about their perceptions of climate change especially the changes in rainfall, temperature and the occurrence of extreme events (Figure 1, 2 and 3).

Further the adaptation options they take to counteract the negative impacts of climate change. The adaptation measures that farmers report may be profit driven, rather than climate change driven. Despite this missing link, we assume that their actions are driven by climatic factors, as reported



by farmers themselves in the studies by Maddison (2006) and Nhemachena and Hassan (2007).

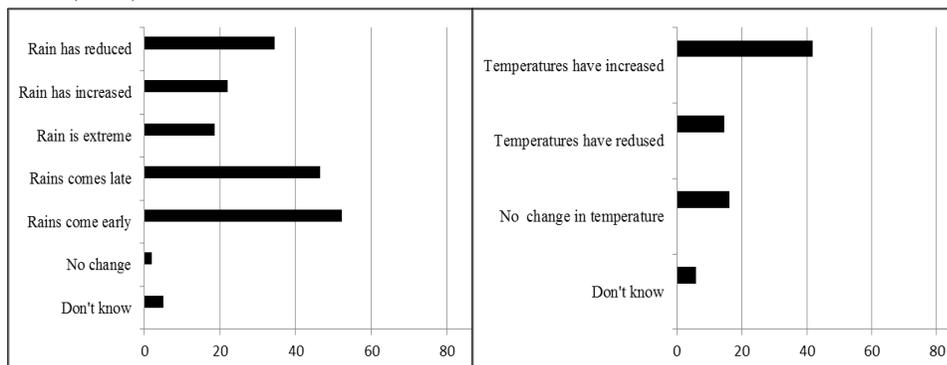


Figure 1: Changes in Rainfall in last 10 years

Figure 2: Changes in temperature in last 10 years

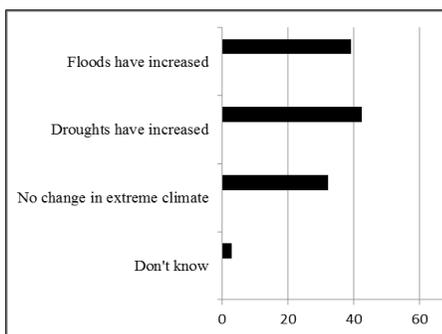


Figure 3: Occurrence of extreme events in last 10 years as a percentage

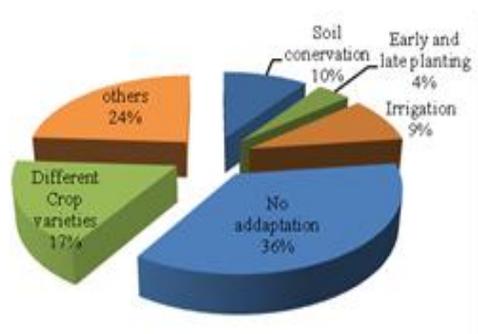


Figure 4: Farmers adapting to climate change

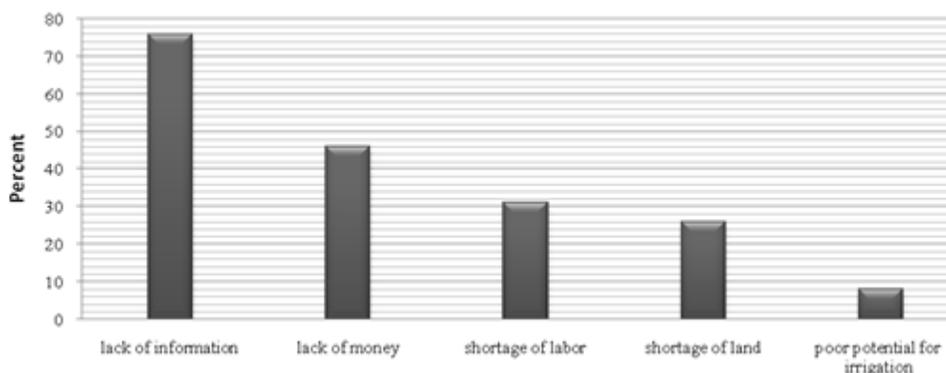


Figure 5: Barriers to adaptation

As indicated in Figure 4, use of different crop varieties (14%) is the most commonly used method, whereas using early and late planting (4%) is the adaptation least practiced among the major adaptation methods identified in major irrigation schemes. Moreover, about 36 percent of the surveyed farmers reported not to have taken any adaptation method. About 24 percent of the surveyed farmers reported any other adaptation method.

3.4 Barriers to Adaptation

The analysis of barriers to adaptation to climate change in the major irrigation schemes indicates that there are five major constraints to adaptation. These are lack of information, lack of money, shortage of labour, shortage of land, and poor potential for irrigation (Figure 5). For instance, lack of information on appropriate adaptation options could be attributed to the dearth of research on climate change and adaptation options in the country.

3.5 Coping Mechanisms

To escape climatically bad years the farming community has been using a wide range of inbuilt coping mechanisms (Figure 6). All climate hazards end up either in eroding the asset of the farmers, or the natural base on which their livelihood depends. Hence, coping strategies adopted are not specific to the climate hazard. Inter household transfers and loans (31.1%), reducing household consumption (26.5%), store grains (12.4%), rent tools/ animals (16.3%), Wage labour (42.8%), sale of household assets (22.3%) were the main coping mechanisms experienced by the farming community in the study area. These are the various adjustments those farmers in the survey area made in their farming activities in response to climate change and variability.

3.6 Changes made in non-Farm Income Sources

Information on the non-farm activities which farmers had taken on to diversify their income sources and therefore to spread the risk associated with farming like total crop failure was analysed (Figure 7). A number of activities had been started to increase household cash income and included stone quarrying, retail business, working as a casual worker at another farm and securing salaried employment. No household had any new additional cash income activity in the Puttlam district. Retail business was the most common type of activity started by households (14%) across the Puttlam district.

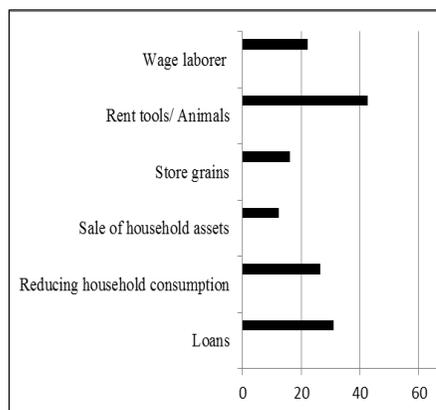


Figure 1: Coping Mechanisms in Percentage

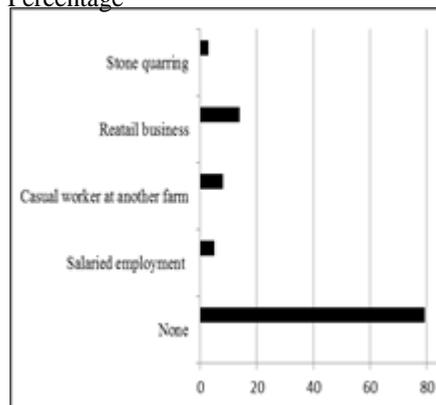


Figure 2: Changes made in non-Farm Income Sources (% households)



4 CONCLUSION AND RECOMMENDATIONS

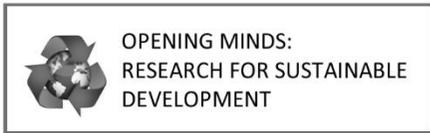
Farmers experience the change in climatic factors. Farmers adapted to climate change by using different methods, of which the major ones are included in this study. Those who did not use any of the methods considered described lack of information on adaptation methods and lack of money as major constraints to adaptation.

These analyses of the constraints to adaptation and the factors that influence farmers' perceptions of adaptation to climate change in the major irrigation schemes suggest a number of different options. These options include raising awareness of climate change and the appropriate adaptation methods, facilitating the availability of credit, investing in yield-increasing technology packages to increase farm income, creating opportunities for off-farm employment, conducting research on use of new crop varieties and livestock species that are better suited to drier conditions, encouraging informal social networks, and investing in irrigation.

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Investigation on Farmer Level Problems for Low Productivity of Paddy Cultivation in Mahagirilla Agrarian Services Division in Sri Lanka

W.B.O.N. Kumari, D.N. Sirisena and C.S. De Silva*

Department of Agricultural Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: csdes@ou.ac.lk*

1 INTRODUCTION

Supplying enough food for the ever growing population has become one of the big challenges facing Sri Lanka today. According to the paddy statistics throughout the past 10 years in Maha and yala seasons, Anuradhapura, Polonnaruwa and Ampara maintain higher average yield than the national average yield (Premaratne and Sangakkara, 2014). Kurunegala has less average yield than the national average yield which should be taken in to consideration because this indicates that there is a clear difference between the potential yield and the farmers' yield in unit land area of the Kurunegala district. It is known that management of water and fertilizer is important to reduce the above yield gap or to increase yield per unit area (Bandara et al., 2006; Datta, 1981). Therefore this study was designed to investigate farmer level problems contributing to low productivity of paddy cultivation with special reference to water management and fertilizing. The specific focus of the study was to examine the prevailing cultural practices, to study the socio-economic conditions of the paddy farmers, and to identify to which extent the farmers have adapted new technological practices to overcome the prevailing problems in Mahagirilla agrarian services division.

2 METHODOLOGY

2.1 Sample design

The target population was farmers who were engaged in paddy cultivation in Mahagirilla Agrarian service Division with all major, minor and rainfed schemes of irrigation systems. There are 16 Grama Niladhari divisions which belong to two Agriculture Instructor divisions. According to Mahagirilla Agrarian Service Division farmer registered book there were 3522 farmers who are engaged in paddy farming. 300 farmers who were engaged in paddy farming from each of the Grama Niladhari division, farming under major, minor and rain fed schemes irrigation systems would be considered as a sample. Farmers were selected using random sampling method and 100 from major schemes, 100 from minor schemes and 100 from rain fed irrigation system.

Data was collected by method of a pre-tested Questionnaire to be filled by the interviewee. There were 45 questions covering the areas of socio-economic constraints regarding paddy farming, prevailing farming practices among farmers, water management and fertilizer problems, adaptation of new technologies with reference to water management and fertilizing (use of leaf colour chart, soil testing, use of parachute technique, use of transplanter machine)



2.2 Data Collection and Analysis

Qualitative as well as quantitative data were collected; both primary as well as secondary data were used. Secondary data were used to supplement the findings. Key Informant Discussions (KID) was used to strengthen the quantitative findings. Secondary data were collected using the publications of Sri Lanka Census and Statistics Department, Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI), World Bank publications etc. Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel 2007. Descriptive statistics along with frequency tables were used. Correlation tests were used for inferential analysis of data. The results obtained from the quantitative analysis were supported by the qualitative data obtained through discussions, interviews and observations.

3 RESULTS AND DISCUSSION

3.1 Basic information about the farmer –age distribution

Mahagirilla Agrarian service Division area belonged to the rural, and dry climatic zone in Sri Lanka. Figure 1 shows that, out of the total number of respondents 45% represents were above the age category 61 years, which reflects the reduction of new entries from young ages to the agriculture industry (paddy cultivation).

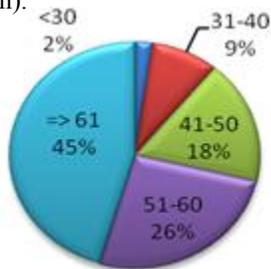


Figure 1: Age distribution of the farmers
Source: Survey data of farmers in Mahagirilla ASD area

3.2 Paddy farming main income

It is observed that 93% of the tested sample in Mahagirilla Agrarian service division fully depends on paddy farming. There are only 7% of farmers who have an alternative income sources (Figure 2).



Figure 2: Paddy farming-Main income
Source: Survey data of farmers in Mahagirilla ASD area

3.3 Duration of land preparation

The prevailing cultural practices shows that the majority of the farmers are not following the standard land preparation duration due to various reasons. This was because farmers have waited until the filling of the tanks/wewa completely to start cultivation and limited time s remained to allocate land preparation. Only one third of the farmer group has been following 21 days land preparation time, which is recommended to be followed by the Department of Agriculture.

3.4 Planting methods

Out of the considered four planting methods, only 13% of farmers have adapted transplanting by Transplanter machine and use of parachute technology which are the new technological planting methods in use today. It reflects the fact that more than 75% of farmers are reluctant to practice the advanced planting methods although they have been made aware by the Department of Agriculture (Figure 3). Also though the broadcasting

method requires more seeds than other methods, the highest number of farmers tends to use broadcasting as it is the easiest method. Furthermore, the water requirement of rice crop varies with the method of crop establishment, and water

has been identified as a scarce resource in Mahagirilla Agrarian Services Division. But these analysed data show that the farmers did not get the benefit of practicing new technological methods which have the ability of saving water.

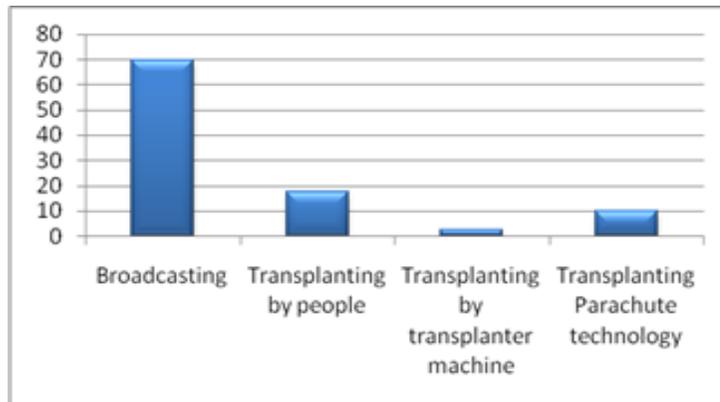


Figure 3: Planting methods used by farmers in percentage
Source: Survey data of farmers in Mahagirilla ASD area

3.5 Fertilizer Application

As it takes about 3 months to make compost, a majority of the farmers were not concerned about pre preparation of compost which is enough for the next season. It is obvious that the farmers who use major irrigation system and apply chemical and organic fertilizers get higher average yield. As per the Table 1, average

yield of minor irrigation systems achieved almost the same average yield of major irrigation schemes as these major and minor irrigation system farmers use organic fertilizers with chemical fertilizer. When only chemical fertilizer is applied the yield is less. This proves that the method of fertilizing has contributed to the low productivity of paddy cultivation in Mahagirilla Agrarian Service Division.

Table 1: Average yield per farmer (Bushel/Ac) against method of fertilizer application

	Average yield per farmer (Bushel/Ac)		
	Major	Minor	Rain fed
Used Chemical+Organic fertilizer	108.64	98.74	58.26
Used only Chemical fertilizer	87.48	74.48	44.78

Source: Survey data of farmers in Mahagirilla ASD area

3.6 Water supply method

Among the considered sample, 16% of those who had faced the water shortage problem are able to overcome the problem by having alternative water storing

sources like rain water harvesting ponds and agro wells. Unfortunately 5% of farmers of the considered sample had to abandon their cultivation due to severe water shortage. However 79% of the sample population did not do any water

supply method and received very low yields (Figure 4). Water shortage is the major problem due to climate change impacts which agrees with this finding. (De Silva et. al., 2007)

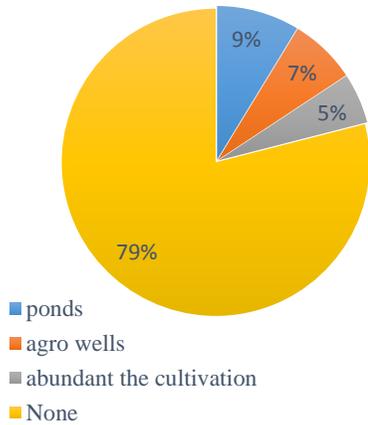


Figure 4: Water supply method (when the available water is not sufficient)
Source: Survey data of farmers in Mahagirilla ASD area

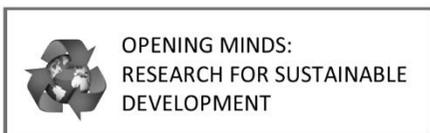
4 CONCLUSIONS

In Mahagirilla Agrarian division, 93% of the farmers are fully dependent on the paddy farming. The age distribution showed that the involvement of the new generation of below 30 years age category is only 2% of the farmers and almost half of the population is above 61 years old. By representation only 13% of the farmers are adapting new technologies such as transplinters for planting and majority still use broadcasting method for the paddy. When chemical fertilizers are applied with organic fertilizers the yield of paddy is better in major, minor and rainfed cultivations. Water shortage is the major problem and the majority (79%) of the farmers obtained low yield due to water shortage problem. Not using modern planting methods also attributes to the low yield in the study area.

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The Potential of Applying Green Technology for the Open University of Sri Lanka

G.H.U Jinendri and B.S.G. Chandrasekera*

Department of Agricultural and Plantation Engineering, Faculty of Engineering Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: bsgayani@gmail.com*

1 INTRODUCTION

Green technology is a modern technique that is in line with sustainable development policies in the modern world (Hasper, 2009), and it is the application of products, equipment and systems used to conserve the natural environment and resources, which minimizes and reduces the negative impact of human activities (www.gpnm.org). As public concerns have grown about degradation of the environment and scarcity of natural resources, government and co-operations have embraced the trend towards green technology concept (Silberglitt, 2009). Various features that are included in green technology concept are sustainable landscape management, the 'green building', green manufacturing, green publishing, biodiversity protection, waste management, water management and energy management (Das Soni, 2015). Green technology is more beneficial for a developing country like Sri Lanka and can be applied in various sectors. This can be practiced effectively in higher education systems like universities with the involvement of their partners i.e. students, academic and non-academic staff. Students represent the majority in a university and they can influence the public, the staff and themselves to initiate and practice this concept with their strengths and intellectual capabilities. The Open University of Sri Lanka (OUSL) has

one of the highest student enrolments among Sri Lankan Universities. Such a large number of students consume more resources than a simple community, institution or enterprise. Eventually, a large amount of wastes, chemicals and poisonous substances are produced during the operation of a university, causing environmental problems for the campus and its neighbourhood (www.oecd.org). The OUSL is situated in a highly populated area of the country, which may affect the environment and the people during its day-to-day operations. The initial purpose of green university concept is to reduce the bad influence on the environment, campus and the community by managing its discharges and wastes (<http://green.dyu.edu.tw>). The green technology will shape the university's capacity for the betterment of the environment and the people. Therefore, with the view of encouraging the university management towards green technology, this study examines the potential of applying green concept mainly through the students of the OUSL.

2 METHODOLOGY

2.1 Research Area

The OUSL is in the capital city of Sri Lanka, precisely in Nawala, Nugegoda. The premises are densely populated with



buildings and the Kirillapone canal is also flowing through the university. Apart from the buildings, there are few parking

areas and reservations. Printing wastage and improper garbage disposal sites are observed in the university premises.



Figure 1: Kirillapone canal (b) printing wastage (c) improper garbage disposal sites

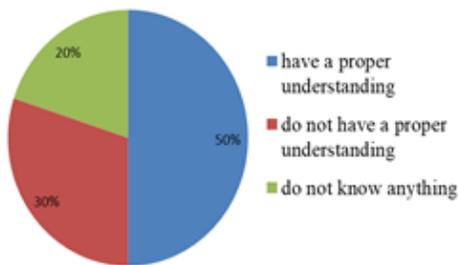


Figure 2: Awareness of the green concept

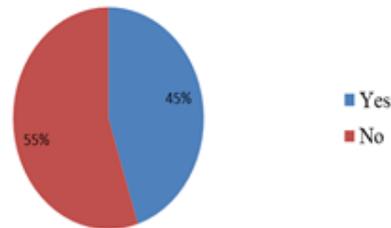


Figure 3: Awareness of applying green technology in OUSL

2.2 Data Collection (2016.06.01-2017.06.15)

This study was based on a primary questionnaire survey conducted with a total sample size of 40 students which was distributed randomly in the university premises and visits were done inside the university premises. Focus was mainly on students since they represent the majority of the university community and their ability to promote this concept in the university. The main variables included are the awareness about green university concept, garbage disposal method, dining services, biodiversity protection, energy system, water management system, green publishing and the improvements needed to be done in the future. The questionnaire comprised of 15 items related to the potential of applying green technology in the OUSL.

3 RESULTS AND DISCUSSION

3.1 Awareness of the Green Concept

According to the results of the survey, 50% of the respondents have a clear idea while 30% have heard about the green technology concept but do not have a proper understanding about it and 20% do not know anything about the concept (Figure 2).

Students do have a slight idea of applying green technology, but more than half of the respondents do not have any idea about applying the concept to the OUSL (Figure 3).



3.2 Waste Disposal

Per the respondents, the majority were not aware about the waste disposal and they were not satisfied with the way the waste/garbage is disposed of at the university. Currently, the green waste and printing materials are burnt and the rest of the wastage is transported to another dump site. In addition, there is a method to categorize the garbage at the OUSL. The food wastage, polythene/plastic, glass, paper are collected in separate bins. The bins are clearly marked to reduce incidents of cross contamination and bins are easily accessed. But the students were not aware of the system very much and they tend to put all kinds of waste into one bin. Furthermore, in line with the government's banning of bringing in and disposing/ burning of all products containing high density polythene, a notice has been displayed on 15th of September 2017 by the management of the OUSL regarding the ban on polythene with effect from 1st of October 2017 which is a timely decision. With the view of increasing the students perception on ecological literacy, Florida Gulf State University has focused on a course called 'The Colloquium: A sustainable Future' which is a graduation requirement for all undergraduates (Uhl and Anderson, 2001).

3.3 Dining System

Dining system includes the canteen and the food provided by them. Currently, the diet consists of different types of snacks, curries and desserts. The food is offered on plastic plates, and take away food is wrapped in lunch sheets and a paper. The OUSL students are not satisfied with the dining system of the university. Per the results of the survey, 40% of the respondents like the method of disposing of the food wastes as organic composting and to prefer to continue with the menu based diet. Hendrix College, Arkansas USA addressed such drawbacks in their canteen diets by providing a model to fortify the local farm economy while promoting sustainable agriculture and a

healthy diet. It is essential that the food served in the cafeterias is locally produced using sustainable agricultural methods and follow strict rules on animal welfare (Uhl and Anderson, 2001).

3.4 Water Management System

The water management system consists of how the water is supplied to the university, water consumption, the way how the waste water is treated, drainage system and the cleanliness of the canals. Most of the students (55%) were not aware of the water management system. The students do not have a clear idea what a water management system meant under the topic of green technology. Currently, a waste water treatment plant is not installed in the OUSL. Waste water is treated and reused in the Penn State University, USA in an environmental friendly way. Wastewater is filtered, broken down, sprayed onto fields and crops and the effluent is sprayed onto fields (Uhl and Anderson, 2001).

3.5 Bio Diversity Protection

Most of students (90%) were not aware of the potential of bio diversity protection in the university.

The university owns a vast area of land and various types of native and non-native flora and fauna. Among them perennials, shrubs, insects, reptiles, amphibians are prominent. Uhl and Anderson (2001) stated that the Penn State University, USA owns 18,000 acres of land but half of the woody plants are non-natives. As a result, they applied hundreds of gallon herbicides and pesticides to the campus grounds each year which are harmful for the environment. To develop a regional identity of biodiversity, Connecticut College, USA, is maintaining an arboretum.

3.6 Energy System

The majority of the students (80%) do not have any idea regarding the energy management system which can be

implemented in the university. In the university, the main source of energy is supplied in the form of electricity through the national grid. The renewable energy sources like solar power systems are not implemented which might reduce the fossil fuel burnt electricity consumption. Many states of the USA have been promoting solar energy with consumer subsidies in the form of tax rebates or renewable energy credits (Cohen et al., 2016). Electricity is consumed for lighting, air conditioning, refrigeration, ventilation, lift operations, computers and other lab equipment. Students are advised about the energy saving tips through notices in class rooms and other public areas. It was observed that students sometimes do not follow the above instructions.

3.7 Green Publishing

According to the results of the survey, 75% of the respondents are interested in receiving their course materials in electronic form. Electronic access to scholarly resources has become a standard tool where energy could be saved with the help of energy efficient servers and computers (Metz and Seadle, 2012). Currently, the students receive course materials in the printed form at the OUSL. As per the Figure 1b, a large amount of printing wastage is accumulated inside the university premises which require extra resources for disposing.

4 CONCLUSIONS

Awareness of the students about green technology concept and its applications which is relevant to the OUSL is not satisfactory. Even though some positive steps were taken by the university management for some areas like waste management and energy saving, the students were not fully aware of them.

5 RECOMMENDATIONS

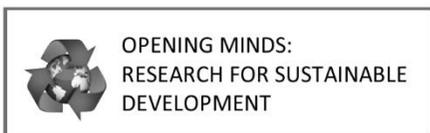
Universities bear a responsibility for visioning and realizing a more sustainable future as they educate the future leaders of our society. Therefore, necessary steps should be taken to implement concepts like green technology which enhance the environmental and social well-being. The OUSL may analyze the requirement of training on students and the staff to disseminate the concept of green technology and some training programmes like demonstrations and workshops are recommended. The university management may take necessary steps to overcome the existing drawbacks of waste disposal system. Furthermore, replacing conventional low efficient lights and other electrical equipment with high efficient appliances; optimizing more natural lighting to interior of the buildings and installing of roof top solar power systems are recommended. Electronic publishing and recycling of papers in the OUSL are recommended to minimize the printing wastage which may eventually conserve trees.

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Computational Studies on Inhibition of Histone Deacetylation by Hydroxamic Acid Derivatives: An *In-Silico* Approach

R. Dushanan¹, G.R. Ranawaka², S. Weerasinghe³ and R. Senthilnithy^{1*}

¹*Department of Chemistry, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

²*Department of Zoology, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

³*Department of Chemistry, University of Colombo, Sri Lanka*

**Corresponding author: Email: rsent@ou.ac.lk*

1 INTRODUCTION

Both genetic and epigenetic modifications of DNA can lead to cancers. Acetyl and methyl histone modifications and DNA methylation are the most studied epigenetic modifications which are now recognized as a common hallmark of human tumours.

Histone is acetylated in its lysine residues within the N- terminal tail protruding from the histone core of the nucleosome. This removes positive charges, thereby reducing the affinity between histones and DNA. As a result, it becomes easier for RNA polymerase and transcription factors to access the promoter region. Therefore, in most cases, histone acetylation enhances transcription while histone deacetylation represses transcription.

There is no evidence that abnormal histone modification can cause cancer, but drugs that alter histone modifications help to turn on genes which help to control cell growth and division. Histone Deacetylase (HDAC) inhibitors cause an increase of the acetylated level of histones, which in turn promotes the re-expression of the silenced regulatory genes in cancer cells and reverses the malignant phenotype.

Interactions of drugs with HDAC, by

covalent or non-covalent binding, may inhibit replication and interfere with transcription by recruiting essential transcription factors from their native binding sites, thus causing the death of cancerous cells. The main objective of cancer therapy is to focus on the interruption of the cellular reproductive cycle. Therefore, if Histone Deacetylation was prevented or controlled in its tracks, an effective anticancer therapy could be developed.

However, a major challenge is the lack of in-depth understanding of the biological function of the structurally diverse HDAC isoforms. Their participation and the mechanism in the process of tumour genesis are also not clearly understood. Computational studies based on Molecular Dynamics (MD) simulations can provide new information regarding the interaction of a drug with HDAC which will provide a better understanding of gene mutation.

This work presents an in-silico approach to study the inhibitory effect of a new hydroxamic acid derivative as a potential anti-cancer drug. Here we report MD simulation studies carried out on the Histone Deacetylase-Drug (HDAC-Drug)



complexes in order to study the stability of the complexes. The secondary structural changes in the HDAC were analysed from the trajectories.

2 METHODOLOGY

X-ray crystal structure of Histone Deacetylase (PDB ID 1ZZ1) was downloaded from the protein data bank. The structures of two drug compounds (derivatives of hydroxamic acids) shown in Figure 1 were generated in Gauss view and optimized with ab-initio calculation with CBS-QB3 basis set using Gaussian G09 software in Linux operating system and each structure was converted to .PDB format using Avagadro software and saved.

AutoDock Tools 1.5.6 docking software package, Vina with 9 modes and an exhaustiveness value of 8 were used to dock each optimized drug on to HDAC enzyme. Enzyme-drug complexes with the best binding score obtained from the molecular docking process were selected as the starting configurations for molecular dynamics studies. In the MD simulation, GROMOS53a6 all atom force field was employed for the enzyme while the force field parameters for drugs were obtained from PRODRG server. The enzyme-drug complex was placed at the centre of a 8.8 x 8.8 x 8.8 nm³ cubical box. Then the complex was solvated by filling the simulation box with about 20,000 SPC/E water molecules and 11 Na⁺ ions were added to maintain electrical neutrality of the system.

Electrostatic interactions were modelled with particle mesh Ewald (PME) with short range cut-off of 1.2 nm. Temperature and pressure of the system were modulated at 300 K and 1 bar using Berendsen's weak coupling algorithm. All bonds were constrained at their equilibrium distances using LINCS algorithm.

Similar simulation protocol was employed for the wild type enzyme (without drug) to compare the behaviour of wild type enzyme with that of complexes in aqueous medium. All the systems were subjected to 500 steps of energy minimization with steepest decent algorithm followed by 100 ps molecular dynamics simulation to equilibrate the system.

After the equilibration step, molecular dynamic simulations were performed for 100 ns for all studied enzyme-drug systems with a 0.002 ps time step using GROMACS molecular dynamic simulation package running in LINUX operating system. The trajectories of the outcomes were saved at every 2 ps intervals for further analysis. All the simulations were carried out using a high configuration Dell Power edge T130 Server.

All calculated properties of the inhibitor PCI-24781 were compared with those of Suberoylanilide hydroxamic acid (SAHA) since it is the well-known inhibitor drug in the clinical practice.

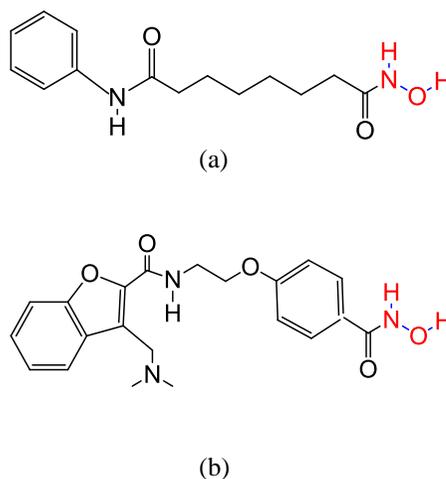


Figure 1: The two HDAC inhibitors used in this study; (a) Suberoylanilide hydroxamic acid (SAHA), (b) PCI-24781

3 RESULTS AND DISCUSSION

The molecular dynamics trajectory files were analysed to study the structural changes of the enzyme with simulation time. The enzyme-drug interaction energies, root mean square deviation (RMSD), radius of gyration (Rg), solvent accessible surface area (SASA) and the root mean square fluctuation (RMSF) of the enzyme were analysed as a function of time.

Root mean square deviation and radius of gyration: The RMSD and Rg of the enzyme in each enzyme-drug complex were compared with the RMSD and Rg of the wild type enzyme and the comparison is shown in the Figure 2.

The RMSD of both the studied drugs slowly increased up to 40 ns of the trajectory and then attained the RMSD value of around 0.3 nm and it remained at this value for the rest of the simulation time.

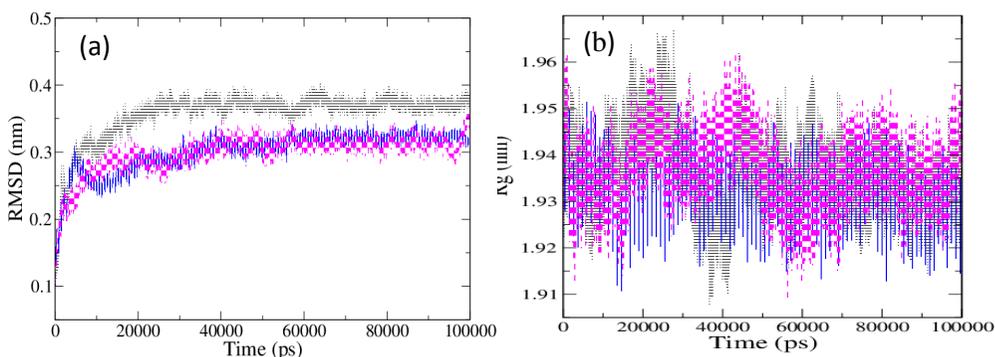


Figure 2: Comparison of (a) RMSD and (b) Radius of gyration (Rg) of the enzyme-drug complexes with wild type enzyme (— Wild type enzyme, - - - SAHA, ···· PCI-24781)

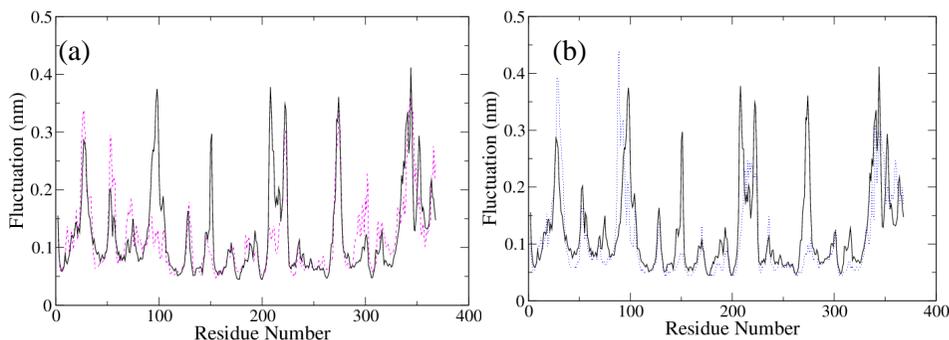


Figure 3: Comparison of RMSF of (a) SAHA – HDAC complex with wild type HDAC, (b) PCI-24781 – HDAC complex with wild type HDAC (— Wild type enzyme, - - - SAHA, ——— PCI-24781)

According to Figure 3, the RMSF of the amino acids of the two studied complexes did not show a drastic change to the RMSF of the amino acids of the wild type enzyme. However, some significant local

conformational changes were observed. With both studied HDAC-drug complexes fluctuation of 28(ALA), 151(GLY) and 208(PHE) amino acids were stabilized with low RMSD.

This may be due to the coordination of water molecules with these amino acids in aqueous medium that led to the stabilization of the fluctuations of the said residues (RMSD of individual residues are not shown here). Similar reduction of fluctuations of the residues 53(SER), 73(LEU), 129(GLU), 274(PRO), 294(ASP), 297(ALA) 300(CYS) and 302(GLY) with the reference drug (SAHA) and of the residues 274(PRO), 208(PHE), 222(ASN) with the new drug PCI-24781 were observed and the RMSD of individual residues did not reveal significant structural rearrangements.

In both complexes, fluctuation of 98(ASP) residue was suppressed and the RMSD of individual residue indicates some structural rearrangements of the residue. While in the enzyme with the new drug, PCI-24781, fluctuations of the residues; 89(ASN), 93(GLY) were enhanced and the RMSD of the individual residues indicate some structural changes of 89(ASN) at about 17th ns and of 93(GLY) at 86th ns.

4 CONCLUSIONS

This *in-silico* study demonstrates that the new drug, PCI-24781 and the reference drug, SAHA exhibit a similar effect on the enzyme and therefore, it could be possible to use the new drug, PCI-24781 as an alternative to the reference drug, SAHA for the inhibition of histone deacetylation.

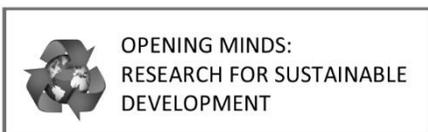
Acknowledgment

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Effect of Different Irrigation Methods and Mulches on Leaf Curl Complex Attack in Chilli in Jaffna District of Sri Lanka

P.Maheswaren¹, C.S. de Silva¹ and T Karunainathan²

¹Department of Agricultural and Plantation Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka

²Agricultural Research Station, Thirunelvely

*Corresponding author: Email: rrdihybridrice@gmail.com

1 INTRODUCTION

Chilli (*Capsicum annum L.*) is a member of the Solanaceae family. Chilli is an indispensable spice due to its pungency, taste, appealing colour and flavour. A large extent under chilli is cultivated in the dry zone of Sri Lanka. At present major chilli growing districts are Anuradhapura, Moneragala, Ampara, Puttalam, Vavuniya, Kurunegala, Hambantota and Mahaweli system. The Department of Agriculture has recommended 8 Chilli varieties up to now namely MI-1, MI-2, KA-2, Arunalu, MI-Hot, MI green, Galkiriyagama selection and the recently released varieties, MICH 3, MI Waraniya 1 and PC 1. The potential yield of these varieties are 10–12ton / ha. But the national average yields are as poor as 8–10 ton / ha. Such low yields are mainly due to high incidences of pest and disease, moisture stress, the use of inferior seeds, poor crop management and high input costs. Chilli leaf curl complex (CLCC) is the major problem resulting in heavy yield losses up to 53% especially during the yala season. CLCC is caused by several factors (Thrips, mites and viruses) of which thrips are the most important factor (Lewis, 1997). The irrigation method plays a major role in increasing the yield and enhancing cropping intensity. In the north water scarcity and inefficient irrigation methods are major reasons for increasing

cost of production. Therefore micro irrigation methods proved to be an efficient method in saving water and reducing cost of production. Micro irrigation has an influence on increasing yield up to 20% to 30% and reduces the pest attack. Most of the Jaffna farmers cultivate the crop in field under traditional irrigation systems in small holdings (Geroge, 2004; Senathirajah, 2005). Even in small holdings with well lift irrigation system water has been expensive because of the energy crisis. Therefore this study was designed to study the impact of irrigation system and mulch on leaf curl complex and yield of chilli during Yala season (May to October).

2 METHODOLOGY

2.1 Site selection

A Field experiment was carried out at the District Agricultural Training Centre, Thirunelvely during May end to October end 2016 in Calcic Red Yellow Latasol soil to study the impact of different mulches under different irrigation systems on growth and yield of green chilli.

2.2 Experimental design

The experiment was conducted in split plot design with 3 replicates. For the



design 3 types of irrigation systems namely sprinkler irrigation system (I1), Drip irrigation system (I2) and Basin irrigation system (I3) were selected. There varieties were Galkiriyagame selection; Super Hybrid and Vijaya hybrid were planted under two types of mulches such as Neem and Gliciridia and no mulch. Irrigation was included in the main plot. Subplot contained variety and mulches in the split-plot design. 27 treatments were tested in this experiment. Statistical Analysis was done using SAS (University version). Treatments used in this experiment were as follows:

Irrigation treatments were,

- I1- sprinkler irrigation system;
- I2- drip irrigation system;
- I3- basin irrigation system.

Varieties were,

- V1- Galkiriyagame selection;
- V2- Super hybrid
- V3- Vijaya hybrid.

Mulches were,

- M1- Control;
- M2- Neem;
- M3- Giliciridia.

27 treatments will be tested in this experiment. Following treatments were tested in this experiment.

- T1- I1V1M1-Sprinkler system, Galkiriyagame selection with no mulch;
- T2- I1V2M1-Sprinklersystem Super variety with no mulch;
- T3- I1V3M1SprinklersystemVijaya hybrid with no mulch;
- T4- I1V1M2-Sprinkler system, Galkiriyagame selection with Neems leaves;
- T5- I1V2M2-Sprinklersystem Super variety with Neems leaves;
- T6- I1V3M2-SprinklersystemVijaya hybrid with Neems leaves;
- T7- I1V1M3-Sprinklersystem Galkiriyagame selection with Gliciridia;

- T8- I1V2M3-Sprinklersystem Super variety with Gliciridia;
- T9- I1V3M3-SprinklersystemVijaya hybrid with Gliciridia;
- T10- I2V1M1-Drip system, Galkiriyagame selection with no mulch;
- T11-I2V2M1-Drip system, Super variety with no mulch;
- T12-I2V3M1-Drip system, Vijaya hybrid with no mulch;
- T13- I2V1M2-Drip system, Galkiriyagame selection with Neem leaves;
- T14- I2V2M2-Drip system, Super variety with Neem leaves;
- T15- I2V3M2-Drip system, Vijaya hybrid with Neem leaves;
- T16- I2V1M3-Drip system, Galkiriyagame selection with Gliciridia;
- T17- I2V2M3-Drip system, Super variety with Gliciridia;
- T18- I2V3M3-Drip system, Vijaya hybrid with Gliciridia;
- T19- I3V1M1-Basin system, Galkiriyagame selection with no mulch;
- T20- I3V2M1-Basin system, Super variety with no mulch;
- T21- I3V3M1-Basin system, Vijaya hybrid with no mulch;
- T22- I3V1M2-Basin system, Galkiriyagame selection with Neem leaves;
- T23- I3V2M2-Basin system, Super variety with Neem leaves;
- T24- I3V3M2-Basin system, Vijaya hybrid with Neem leaves;
- T25- I3V1M3-Bsin System, Galkiriyagame selection with Giliciridia;
- T26- I3V2M3-Basin system, Super variety with Giliciridia;
- T27- I3V3M3-Basin system, Vijaya hybrid with Giliciridia

2.3 Nursery management

Soil was sterilized by burning straw and beds (3 m×1 m×15 cm) were prepared. Seeds were soaked by using attonic for



one hour to enhance root formation. Seeds were directly sown at 10 cm between lines and 1 cm depth. A Thin layer of top soil was laid above the seed lines. After that, beds were treated with Homai (6g / 5l H2O). Nursery beds were covered with dried banana leaves to prevent water loss. Then the beds were treated with Elson to prevent the termite and ant problem. The nursery bed was protected from rain by covering it with white polythene.

2.4 Field preparation and layout

For proper establishment of seedlings, soil should be moist, friable, well aerated and weed free. Thus ploughing (2376m²) and two hoeing were done to obtain the fine tilled condition. 3 blocks were made and one block was further divided in to 27 plots of 3m×3m size. Nine plots were covered by drip or basin or sprinkler irrigation system. One block included 675 hills and every block included sprinkler, drip and basin irrigation system. Each plot contained 9m² land areas with 25 hills.

2.5 Field planting

The 35 day old seedlings were transplanted at 60 cm×60 cm (1pts / hill). Healthy, disease free and good quality seedlings were selected from nursery. Shade was provided for 2 to 3 days. Seedlings were irrigated immediately after transplanting by basin, drip sprinkler and hand. The gap filling was done after one week of transplanting.

2.6 Cultural practices

Watering, fertilizer application, weeding, pest and disease control were done according to the Department of Agriculture recommendations. Parameters measured were number of CLCC affected plants in all three mulches and three irrigation methods, and yield as 1st, 2nd and 3rd harvesting in each treatments.

3 RESULTS AND DISCUSSION

3.1 Incidence of Thrips for chili leaf curl complex attack.

Chilli leaf curl complex (CLCC) incidence was significantly different between blocks and significantly differed between the variety and mulches (Figure 1). Thus it could be concluded that there is 3 way interaction between I*M*V. Incidence of chilli leaf curl complex (CLCC) attack was low at 5th week after transplanting. After that CLCC damage increased due to hot weather (Figure 1). Figure 2 shows, graphically at maximum CLCC observed (10 plants) in Galkiriyagama selection with no mulch under basin irrigation system at 12th weeks after planting and minimum thrips damage was observed (2 plants) in super hybrid with neem mulch under sprinkler irrigation system at 5th week after planting due to the better microclimate.

3.2 Chilli leaf curl complex attack among the irrigation

CLCC was significantly different among the irrigation systems (Figure 2). Incidence of CLCC was low at under sprinkler irrigation at 5th week. After that CLCC was increased due to the hot weather.

3.3 Chilli leaf curl complex attack among the mulches

CLCC was significantly different among the mulch systems and lowest affected plants were observed in neem mulch at 5th week after transplanting. Highest was observed in basin irrigation at 8th week after transplanting in shown below Figure 3.



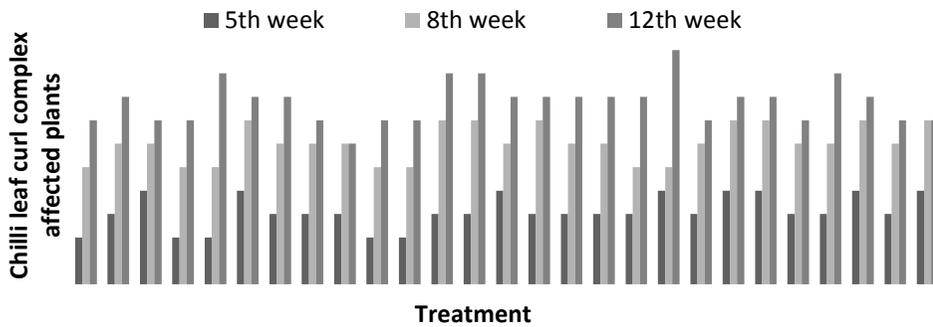


Figure 1: Chilli leaf curl complex in different treatment at 5th, 8th and 12th weeks

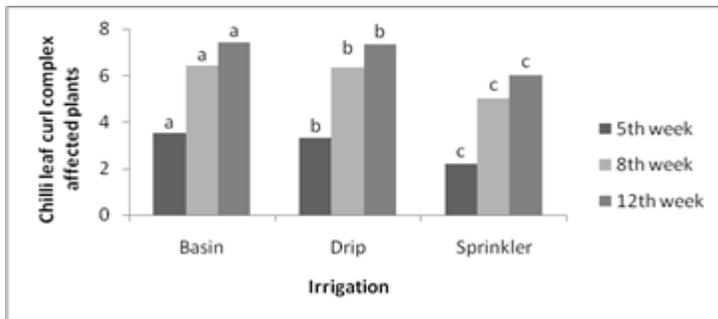


Figure 2: Chilli leaf curl complex attack under different irrigation systems

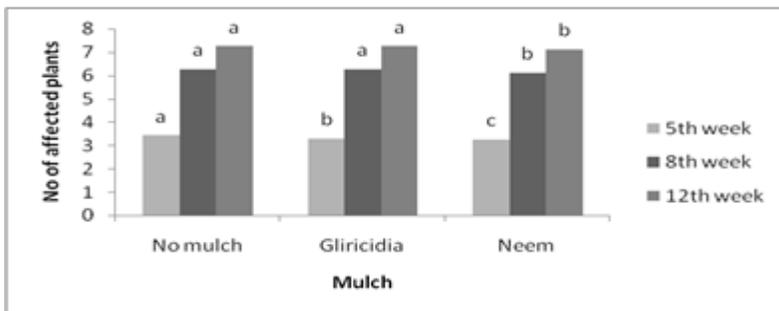


Figure 3: CLCC attack among the mulch

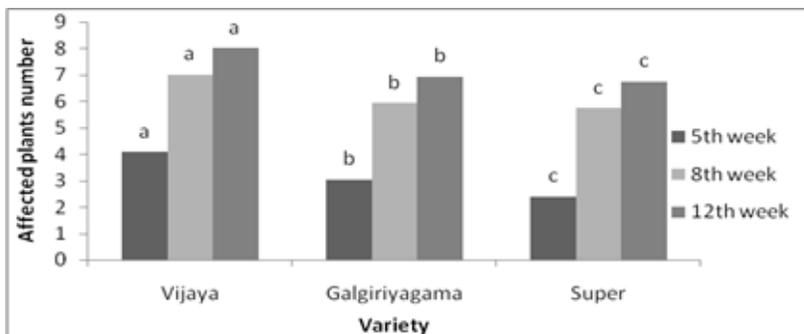


Figure 4: CLCC attack among the varieties



3.4 Chilli leaf curl complex attack among the mulches

CLCC was significantly different among the mulch systems and lowest affected plants were observed in neem mulch at 5th week after transplanting. Highest was observed in basin irrigation at 8th week after transplanting in shown below Figure 3.

3.5 Chilli leaf curl complex attack among the variety

CLCC was significantly different among the variety. Minimum attack was observed in super hybrid and maximum attack was observed in Vijaya at 8th week after transplanting in shown in Figure 4.

3.6 Yield

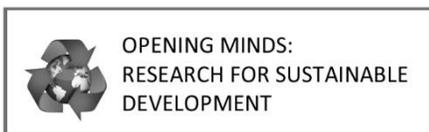
Chilli yield was significantly different between the irrigation, variety and mulch and non-significant between block. The highest yield was obtained in super hybrid with neem mulch under sprinkler irrigation system at 2nd harvesting. The lowest yield was recorded Galkiriyagama selection with no mulch under basin irrigation system. These findings agree with Shinde *et al.*, (1999) and Wijerathana Banda, (1997).

4 CONCLUSIONS AND RECOMMENDATIONS

Maximum yield was recorded under sprinkler irrigation system super hybrid variety with neem mulch due to the low incidence of pest attack at 2nd harvesting (12ton / ha. Therefore sprinkler irrigation system is the best in Chilli cultivation with the use of neem mulch to reduce the thrips attack and Chilli leaf curl complex. The micro climate of the plant and soil will also change respectively by the sprinkler irrigation and neem mulch which reduce the soil temperature. Low temperature leads to biological control of the pest resulting in a higher yield.

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Growth and Yield Performance of Newly Introduced Chilli Variety (*Capsicum annum* L. var. MI 1) Grown under Basin Irrigation System in Jaffna District of Sri Lanka

Ahilan Krishanpillai and C.S. De Silva*

¹Department of Agricultural and Plantation Engineering, The Open University of Sri Lanka, Nugegoda, Sri Lanka

*Corresponding author: Email: csdes@ou.ac.lk

1 INTRODUCTION

In Sri Lanka, the average extent of Chilli cultivation in 2014 is about 14,294 ha and the production is about 60,269 Mt of green Chilli. Currently the Department of Agriculture recommended Chilli varieties are not sufficient to give a higher yield combating the major pest and disease outbreaks, especially the Chilli leaf curl complex and viruses. The situation has been further aggravated by the factors such as high cost of production due to high cost for labour and agro-chemicals and unavailability of quality seeds of high yielding varieties. Since 1962 the DOA has developed few open pollinated Chilli varieties having the yield potential of 2.5-3.5 Mt/ha and 8-15 Mt/ha of dry Chilli and green Chilli respectively, the average farmer yield remains below 1.0 t/ha of dry Chilli. Dry Chilli production within the country is not enough to supply domestic demand for dry Chilli. Therefore a large amount of dry Chilli is imported from other countries. Chilli leaf curl complex (CLCC) is the major problem resulting in heavy yield losses up to 53% more especially during *yala* season. CLCC is caused by several factors (Thrips, mites and viruses) of which thrips are the most important.

Most of the hybrid Chilli varieties which are produced by the Asian countries are imported by private seed handlers because

of the unavailability of quality seeds of high yielding varieties. In the recent years, these exotic Chilli hybrids are also becoming popular among Sri Lankan farmers due to their high yield potential, uniform growth, early maturity and eye catching appearance. The price of these hybrid seeds is very high and these exotic hybrids show less adaptability under local conditions. Most of the exotic Chilli hybrids are highly susceptible to major pest and diseases in Chilli.

The Department of Agriculture has recommended 8 Chilli varieties up to now namely MI-1, MI-2, KA₂, Arunalu and MI-hot. 1. The potential yields of these varieties are 10–12 ton / ha. But the national average yields are as 8–10 ton / ha. Such low yields are mainly due to high incidences of pest and diseases, moisture stress, use of poor crop management and high input costs. But now the Department has introduced the first hybrid Variety as a MI Hybrid 1 to increase the yield and enhance cropping intensity.

Most of the Jaffna farmers cultivate KA 2 and CIMI hybrid in field in small and medium holding level. Even the small holding has been expensive because of the cost of cultivation. Based on these facts, a study was carried out during May to September 2016 to test the adaptability of Department of Agriculture newly



introduced MI hybrid variety with other local varieties KA2, MI Green and CIMI Hybrid under local conditions.

- T2- MI Green
- T3-CIMI Hybrid
- T4-MI Hybrid

2 METHODOLOGY

2.1 Check variety and the specific characters

MI I Hybrid is the newly introduced check variety. This variety has medium size leaves and it is grown up to 60 cm with a vertical growth pattern. Large size pods with 10-15 cm length are suitable for both green Chilli and dried Chilli. The yield is more than 3 t/ha of dried chilli and 12 t/ha of green Chilli.

A relatively higher level of resistance is shown to fungal diseases and leaf curling. This experimental hybrid has attractive green shiny pods.

2.2 Experimental design

A field experiment was carried out in Chilli crops to evaluate the different variety practice during Yala in Jaffna. Most of the Jaffna farmers cultivated local varieties such as KA2, MI green and CIMI hybrid.

The experiment had to be conducted in randomized completely block design with 3 replicates. The distance between both blocks and plots were 0.5 m. The recommended KA2, MI- Hybrid 1, MI Green and CIMI hybrid were planted. Each plot (28.8m²) consisted of ten rows of plants at the spacing of 60cm x 60cm and 1 plant per hill.

Eighty plants were contained in each plot and each replicate contained 320 experimental units. The following treatments were tested in this experiment, each treatment has 3 replicates.

- T1- KA2 Variety

2.3 Field planting

The 35 days old seedlings were transplanted at 60 cm×60 cm spacing. (1pts. / hill) Healthy, disease free and good quality seedlings were selected from nursery as shown in Figure 4. Seedlings were irrigated immediately after transplanting by hand and basin.

2.4 Cultural practices

2.4.1 Watering

Watering was done 2 times / day after transplanting by hand up to 2 weeks as shown in (Figure 1). Then at initial stage irrigation was given at 3 days interval to maintain continuous moisture to ensure better establishment of plants. After that, irrigation frequency was increased to 4–5 days (basin irrigation system) and there after irrigation was done depending on the soil moisture status.

2.4.2 Fertilizer application

Fertilizer application was done according to the Department of Agriculture recommendation. The following recommended fertilizer mixture was given with compost as basal application and irrigation was provided one day early. TSP (Triple superphosphate)–100 kg / ha, MOP (Muriate of potash)–50 kg / ha. Basel fertilizer application was applied to twelve plots.

Site selection, Nursery management, pest and disease control and all the other cultural practices were carried out according to the Department of Agriculture recommendations.





Figure 1: Irrigation methods used in the study (a) Manual Watering (b) Basin irrigation

3 RESULTS AND DISCUSSION

3.1 Growth Parameters

3.1.1 Germination of Chilli seeds

The germination percentage in each treatment was above 95% which shows that the Chilli seeds planted are in good quality (Figure 2). The highest germination percentage was observed in T4 and T3 treatments.

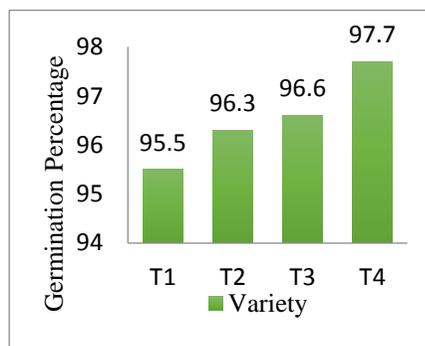


Figure 2: Germination percentage

3.1.2 Plant Height

The results of influence of cultivars on plant height are shown in Figure 3. Cultivar had a significant ($P < 0.05$) effect on plant height. Cultivar MI 1 Hybrid had the highest mean plant height (78.71 cm) while cultivar KA2 had the lowest magnitude of plant height (43.29cm). There is a significant difference among varieties for plant height.

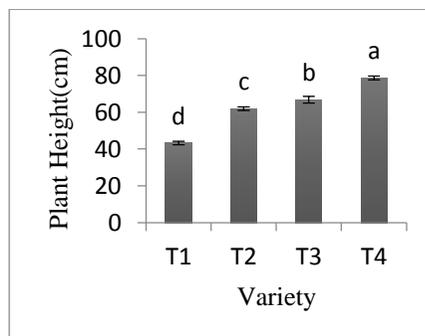


Figure 3: Mean plant height

3.1.3 Canopy Diameter

Mean values of canopy width of all the tested entries range from 53.5 cm – 74.04 cm (Figure 4). Canopy width was significantly different among varieties, and MI 1 Hybrid had the highest canopy width. KA2 local variety had significantly lower canopy width than other varieties.

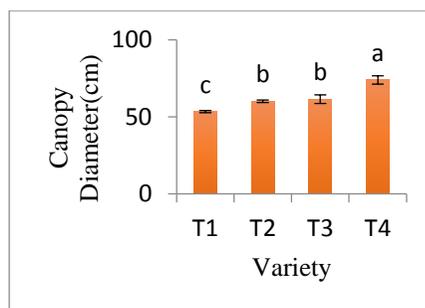


Figure 4: Mean canopy diameter

3.2 Yield Parameters

3.2.1 Number of pods per plant

The number of pods is an important yield component of Chilli to achieve highest yield. Pod numbers of the experimental varieties were significantly different and varied from 56 to 213cm (Figure 5, 6 and 7). Highest number of pods was obtained from MI 1 Hybrid (Figure 8). However, MI Green, the local variety had significantly lower pod number than other varieties.



Figure 5: KA2 variety chilli cultivation



Figure 6: CIMI Hybrid variety chilli cultivation.



Figure 7: MI 1 Hybrid variety Chilli

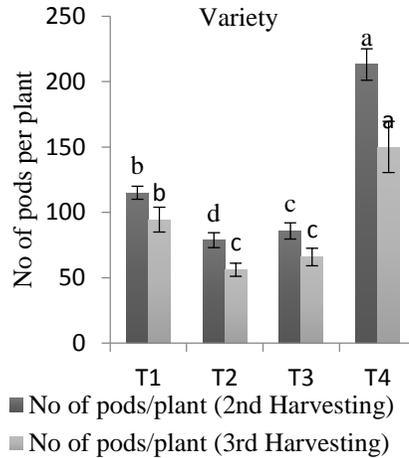


Figure 8: Number of pods per plant

3.2.2 Pod length

The average pod length was also statistically different among varieties (Figure 9). The pod length varied from 6-11 cm. The shortest length was recorded from KA2 while the longest were from MI 1 Hybrid. There is a significant difference among varieties in the case of fruit length.

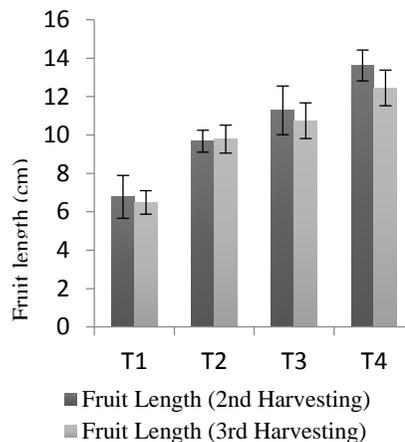


Figure 9: Mean pod/fruit length



3.2.3 Pod weight per plant

The pod weight is an important yield component of Chilli to achieve highest yield. Pod weight of the experimental cultivars varied from 167.6g to 793.93g (Figure 10).

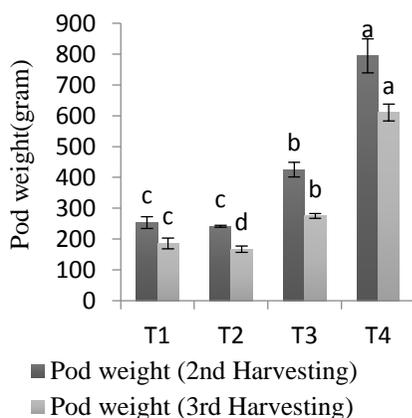


Figure 10: Mean Pod weight per plant chilli for 2nd and 3rd

3.3.4 Yield

Mean yield of green chilli of all the tested treatments for 2nd and 3rd harvesting range from 1.60t/ha to 10.07t/ha (Figure 11).

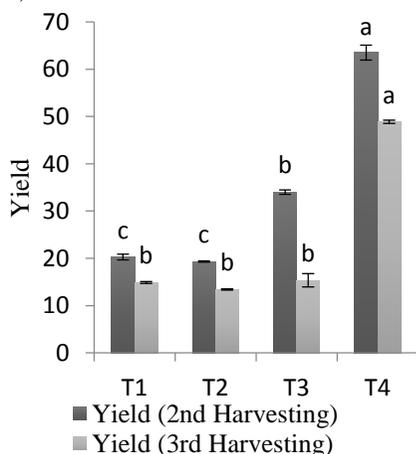


Figure 11: Mean yield of harvesting in treatment

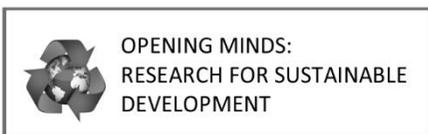
The highest mean green chilli yield was attained in variety MI I Hybrid and the difference in yield with the other varieties was highly significant at P=0.05. Pod weight was highest for cultivar of MI I hybrid. It had good pod size with high pod numbers to obtain a good yield. Second and third green chilli yield was attained in varieties CIMI, KA2 respectively.

4 CONCLUSIONS AND RECOMMEDATIONS

MI I hybrid is the best Chilli variety based on the yield performance of this study, it showed the highest yield. Therefore farmers in Jaffna District could be advised to cultivate as MI 1 hybrid compare to other the other local varieties such as KA2 what they are cultivating at present.

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Roles of Different Nearly Neutral Models in Maintaining Species Coexistence of Tropical Forests

T.L.M. Ruberu^{1*}, I.A.U.N. Gunatilleke², C.V.S. Gunatilleke² and R. Punchi-
Manage¹

¹*Department of Statistics and Computer Science, University of Peradeniya, Sri Lanka*

²*Department of Botany, University of Peradeniya, Sri Lanka*

*Corresponding author: Email: laksru21@gmail.com

1 INTRODUCTION

One of the central issues in ecology is the question of species coexistence. It has been found that the ecosystems of the world contain a remarkable diversity of species. Out of these, tropical forests are high in species richness compared to other forests. Dozens of theories have been proposed to explain the possible mechanisms of species coexistence. (Hubbell, 2001, Seidler and Plotkin, 2006, Wright *et al.*, 2002). But this question still does not have a specific answer which is agreed upon. The recently introduced Hubbell's neutral theory (Hubbell, 2001) provides a new framework for this debate. Neutral theory considers the community to be saturated and the species to be functionally equivalent (Hubbell, 2006, Hubbell, 2001). Functional equivalence implies that all the individuals have same dispersal abilities, birth rates and death rates. The originally proposed Hubbell's neutral theory is spatially implicit and assumed unlimited dispersal ability of species. That is, once an individual dies, the vacant site is occupied by any individual of the local community with probabilities equal to the post abundances of species in the local community. However Assumptions of the neutral theory were strongly criticized by supporters of the niche theory. They argued that species are different with respect to their birth, death rates and dispersal abilities.

A crucial factor that is used to assess species coexistence is species richness. Species richness gives the total number of species recorded in an area at a given time. Higher species richness cause heterogeneity and stabilize the ecosystem. This study is focused on identifying a nearly neutral model that is a variant of the neutral model which facilitates high species coexistence than the neutral model in terms of species richness. With this purpose (1) four nearly neutral models are simulated where each model relax a subset of assumptions in the neutral model (equal death rates, equal dispersal ability) and species richness values after 50 years under each nearly neutral model was compared with that of the neutral model. (2) Point patterns of species after 50 years under all models were studied. However this study does not consider the speciation rates and assumes the community is isolated. Thus no new species originate through evolution and species do not migrate to the community from outside. It is of utter importance to preserve the diversity while we dominate this planet since the cost of replacing the services provided by this diversity if possible would be extremely expensive. For this cause identifying the mechanisms that ensure species coexistence is of extreme importance.



2 METHODOLOGY

2.1 Study Area

We considered data from all the species in the 500m × 500m fully mapped Sinharaja forest plot (Sri Lanka). In the plot large trees of all the species were considered. The 99th percentile of ranked dbh values for all the trees of each species were determined and 93,593 trees with a dbh ≥ dbh (99) ^(2/3), representing 238 species were considered as adults (Bagchi *et al.*, 2011).

2.2 Composition of the Dataset

The dataset for empirical data was collected by a collaboration between Centre for Tropical Sciences and Department of Botany, University of Peradeniya. Two censuses of the dataset taken at five year time intervals (1996, 2001) were used for the study. The variables used were Tree ID (used to uniquely identify every individual tree), species name, spatial coordinates, diameter at breast height and whether a tree is dead or alive at the time of census.

Table 1: Description of the Models

Model	Assumption Relaxed	Selection of Death Tree	Replacement
Neutral model	Null	Random	Replacement occurred with constraint
Euclidean distance model	Assign species specific limited dispersal abilities through Euclidean distance method	Random	Euclidean distance between death and random trees (d) was determined. Replacement occurred only if d did not exceed dispersal threshold value of recruit species
K th nearest neighbour distance model	Assign species specific limited dispersal abilities through K th NN distance method	Random	Euclidean distance between death and random trees (d) was determined. Replacement occurred only if d did not exceed dispersal threshold value of recruit species
Unequal death rates model	Assign different death rates for species	Subject to death probabilities	Replacement occurred without constraints
Unequal death rates and dispersal limited model	Assign species specific limited dispersal abilities through K th NN distance and death rates	Subject to death probabilities	Euclidean distance between death and random trees (d) was determined. Replacement occurred only if d did not exceed dispersal threshold value of recruit species

2.3 Models of the Study

Death rate of trees in Sinharaja forest plot was calculated for a 5yrs., period (mortality =6956) using the data from first two censuses. To relax a subset of the assumptions in the neutral model, species specific dispersal threshold values and

birth, death rates were assigned to species. Two methods were employed to compute different dispersal threshold values for species. (1) Obtaining the matrix of the Euclidean distance between each pair of conspecific trees and taking their average. (2) Measuring 100th nearest conspecific neighbour distance from each tree



belonging to a given species and averaging thus obtained values. In both these methods singletons (Species with only one tree) were given unlimited dispersal ability. The probability of death of a given species (d_j) was computed using $d_j = i/\text{mortality rate}$, where i is the number of dead trees after 5 yrs., of j^{th} species. In each of the following

models two trees from the plot were selected as death tree and the recruit tree (Recruit tree was always randomly selected). The vacant site was then replaced by the recruit tree. However the selection of two trees and replacement occurred subject to constraints considered under each model. Species richness was recorded after every five years for 50 years.

3 RESULTS AND DISCUSSION

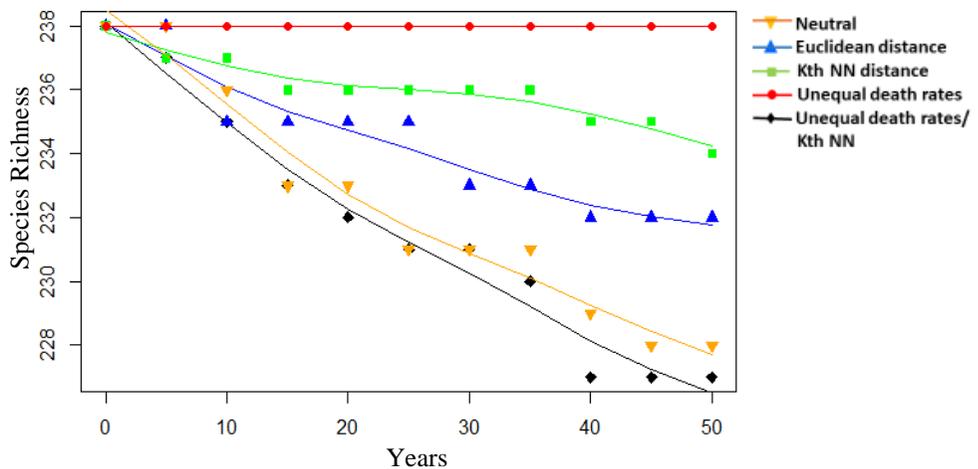


Figure 1: The species richness curves of the models

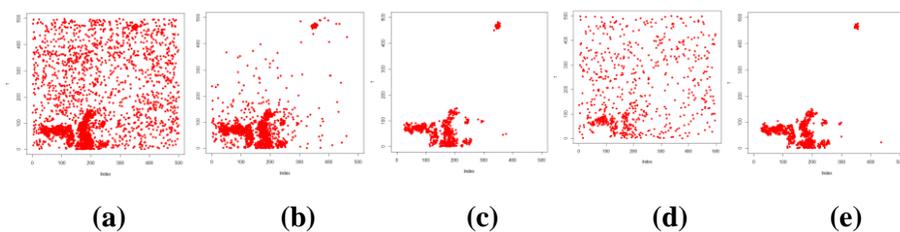


Figure 2(a)-(e): The spatial arrangement of one of the species “AGROHO” after 50 yrs under five different models. (a) Neutral Model (b) Euclidean distance (c) K^{th} -nn distance (d) Unequal death rates (e) Unequal death rates and K^{th} -nn distance

The species richness of the neutral model was lower than that of the dispersal limited models after 50 yrs. Species that have limited dispersal ability cannot reach all the favourable sites. Therefore, limited

dispersal ability of species can delay species extinction and mono-dominance. However it is observed that the model which employed K^{th} nearest neighbour distance to assign dispersal threshold

values performed considerably well than the Euclidean distance model. In tropical forests many species are aggregated into several clusters (Seidler and Plokin 2006; Plotkin et al. 1996). When computing the Euclidean distances between each pair of conspecific trees both inter cluster and intra cluster distances are considered. If two clusters of conspecific trees are located at opposite corners of the plot this might result in very high distances yielding high dispersal threshold values for species. On the other hand it is less probable for 100th conspecific neighbour to be in a distinct cluster. Hence assigned dispersal threshold values for species are low. This might be the reason for the species richness values of Euclidean distance model to fall in close proximity with that of the neutral model. Further the singletons were assigned unlimited dispersal ability. This assumption leaves an advantage for the rare species. However this advantage could be ecologically justified considering low density dependent effects of rare species.

The model that considers death rates conserves species richness at initial level. This work allows us to study separate effects of dispersal limitation and different death rates. However it was found that many species were extinct during the period of 50 yrs., when species have unequal death rates and limited dispersal abilities. This result is surprising because niche theory assume that species differences such as death rates and dispersal ability can contribute to maintain the species richness. Species interactions might be the reason behind this.

There were 238 species in the Sinharaja forest plot. Spatial arrangements of a few dominant species were plotted initially and after 50 yrs., under the neutral and nearly neutral models. It was evident that the initially clustered conspecific trees were scattered afterwards. This provides further evidence that the dispersal limited species cannot reach the preferred sites.

4 CONCLUSIONS AND RECOMMENDATIONS

Species coexistence can be better explained when moving away from strict neutrality. Assigning different dispersal threshold values for species contribute in maintaining species richness. However these affects are insignificant unless strong dispersal limitations are considered. It is evident that dispersal limitation and death rate alone can explain high species richness and the neutral model has oversimplified assumptions that are not realistic. However adding more complexity decreases the performance of the model. Therefore the best model is not a simple model nor a very complex model but a moderate model. The model with different death rates best preserved the species richness. Hence this model could be identified as the best model that explains the species coexistence in terms of species richness maintenance. This study provides some evidence to support the preservation of the spatial arrangement of species

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R.S.S.Chandrasena^{1*}, I.A.U.N. Gunatilleke², C.V.S. Gunatilleke², and
P.M.S.A. Ruwan¹

¹*Department of Statistics and Computer Science, University of Peradeniya, Sri Lanka*

²*Department of Botany, University of Peradeniya, Sri Lanka*

**Corresponding author: Email: ssureshika@gmail.com*

1 INTRODUCTION

Species abundance distribution (SAD) is the second most important macro-ecological pattern in tropical forests. In general, rank SAD shows positive skewed distributions due to the many singleton species found in tropical forests. Fisher log series and Preston octave curves (log normal distribution) were used to explain the SAD. Although Fishers log series can explain the long tail of SAD, it needs biological explanation. In contrast, Preston assumes that long tail of the SAD is a sampling effect and for large samples long tail of SAD distribution is diminished. Hubbell's neutral theory (Hubbell, 2001); a dispersal assembly theorem, considers species are functionally equivalent. This theory underlines that community is saturated and replacement is only possible when a tree dies. Species are functionally equivalent and all the off-springs have an equal chance possible of being replaced. According to Hubbell (2001), local community undergoes an ecological-drift over time. Extinction of rare species lead to mono-dominance in local community. However, this mono-dominance is delayed by the immigration (m) of new species to the local community from the meta-community (Rosindell *et al.*, 2011).

Species abundance of a meta-community stays at the equilibrium between extinction and speciation rate (ν). Hubbell (2001) states that fundamental biodiversity number ($\theta = 2J_M\nu$) and dispersal limitation (m) alone can explain SAD of a local community. When $m=0$ local community is fully isolated. When $m=1$ local community is a nested subset of the meta-community. If neutral theory is true, then rank relative SAD under the neutral model should closely follow the empirical SAD of the community. This indicates that the species interaction has little effect on the shape of the SAD and the high species richness in tropical forests diminishes species interactions (Hubbell, 2006). Further, this will be useful for constructing SAD under neutral model for the considered forest plots. The main objective of this study is to find the best θ and m values and explain the rank SAD using Hubbell's neutral theory.

2 METHODOLOGY

2.1 Study area

Sinharaja forest is a 500 m x 500 m (25-ha) plot which is located in the southwest

region of Sri Lanka. It is the largest block of relatively undisturbed lowland evergreen rainforest in Sri Lanka. The elevation range of Sinharaja FDP lies between 424 m and 575 m above sea level. Sinharaja is an UNESCO World Heritage Site at the center of the ever-wet southwestern region of Sri Lanka. It was established in 1993 by the University of Peradeniya and the Forest Department of Sri Lanka. The trees in the plot were censused from 1994 to 1996, where the diameters at breast height (dbh) of all freestanding stems greater than or equal 1 cm were measured. In Sinharaja 18,065 adults were found (trees with diameter of breast height ≥ 10 cm), belonging to 188 species. (Census year-1996)

2.2 Data set

Data from Sinharaja FDP which was initiated in 1996 was used to construct the empirical SAD. The data set contains 20 variables but only few of them are considered to this study (species name-sp and diameter of breast height-dbh). Hubbell (2001) assumes that the neutral theory works for the adult trees. In his seminal work he used trees with diameter

at breast height (dbh) ≥ 10 cm as adult trees. Therefore, in our study we considered only about adult trees (dbh ≥ 10 cm) in the 500x500 Sinharaja FDP. The θ and m values for nine other forest plots were calculated using freely available data from the Centre for Tropical Forest Science/ Smithsonian Institution Global Earth Observatory network (<http://www.sigeo.si.edu/>). Each data set contains two sets of data for diameter of breast height (dbh) ≥ 1 cm and dbh ≥ 10 cm. For this study, only the trees with dbh ≥ 10 cm were considered from the latest census of each FDP.

2.3 Species abundance distribution

We first simulated local communities with different θ and m combinations with fixed local community size ($J=18,065$). Here, J is equal to the number of adult trees in the fully mapped forest plot (Sinharaja / Sri Lanka). A species generator (Etienne et al., 2005) was used to generate the species abundances for a local community with different θ and m combinations (Table 1). In total there were 144 θ and m combinations.

Table 1: θ and m combinations for fixed community size (J)

θ	20	25	30	35	36	37	38	39	40	41	42	45
m	0.01	0.1	0.13	0.14	0.15	0.16	0.2	0.3	0.5	0.8	0.9	1

Next best θ and m combination was selected by minimizing the sum of squared difference of species rank relative abundance of neutral model and species

rank relative abundance of Sinharaja forest plot. Further we used likelihood maximization to estimate the two parameters θ and m (Etienne *et al.*, 2005).

$$P[D | \theta, m, J] = \frac{J!}{\prod_{i=1}^s n_i \prod_{j=1}^J \Phi_j!} \frac{\theta^s}{(I)_J} \sum_{A=S}^J K(D, A) \frac{I^A}{(\theta)^A}$$

Where, θ - Fundamental biodiversity number, m - Immigration rate, J - Total number of individuals, D - Abundance

distribution, s - Number of species, n_i - Number of individuals for the i^{th} species, a_i - i^{th} ancestor when it is the i^{th} species, A -



Summation of all the ancestors from the first species to the s^{th} species, $I = m(J-1)/(1-m)$

Finally results from minimizing the sum of squared difference method and likelihood maximization method were compared. The statistical analysis was carried out using *R* software (*R* Core Team, 2014).

3 RESULTS AND DISCUSSION

When m is large we found out SAD of the local community is approximated to SAD of the meta-community. We also observed a long tail of rare species in SAD of the local community (Fig. 1a.). In contrast, when m is small, species richness is low and local community is isolated (Fig. 1b).

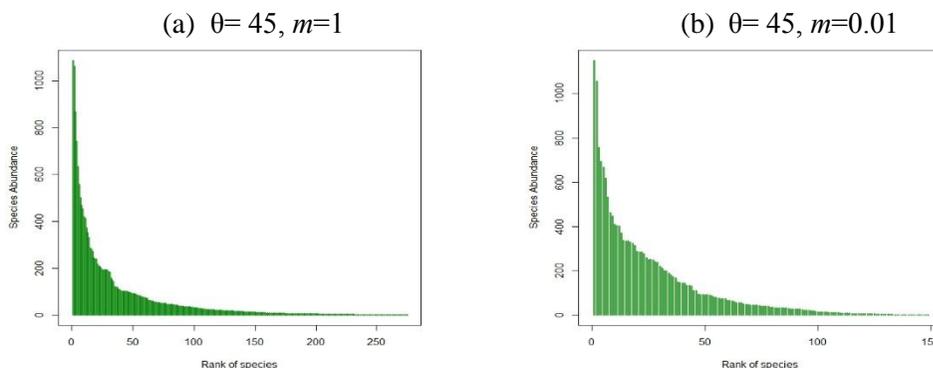


Figure 1(a), (b): Rank SAD for two different θ and m combinations for a fixed local community ($J=18,065$; equal to all the adult trees, $\text{dbh} \geq 10$ cm, in the Sinharaja forest plot).

When, $\{\theta = 40, m = 0.13\}$ rank relative SAD of the neutral community fitted to the empirical SAD. These are biologically acceptable (Figure 2).

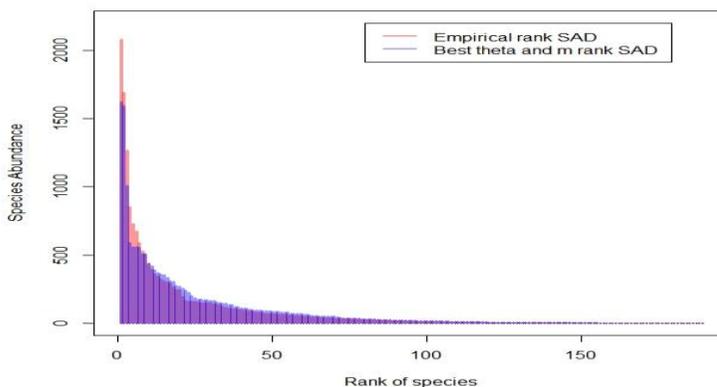


Figure 2: Blue bars-Rank SAD for best θ and m combinations ($\theta = 40, m = 0.13$) for a fixed local community size ($J=18,065$; equal to all the adult trees in the Sinharaja forest plot). Red bars-Empirical rank SAD for all the adult trees in the Sinharaja forest plot. Purple bars-Overlapped empirical and best θ and m rank SAD.

Etienne et al., (2005) suggested the maximum likelihood estimator method to find the best θ and m combination. We

used his method to estimate the two parameters. But his method works partially. For Sinharaja, Lenda, and Edoro

forest plots give very large m values (m values which are nearly equal to one indicates no dispersal limitation and local community is a nested subset of meta-community). Such m values are biologically unacceptable. On the other

hand Etienne et al., (2005) gives low m values for Pasoh forest plot compared to BCI forest. However Hubell et al., (1997) found that species in Pasoh forest show high dispersal ability than the BCI forest.

Table 2: θ and m combination for 10 forest dynamic plots in Centre for Tropical Forest Science (CTFS).

Study plot	Study area (ha)	Community size (yr.) (J)	Species Richness (S)	Θ	m
BCI	50	20848 (2005)	227	46.45	0.12
EDORO	10×2	9382 (2000)	207	36.06	0.999
FUSHAN	25	19270 (2002)	77	10.86	0.441
KORUP	50	24591 (1998)	308	52.73	0.547
LAPLANADA	25	15013 (2003)	173	30.1	0.405
LENDA	10×2	7300 (2000)	213	40.96	0.999
MUDUMALAI	50	12579 (2000)	61	8.3	0.925
PASOH	50	28279 (2000)	671	192.64	0.077
SINHARAJA (SL)	25	18065 (2001)	188	29.15	0.999
YASUNI	50	17434 (2003)	819	205.97	0.406

4 CONCLUSIONS

In this study we found that when $\theta=40$ and $m=0.13$, the empirical rank SAD of the neutral community is approximated to the rank SAD of the 25-ha Sinharaja forest plot. These results indicate species abundance distribution in the Sinharaja forest is largely driven by neutral process. When m is large we found out SAD of the local community is approximated to SAD of the meta-community. We observed a long tail of rare species in SAD of the local community in Sinharaja forest. Also when m is small, species richness is low and local community is isolated. We found that maximum likelihood estimation perform poorly for parameter estimation.

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Mapping and Functional Validation of a Quantitative Trait Loci (QTL) For Salt Tolerance in a Sri Lankan Rice Cultivar

B.P. Abhayawickrama, D.R. Gimhani and N.S. Kottearachchi*

Department of Biotechnology, Wayamba University of Sri Lanka, Sri Lanka

**Corresponding author: Email: kottearachchins@yahoo.com*

1 INTRODUCTION

Soil salinity is identified as the second most widespread problem next to drought in rice growing areas worldwide (Waziri *et al.*, 2016). With the increase of world population and reduction of agricultural lands due to industrialization, there is an urgent requirement to utilize salinity affected land to fulfil food requirement in near future (Turan *et al.*, 2012, Ray and Islam, 2008). When considering the Sri Lankan context, Sirisena *et al.*, (2010) have shown that rice production is limited due to soil salinity, both in coastal and inland rice growing areas.

Rice is identified as a salt-responsive crop (Moradi and Ismail, 2007) affected by salinity at varying degrees during different growth stages. It is highly susceptible to salinity at seedling and reproductive stages while more tolerant at germination stage (Gupta and Huang, 2014, Moradi and Ismail, 2007, Zeng and Shannon, 2000).

Salinity stress tolerance in plants is a complex trait. It is determined by the cumulative effect of different mechanisms governed by many genes or quantitative trait loci (Horie *et al.*, 2012, Turan *et al.*, 2012). By identifying the QTLs or genes accounting for salinity, they can be utilized to generate improved plants by breeding techniques (Turan *et al.*, 2012, Zeng and Shannon, 2000).

A previous study conducted at

International Rice Research Institute (IRRI) in 2014 identified many promising QTLs leading to salinity tolerance by phenotypic assessment of bi-parental mapping population of At354 (salinity tolerant) and Bg 352 (salinity susceptible) cross. However, usually phenotype and genotype associations vary in different environments and therefore, it is necessary to validate the effects of QTLs in other environments. In view of this we conducted a phenotypic assessment with selected 94 Recombinant Inbred Lines (RILs) of At354 and Bg352 mapping population which had previously genotyped with SNP markers, in Sri Lankan environment in 2017. The present study explains the results obtained from the mapping of Chromosome 3 in Sri Lankan environment in comparison to the QTL hotspot identified in IRRI.

2 METHODOLOGY

2.1 Experimental site and plant material

Previously identified 94 extreme RILs (47 RILs of extremely salinity tolerant and another 47 RILs of extremely salinity susceptible) along with At354 and Bg352 parental lines were grown in a hydroponics system according to the protocol described by Gregorio *et al.*, (1997) at the plant house which had 100%



sunlight penetration, Faculty of Agriculture and Plantation Management, Makandura. Experimental setup was established according to the randomized complete block design. Two blocks were used with four individual plants from each line per block representing four replicates per RIL.

2.2 Phenotypic assessment under salinity stress

Initially, the salinity of the nutrient solution was adjusted to 6 dSm⁻¹ of electrical conductivity (EC) by adding appropriate amount of analytical grade NaCl. After 2 days, salinity was increased up to 12 dSm⁻¹ (100 mM) of EC and the condition was maintained for 21 days for screening. The pH of the nutrient solution was monitored at 5.0 every other day while continuing the higher EC level. The seedlings were assessed using salt responsive morpho-physiological indices viz., salinity survival index (SSI), shoot length (SL), root length (RL), shoot dry weight (SDW) and root dry weight (RDW).

2.3 QTL Analysis

QTL analysis was carried out by composite interval mapping (CIM) approach with Windows QTL cartographer v2.5_011 software using the SNP marker genotypes which were obtained from our previous study, Gimhani *et al.*, (2016). Permutation test (500 times) was carried out for each trait to establish a LOD (Logarithm of Odds) threshold value at 0.05 significance level. It was assumed that one million bases on a rice chromosome are equivalent to approximately 3.92 cM, for the estimation of genetic distances between markers for QTL mapping. The physical position of SNP markers of Nipponbare genome in Mb was multiplied by a factor of 4 to approximately estimate the marker distances in centi Morgan (cM).

3 RESULTS AND DISCUSSION

Five salinity responsive morpho-physiological traits were analyzed to detect QTLs on chromosome 3. Present findings revealed one putative QTL for a prominent growth related parameter; shoot dry weight (SDW) exceeding the experimental-wise LOD threshold (Figure 1).

The QTL identified for SDW was localized within the flanking region of 34.1-34.7 Mb (136.5-138.7 cM) with its peak positioning at 34.5 Mb (Table 1). According to the QTL mapping study conducted by Gimhani *et al.*, 2016 a promising QTL hotspot has been identified within approximately same flanking region of 34.9-35.8 Mb responsible for five traits viz., SL (*qSL3*), Shoot fresh weight (*qSFW3*), SDW (*qSDW3*), Shoot Na⁺ concentration (*qSNC3*) and shoot Na⁺/K⁺ ratio (*qSNK3*). Interestingly, the QTL identified in the current study for SDW is with close proximity to this QTL hotspot. This result indicated that the QTL *qSDW3*, would be a promising QTL as is validated in two environments, IRRI and Sri Lanka in years 2014 and 2017 respectively. Slight deviation in QTL locations could be raised due to different handling status in two locations and differences in experimental settings at IRRI and Sri Lanka.

Present QTL had a LOD score of 7.66 indicating tight linkage of the QTL with the respective trait. It explained phenotypic variation of 53.5% which is comparatively a higher value while showing a negative additive effect indicating the contribution of the Bg352 allele for increasing the shoot dry weight in favour of salinity tolerance. But it was noted that the salinity tolerant allele donor of SDW in Gimhani *et al.*, 2016 was At354.

The QTL positions were compared with the physical location of markers linked



with QTLs based on Nipponbare genome and accordingly, the flanking SNP markers of the QTL detected in this study were namely 3501392 and 3522453. There could be slight variations in the physical position of flanking markers in bp wise, since an *indica* mapping population was used in the study.

According to past studies, Sabouri and Sabouri (2008) have identified a QTL for Na⁺/K⁺ ratio flanking 22.4-36.1 Mb on chromosome 3. In addition Champoux *et al.*, (1995) have identified a QTL associated with drought tolerance within 22.7-35.8 Mb region. The QTL identified in the current study was also embedded within the given regions. Therefore, the QTL for SDW detected on chromosome 3 could be a prominent one and this region might contain genes responsible for regulating salinity stress.

Table 1: Description of the QTL detected for SDW under salinity stress in Sri Lanka.

Feature	Value / name
LOD score	7.66
Chromosome	3
Peak position	137.9 cM (34.5 Mb)
Flanking region	136.5 – 138.7cM 34.1-34.7 Mb
Flanking SNP markers	3501392 - 3522453
R ²	53.5%
Additive effect	- 0.3053
Salt tolerant allele donor	Bg 352

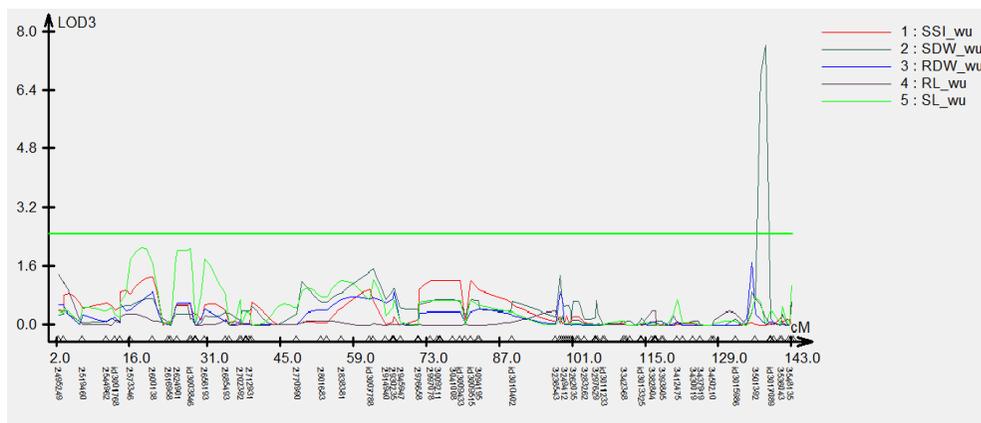


Figure 1: QTL map of chromosome 3 drawn by QTL cartographer v2.5_011 software.

4 CONCLUSIONS

It can be concluded that qtl identified for sdw in the present study validates the previously identified qtl for sdw by gimhani *et al.*, 2016. In addition, it is a promising qtl, since qtls for different traits are also being previously reported in the

similar region. Therefore, current region which is responsible for different salinity responsive traits could be used for introgression as a unit into elite rice varieties to improve salt tolerant lines followed by breeding

Acknowledgment

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Reproductive Biology of *Dacus persicus* (Aak Fruit Fly): A Pest of *Calotropis gigantea* in Sri Lanka

S. Wijeweera and K. De Silva*

Department of Zoology, Faculty of Science, University of Ruhuna, Sri Lanka.

*Corresponding author: Email: kumududs@zoo.ruh.ac.lk

1 INTRODUCTION

Calotropis species are categorized under the family of Apocynaceae in the plant kingdom. *Calotropis* plants grow as a small tree or spread as a shrub. It is drought resistant, salt tolerant and prefers disturbed sandy soils (Kumar *et al*, 2013). These species are distributed throughout the tropical regions. They are native to Asia and Africa (Sigh *et al*, 2013). Three species are recorded namely: *C.procera*, *C.acia* and *C.gigantea* (Bebawi *et al*, 2015). *C.gigantea* and *C.procera* are more common and have wider distribution than *C.acia* (Bebawiet *al*, 2015).

They have similar botanical characteristics and similar pharmacological effects, (Kumar *et al*. 2013) and are widely used in ayurvedic medicine. Different plant parts of *C.procera* are used in treatment of bronchitis, asthma, leprosy, eczema, elephantiasis, baldness, hair loss, toothache, intermittent fevers, rheumatoid/joint swellings and paralysis (Quaziet *al*, 2013). *C. gigantea* used in order to cure various types of cutaneous diseases, tumors, intestinal worms, inflammations, intermittent fever, anorexia, asthma, bronchitis, paralysis, cough, swellings and dyspepsia (Sethi, 2014).

Dacusspp. (sub family Tephritidae) are recorded as one of the commonly found insects on *Calotropis* sp. (Dhileepan

2014). Only two species of fruit flies, *Dacus persicus* and *Dacus longistylus* are recorded as pests on *Calotropis* species (Dhileepan 2014). Both species are considered as monophagus species. *D.persicus*, commonly known as Aak fruit fly, is present in Sri Lanka. There is no known record of *D.longistylus* within the country (Dhileepn, 2014). Aak fruit fly larva is a major destructive seed predator in *Calotropis* species (Sharma and Amritphale 2008). The damage is directly focused on the reproductive output of the plant which severely reduces the propagation of the *Calotropis* species. Therefore, *D. persicus* act is a major pest of *Calotropis sp*; and the reproductive biology of *D.persicus* is important in order to minimize the pest attack for this valuable medicinal plant.

No studies have been conducted on *D.persicus* of *C. gigantea* in Sri Lanka. The present study aims to fill in the important gap regarding the reproductive biology of *Dacus persicus* in Sri Lanka which could be used to develop pest management practices on *C.gigantea*.

2 METHODOLOGY

Eight locations of Southern province were selected for monthly sampling in order to study their reproductive biology of Aak fruitfly. The sites were Kalametiya (6° 6'



N; 80° 55' E), Medilla (6° 2' N; 80° 48' E), Tangalle (6° 1' N; 80° 47' E), Dadalla (6° 2' N; 80° 11' E), Thalpe (5° 59' N; 80° 16' E), Kamburugamuwa (05° 56' N; 80° 29' E), Habaraduwa (5° 59' N; 80° 18' E) and Palena (5° 56' N; 80° 29' E).

Male and females of *D.persicus* were collected from above selected sites, directly by hand picking and were placed in plastic vials. They were reared in the laboratory, Department of Zoology in University of Ruhuna to study mating behaviour, larval development and oviposition. Flies kept in captivity in transparent plastic boxes covered with wire- mesh material on top. They were fed with bee honey and sugar solution kept in a small petri-dish. Each pair of adult male and female flies was kept in separate transparent plastic boxes. Mating behaviour was recorded and each mating pair was observed for pre-mating, mating, post mating, pre- oviposition, oviposition behaviour and the time taken for each activity under laboratory conditions.

Calotropis fruits of different maturity stages were plucked from trees and also recently fallen fruits (148 in number) were collected from the ground. Fruits were dissected under laboratory conditions. The larval stages were extracted to determine the number of larval instars. Larval stages were placed in 70% alcohol. The maximum length of the head capsule of each larva was measured using a calibrated ocular micrometer in a binocular dissecting microscope.

In addition, *Calotropis* fruits (250 in number) were collected from selected sites and egg clusters were extracted from infected fruits. Number of egg clusters per fruit and eggs per cluster was recorded and maximum length and width of extracted eggs were measured. Extracted eggs, larval stages and pupae were reared under laboratory conditions at a temperature (27± 1 °C) to study the life cycle stages of the Aak fruit fly. The mortality was also recorded.

3 RESULTS

Observations of mating behaviour of fruit flies revealed that, flies mated at any time during the day. Before mating, male fruit fly showed a dancing behaviour to attract females. After several mounting attempts, prolonged copulation occurred. Mating time period of fruit fly pairs were observed and the mating time period was recorded as 53.80 (± 1.68) minutes. After mating, female ovipositor was greatly elongated. The length of ovipositor varies from 3 mm to 12 mm.

Gravid females aggregate on immature fruits in order to oviposit their eggs. Ovipositing by 2- 3 females within the same fruit was recorded. When a female fly finds a suitable spot, it bends its abdomen along the long axis of the body then moves the ovipositor into the fruit penetrating the outer cover of the fruit. The duration of oviposition was observed in ovipositing females recorded as 92.31 (± 2.62) minutes.

Eggs were observed on inner most layers of pericarp or sometimes on seeds. The eggs were laid in clusters. Only one cluster per fruit was recorded even though few females oviposited in same fruit. Average egg count of an egg clusters was calculated as 18.5 (± 0.847). Each cluster consists of pale whitish, delicate eggs arranged as a bunch of bananas. Sometimes 3-4 eggs were attached to each other and appeared as a separate bunch. The egg is elongated, slightly curved and tapering towards either end. One end of the egg is rounded while the other end is more pointed. Average maximum length of fruit fly eggs was recorded as 1.35 (±0.01) mm.

2-3 days, after oviposition eggs gave rise to first larval instar. Larvae just after hatching were transparent and head capsule was not clearly distinguishable. After 3-4 days it turned into brownish colour. The developing larvae were creamy white in colour with brownish



head capsule and mandibles. According to head capsule measurements, *Dacus persicus* consisted of three larval instars. The third larval instar metamorphoses into pupa stage. The cocoon is cylindrical in shape but rounded at both ends and dull creamy white in colour with horizontal ring like ridges.

Average percentage mortality of larvae is recorded as 21.24% while an average number of cocoons per fruit is 7.04 (\pm

1.13). The average maximum width is recorded as 0.29 (\pm 0.004) mm and average maximum length is 0.65 (\pm 0.006) mm. Average percentage mortality of cocoons per fruit is observed as 33.48%. The average number of newly developed fruit flies per fruit was 3.522 (\pm 0.772). Within 10- 15 minutes after hatching, they able to fly. Observation of 50 newly emerged adults showed a sex ratio as 1:1. Field studies, showed higher abundance of females.

Table 1: Summarized data of *D. persicus* reproductive biology in *C. gigantea*

Index	Sample size	Average / Percentage
Mating time period	20 fruit fly pairs	53.80 (\pm 1.68) minutes
Oviposition time period	13 female fruit flies	92.31(\pm 2.62) minutes
Post oviposition time period	08 female fruit flies	18.75 (\pm 2.98) minutes
Number of fruit fly eggs per egg cluster	31 egg clusters	18.5 (\pm 0.847)
Maximum length of fruit fly egg	66 fruit fly eggs	1.35 (\pm 0.01) mm.
Number of larvae per an infected fruit	44 fruits	11.91 (\pm 1.27)
Mortality percentage of larvae per fruit	22 fruits	21.24%
Number of cocoons per an infected fruit	22 fruits	7.04 (\pm 1.13)
Maximum length of a cocoon	60 cocoons	0.65 (\pm 0.006) mm
Maximum width of a cocoon	60 cocoons	0.29 (\pm 0.004) mm
Pupation time duration	18 cocoons	11.72 (\pm 0.26) days
Mortality percentage of cocoons per fruit	22 fruits	33.48%
Number of newly merged fruit flies per an infected fruit	22 fruits	3.522(\pm 0.772)

4 DISCUSSION

Reproductive behaviour studies revealed a tendency of Aak fruit flies to oviposit fruit fly on immature *Calotropis* fruits. This may be due to two major reasons. Immature fruits are easy to penetrate and ensure the placement of eggs in inner pericarp layer. On the other hand, immature fruits consisted of immature seeds which were suitable food source for newly emerged larvae with delicate, developing mouth parts. Sharma and Amritphale 2008 also have shown that female gravid fruit flies are highly attracted to soft fruit morph than hard fruit morph of *C. gigantea* due to high penetrability of oviposit in soft morph fruits than hard morph. Male fruit flies were associated with immature fruits, during oviposition period of females. It

might be due to easy accessibility to females for mating process as well as territory marking on suitable host fruits for facilitating females for oviposition (Aluja and Liedo 2013).

Observations on pre and post oviposition behaviours of *D.longistylus* by Parihar 1984, is closely related with *Dacus persicus* behaviour in present study. While it was observed that, 2-3 females oviposited within one fruit; dissected fruits however showed only one egg cluster. It might be due to pseudo-oviposition of female fruit flies. In contrast, findings by Parihar (1984), of *Daculongistylus* explained that a fruit contains 2- 4 clusters of eggs. Similarly *D.longistylus* egg is 1.00 mm in length



while in *Dacus persicus* the eggs are (1.35 mm). Morphology of fruit fly egg of both species is similar. Cocoon size of *D. longistylus* is 0.45 mm in length and 0.2mm in width while *Dacus persicus* of Sri Lanka 0.65 mm in length and 0.29 mm in width.

To control fruit flies, parasitoids have been introduced in different countries of the world (Wang et al. 2004). According to Wang *et al.* 2004, some species act as egg- larval parasitoids. Other species parasitize on pupae of fruit flies (Guillen *et al* 2002). In the present study, some cocoons were parasitized by an unidentified Dipteran. Parasitic fly laid eggs in cocoons. The parasitic fly cocoons are dull creamy white and elongated but smaller than cocoons of *Dacus persicus*.

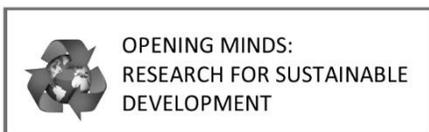
The fruit flies reared in laboratory had a 1:1 sex ratio of female and male. In field observations, the female fruit fly abundance was higher than males. The observation of higher abundance in female fruit flies than male may occur due to long lifespan of female fruit flies.

The findings of the present study provide detailed information on *D.persicus* reproductive biology in Sri Lanka. This information is required for pest management practices of *D.persicus*, which acts as destructive pest of *C. gigantea*.

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A Preliminary Survey on Drinking Water Availability during 2017 - Flash Floods in Diyagama, Kalutara District of Sri Lanka

K.G.R. Madubashini and B.S.G. Chandrasekera*

*Department of Agricultural and Plantation Engineering, Faculty of Engineering
Technology, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

**Corresponding author: Email: bsgayani@gmail.com*

1 INTRODUCTION

Sri Lanka being a tropical country, the magnitudes of rainfall vary from less than 900 mm on the southeast coast to 5000 mm on the western slopes of the highlands. The rainfall pattern is influenced by the monsoon winds of the Indian Ocean and the Bay of Bengal and is marked by four seasons (DMC - Disaster Management Centre, 2014). The incidences of flooding seem to be more frequent in the districts of Kalutara, Ratnapura, Gampaha, Ampara and Jaffna due to intense rainfalls experienced recently (DMC, 2009). The last South-west monsoon was activated on 24th May 2017 and 12-hours of heavy rains fell on Namunuthanna (619mm), Bulathsinghela (419mm), Morawaka (406mm) and Walasmulla (437mm) leading to riverine floods of the Kalu, Nilwala and Gin rivers. As a result of this, sudden flash flood occurred within a very short period, more than 465,000 individuals were affected, 20,792 houses were impacted and over 250 deaths were reported (DMC, 2017). Rural water supplies such as shallow and deep surface wells, hand pump operated deep tube wells and their support structures were totally or partially destroyed due to this flooding. As a result, 12,180 drinking water resources were affected along the Kalu, Nilwala and Gin river basins (DMC, 2017). During the post flood recovery assessments, the damages

were measured in physical terms for which the monetary repair or replacements are to be estimated later (DMC, 2017). In such circumstances, these water sources were most probably contaminated with faecal coliforms (FC) and by various pathogenic bacteria which are harmful to human health (Sirajul Islam *et al.*, 2007). As per the reports of WHO 2004, water-related diseases continue to be one of the major health problems globally and 2.2 million cases of waterborne diarrhoea deaths were reported to be responsible for 3.7 % of total deaths. Thus, contaminated water can be a mode of transmission of pathogens via washing utensils, raw-consumed vegetables etc. (Sirajul Islam *et al.*, 2007). In comparison with ground water reservoirs, surface water bodies are more vulnerable to faecal contamination due to the absence of natural soil protection and filtration (Kistemannet *al.*, 2002). During heavy rainfalls, the microbial load in running water may suddenly increase substantially and reach water bodies very quickly (Kistemannet *al.*, 2002). At present, there is no proper mechanism available to maintain the drinking water requirement during a flood in the study area. This preliminary survey examines the ability to supply the drinking water requirements of flood-affected people during and after the flash floods in the



village Diyagama, Kalutara district of Sri Lanka.

2 METHODOLOGY

2.1 Description of the Study Area

Diyagama is located in the Kalutara District closer to the northern bank of Kalu River (Figure 1) {GPS range-(6.630229, 79.995441),(6.636069, 80.009668)}. This is an economically impoverished, (mean income 25,471 Rupees.) densely populated area (991 individuals) with unplanned housing and inadequate water and sanitation facilities. Households at the banks of the Kalu River were visited and data on drinking water were systemically gathered. According to the census and statistics, 2012 there are 92 protected wells outside the premises, 145 unprotected wells, 5 tap lines inside and outside the premises, 15 rural water projects and 11 bowsers to supply water to this area (www.statistics.gov.lk).



Figure 1: A map of sampling sites in the study area

2.2 Data Collection and Statistical Analysis

This study was based on a questionnaire survey conducted with a total sample size of 40 households which were distributed randomly in the Diyagama area. The main variables included were the distance from natural water source (Kalu River) to home, the source of water used for drinking purpose, the amount of water used for drinking and other purposes,

time-period of the disruption of routine life due to floods, water treatment before drinking, whether water source is affected or not, time taken for water source restoration, the institutions who provided the flood relief, the type of flood relief received during the flash flood and the awareness about the disaster management programs etc. A questionnaire comprised 21 items related to the fulfilment of water requirement during and after the flood. The results were analysed by the SPSS 16.0 statistical software ($\alpha=0.05$) and the association between the distance from the water source to the home and the effect from flood was tested with Kendall's tau-b test.

3 RESULTS AND DISCUSSION

3.1 The distance from the water source to the home

All the respondents lived within the range of 500m distance from the Kalu River, 60 % of them lived in the 50 m distance and rest lived in the 100m and 300 m distance as indicated in Figure 2a. Therefore, they are at a high risk of facing a flood in the future as well. The p value obtained was 0.047 as indicated in the table 1. Therefore, there is a negative relationship between the distance from the water source to the home and the effect from the flood.

3.2 The type of water source used

Majority of the respondents (55%) used their well to fulfil their water requirement (Figure 2b). Only 15 % consumed water supplied by the National Water Supply and Drainage Board. During the flash flood 80 % of the wells were affected and hence the villagers had difficulties in getting portable water during the flood. Furthermore, only 55 % of respondents boiled the water before drinking and the remnant therefore, has a huge possibility of getting infections through water contamination.



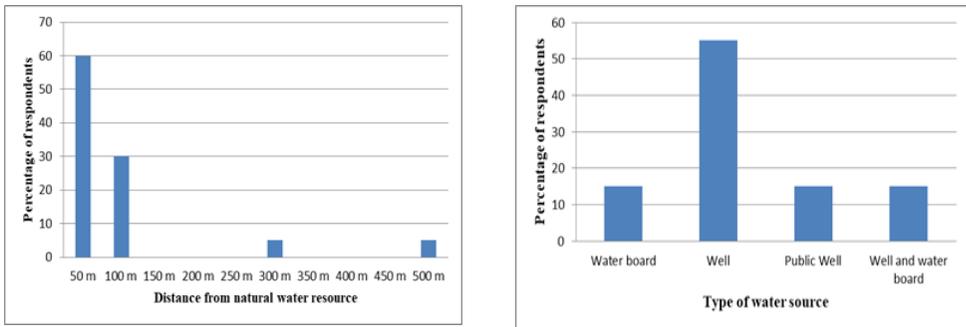


Figure 2a. The distance from the natural water resource to home, **2b.** The type of water source used for drinking purposes by the respondents

Table 1. The significant association between the distance from the water source to the home and the effect from the flood

	Value	Asymp. Std.Error ^a	Approx. T ^b	Approx. Sig.
Ordinal by Ordinal Kendall’s tau-b	-.376	.162	-1.983	0.047

- a. Not assuming the null hypothesis
- b. Using the asymptotic standard error assuming the null hypothesis

3.3 The type of flood relief received by the affected people

Nearly 41 % of flood relief was received in the form of dried food items, only 20 % received bottled water (Figure 4). The average daily drinking water consumption of these respondents was 6.23 litres and the average days taken for restoration of water resources was 6.73. The average water requirement until the restoration was 41.25 litres. Only 5.50 litres of water were received during this time as flood relief. Therefore, the villagers had to face drinking water shortages during and after the flood.

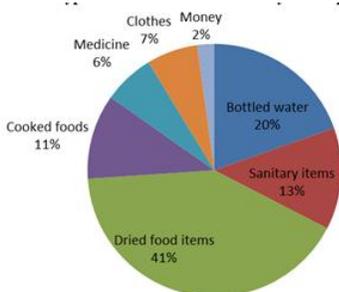


Figure 4: The type of water resources used by the respondents

3.4 Cleaning and testing of drinking water sources

90% of the flood affected wells were cleaned by the voluntary organizations and the government. But the quality of the water was not tested for microbial and other possible contaminations prior to drinking by the villagers.

3.5 The awareness of the disaster management program

Results of the survey recognized that, only 23 % of the respondents were aware of the post-disaster management procedures. Hence, this study highlights the requirement of implementing effective awareness programs on natural disaster management for people in possible affected areas.

4 CONCLUSIONS

Villagers of Diyagama identified the shortage of water during the recent flash flood as the major problem. Even though they received flood relief, the supply of

drinking water was lower than the actual requirement. On the other hand, to obtain floods relief in the affected areas took some time. Regarding the purifying of the drinking water sources, mainly wells, the respondents were satisfied. But they had some doubts whether it had been done properly. Further studies are needed to assess the sources of contamination, quality of the water sources in that flood affected areas. Relevant government officials or any other responsible parties have not visited the area for water sample collection for microbial analysis such as *E-coli* which is necessary before they start drinking water from the wells and other water sources.

5 RECOMMENDATIONS

There should be a quick mechanism to supply drinking water continuously during such situations. Pipe borne water from the National Water Supply and Drainage Board does not seem sufficient and it is recommended that it is extended further in the affected areas. Immediate action should be taken to clean the drinking water sources and ensure the water quality through proper testing methods. Public awareness of the potential danger of consuming contaminated water, in-house treatment procedures and techniques are recommended.

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Preliminary Study on Biomass Mapping along the Coastal Zone of Hambantota Region, Sri Lanka Using Landsat Imagery

J.E. Dellysse¹, B.D. Madurapperuma^{1*}, K. A.J.M. Kurupparachchi²

¹*Department of Environmental Science and Management, Humboldt State University.*

²*Department of Botany, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

**Corresponding author: Email: bdm280@humboldt.edu*

1 INTRODUCTION

Coastal biomes will be the primary indicators of ecological, agricultural and sociological health as climate change intensifies natural forces along the world's coastlines in the coming decades. The services of cost line vegetation offer protection from previous and current coastal land disturbances from Sea Level Rise (SLR) or tsunami-like natural disasters. Almost half of Sri Lanka's southern coastline architecture (Illangasekare, 2006) and costal ecosystems (Dellysse and Madurapperuma, 2017) were affected by the tsunami in 2004. These coastal habitats and dynamic ecosystems become even more critically important to stabilize and conserve coastal bioshield mass and maintain ecological services (Rahman and Rahman, 2013). Remote sensing techniques such as, normalized difference vegetation index (NDVI), object-based image analysis and image classification have been widely applied for monitoring coastal habitats. This study examines the land-use changes in coastal habitats in the Hambantota district of Sri Lanka using Landsat 5 and 8 imagery with 30 m resolution to assess the resilience of several coastal vegetation pre and post 2004 tsunami-based on land-use categories within the limits of 30 m satellite imagery. The results of this study would motivate future studies with feasible technologies and address best coastal ecosystem conservation strategies.

Additionally, we expect to use these results to provide proof of concept for a larger study and an updated GIS model of this coastal region will be developed using high resolution 2-10 cm aerial photographic techniques utilizing Kite Aerial Photography (KAP).

2 METHODOLOGY

A vegetation/land-use pre and post tsunami model for Hambantota coastal areas in Sri Lanka was developed using Landsat images that were acquired from the time index 2004-02-11, 2005-02-13 and 2016-11-10. These images were preprocessed using a mathematical formula to convert radiance to reflectance values which was done using ENVI[®] prior to normalized difference vegetation index (NDVI) calculation. The NDVI in each year was then used to detect the greenness change over time: 2004-2005 short-term, 2005-2016 long-term and 2004-2016 for the entire time step. Then, the changed images were reclassified into three classes, where negative values for vegetation i.e. decreased, zero for unchanged and positive values for regeneration. Finally, reclassified changed images were summarized by land-use/cover classes (DATA.GOV, 2015) using the tabulate area function in ArcMap[®] to evaluate the impact of post-tsunami in short-term and the vegetation recovery in long-term.



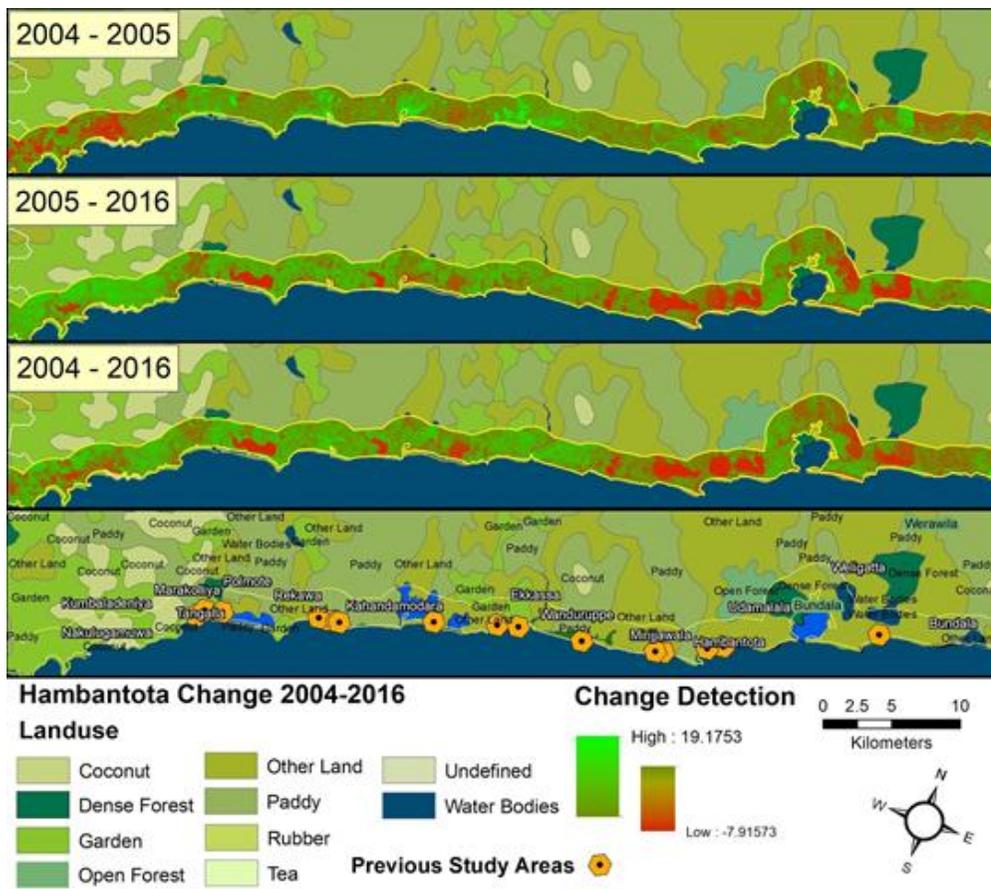


Figure 1: Vegetation change detection of Hambantota coastal regions between 2004 - 2005 (short-term after tsunami disaster), 2005 - 2016 (long-term), and 2004-2016 (entire time step) referring to land-use/cover classes. NB: NDVI change detection showed a biomass loss in red-brown and biomass increment in green. Previous study areas adopted from Bambaradeniya *et al.*, (2006) survey.

3 RESULTS AND DISCUSSION

Results of the study showed that the vegetation in Hambantota was significantly disturbed immediately after the tsunami disaster (between 2004 and 2005). Then, the vegetation had increased between 2005 and 2016 due to the implementation of coastal rehabilitation programs supporting regeneration of coastal vegetation (Figs. 1 and 2) as noted by Bambaradeniya *et al.*, in 2006 (Fig. 1). This notable vegetation change was in part a result of agricultural practices where agricultural lands proved to be less

influential as a prophylactic for the mitigation of wave impacts.

Although our study showed that human-influenced land uses were more vulnerable to tsunami wave action and inland flooding in the short term (2004-2005), a satisfactory regeneration had been observed in the long-term (2005-2016) due to coastal rehabilitation programs (Fig. 2). As the best management practices of coastal ecosystems for climatic vulnerabilities, it



needs to further address the use of human-induced lands to transform these, at risk areas to more natural coastal habitats such as, coastal shrubs and mangroves.

Our study showed the NDVI change over time in relation to different vegetation classes, however we could not estimate biomass due to lack of *in-situ* data. High-resolution remote-sensing data (~10 cm -3 m) are useful for fine scale mapping of coastal vegetation and estimating biomass with high accuracy. For example, unmanned aerial vehicles (UAV) built with multispectral sensors are useful for generating high-quality orthoimages and

3D point cloud data for rendering biomass distribution along the coastal areas (Lopatina, 2013). A remote sensing technique such as, segmentation of orthoimage with 3D point cloud data, and classification of segments are used for measuring biomass of particular vegetation (Lopatina, 2013). Kite Aerial Photography (KAP) is reliable and affordable in developing countries like Sri Lanka. The low-cost and high spatial resolution offers substantial advantages compared to other platforms like UAV's; additionally KAP often meets any legal restrictions and issues.

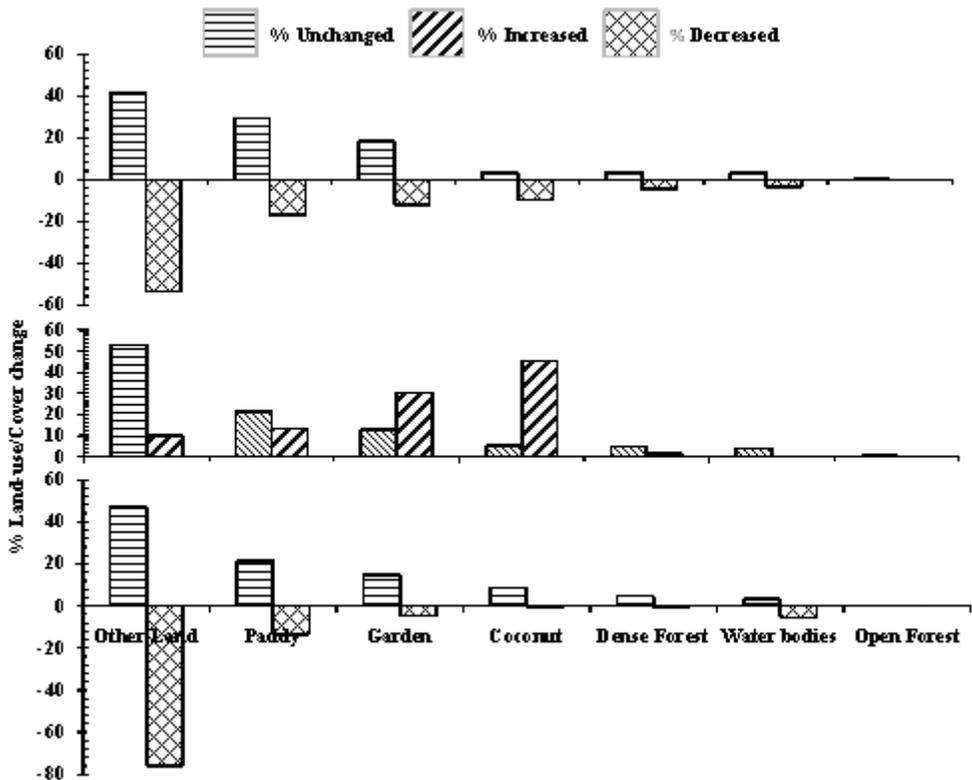


Figure 2: Vegetation biomass change (NDVI) in relation to land-use/cover category of Hambantota coastal habitats between 2004 - 2005 (short-term after tsunami disaster), 2005 - 2016 (long-term), and 2004-2016 (entire time step).

KAP specific kite designs also offer advantages such as stability in varying wind conditions. Furthermore, digital cameras can be modified with expanded capabilities through open source software and commercial grade dual band pass Red-NIR filters to obtain NIR images for creating NDVI. As an example, the southern coast of Durai Island, Indonesia used KAP for mapping sand beaches and rocky outcrops with 3.1 cm spatial resolution (Currier, K. (2015). Furthermore, the study revealed that the kite was better suited for windy conditions, which is applicable for the Sri Lankan coastal regions of Hambantota. As a result KAP has a multitude of positive capabilities which are necessary if Sri Lanka is to obtain high resolution images. A future comparative analysis of vegetation biomass i.e. changes detection, would be beneficial to the scientific community and to the people of Sri Lanka.

4 CONCLUSIONS AND RECOMMENDATIONS

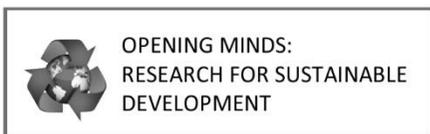
The results of this study revealed that the vegetation affected had been intensively recovered by 2016. It is further suggested that a government funded incentives program be established for coastal communities for the purpose of converting their agricultural lands to sustainable land-use/cover classes (i.e. coconut and coastal shrub vegetation) to mitigate the tsunami and cyclone effects and also to provide greater soil stabilization to mitigate increased wave action as a result of SLR. Even though, Landsat satellite data has advantages as it can explain changes to certain extent with low cost, the obvious limitation of the study is the low 30 m resolution of Landsat images that can hinder minor land-use changes of vegetation. Therefore, our study can be used as a baseline data set for future comprehensive studies and collecting in-situ data using Kite Aerial Photography.

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PHYSICAL SCIENCES



Fabrication of Sodium Ion Rechargeable Battery Using Earth Abundant Orthosilicates

T.N. Alahakoon¹, V.P.S. Perera², N. G. S. Shantha¹, C.H. Manathunga^{1,3*}

¹*Department of Physics, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*

²*Department of Physics, Faculty of Natural Sciences, The Open University of Sri Lanka, Nugegoda, Sri Lanka*

³*Center for Advance Material Research, Faculty of Applied Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*

*Corresponding author: Email: chandimavc@sjp.ac.lk

1 INTRODUCTION

Recently, various high capacity anode materials have been developed for sodium ion batteries. However, on the cathode side, the capacity is often low. The reason is the intrinsic limit of intercalation-type cathodes, which can only accommodate one sodium ion per transition metal core (Zhu *et al.*, 2015). Magnesium metal provides two electrons per atom, giving it an attractive volumetric capacity than Lithium metal. It also reduces the battery cost due to its natural abundance in the earth's crust as the fifth most abundant element. It also provides higher volumetric capacities than Lithium metal (3832 mAh cm⁻³ for Magnesium and 2061 mAh cm⁻³ for Lithium) (Mohtadi and Mizuno, 2014). Rechargeable aluminium-based batteries have an advantage due to their low manufacturing cost and low flammability, together with three-electron-redox properties leading to high capacity. During the last three decades aluminium-based batteries have encountered several problems, such as cathode material disintegration, low cell discharge voltage capacitive behaviour without discharge voltage plateaus and insufficient cycle life with rapid capacity decay (Lin *et al.*, 2014).

Olivine type structures (MgMSiO₄) also use as the cathode material and in Li₂FeSiO₄, the SiO₄⁻⁴ tetrahedral is arranged in the same way as in the MgMSiO₄. In olivine type MgMSiO₄ the theoretical capacity exceeds 300 mA h g⁻¹ and operational voltage is expected to be higher than the common magnesium battery. SiO₄⁻⁴ which are expected to cause lattice stabilization for magnesium intercalation through the presence of strong Si-O bonds (Orikasa *et al.*, 2014).

Within manganese-based poly-anion-type compounds, Li₂MnSiO₄ (LMS) is attractive mainly for the possible two-electron exchange reaction, giving a theoretical capacity of 333 mA hg⁻¹. However, LMS materials still have numerous issues. First, it is hard to obtain a high-purity phase of LMS, Secondly, their poor electrical conductivity and low lithium diffusion coefficient severely limit the rate performance (Hu *et al.*, 2013). But poly-anion type compounds such as lithium metal phosphates and silicates are used in rechargeable batteries due to good practical merits such as high safety, low cost and constant voltage.

Lithium ion batteries also have some problems. They require protection from



over charge and discharge and Lithium ion batteries have ageing problem (<http://www.radioelectronics.com>).

Normally, Lithium ion rechargeable batteries are more costly than Nickel Cadmium cells. Sodium has very similar chemical properties as Lithium. It is empirically proven that the characteristics of mechanisms are identical when Sodium and Lithium are correlated in industrial processes.

In this study, for the first time, we have synthesized $\text{Na}_2\text{MnSiO}_4$ by solid state reaction of Na_2CO_3 , MnCO_3 and SiO_2 and fabricated sodium ion rechargeable battery using it as the cathode material.

2 METHODOLOGY

2.1 Cathode Material Synthesis

Cathode materials were synthesized using solid-state reaction of amorphous SiO_2 , MnO_2 and Na_2CO_3 taken in 1:1:1 molar ratios. All three materials were mixed using a ball mill with acetone. Sample was then dried at 800 °C for 6 hr before calcinate. Thereafter transferred to an argon-filled glove box, owing to the inherent sensitivity of the material upon air exposure.

2.2 Materials characterization

The reactants and the product were characterized with the X-Ray Diffraction (XRD) to identify phase and nature of the synthesized material.

2.3 Cell Fabrication and Testing

Electrodes were prepared using the active materials to which carbon black and Polyvinylidene Fluoride (PVDF) were added ~10% and ~15% respectively by weight. The binder, PVDF was dissolved in 1-methyl-2-pyrrolidinon. This slurry was coated on an aluminium sheet as a

thin film using the doctor blade method and dried on a hot plate at 120 °C until the solvent completely vaporized. The rechargeable battery was fabricated using the cathode of active material coated on Al foil and metallic Sodium as the anode in an Argon filled glove box. The electrolyte was 1 M NaClO_4 in propylene carbonate. Charging and discharging of the cell was monitored and specific capacity was calculated accordingly.

Impedance Spectroscopic (IS) analysis was done using Autolab FRA 32 in the frequency range of 1.0 M Hz to 10.0m Hz, by plotting Nyquist plots to identify the charge transfer characteristics of the cell.

3 RESULTS AND DISCUSSION

The synthesized material was characterized with X-ray diffraction spectroscopy. Figure 1 shows the X-ray diffraction pattern of the synthesized material which include Sodium, Manganese, and Silicates. The X-ray diffraction patterns of reactants were also taken into account to confirm the formation of sodium manganese orthosilicate. The insert is the XRD pattern of the pure SiO_2 used in this synthesis and it is found to be in amorphous form. The amorphous nature of silica disappeared after synthesizing active material confirmed by the sharp peaks appearing in the XRD pattern.

The charging and discharging of the cell galvanostatically with 0.5 mA current is shown in Figure 2. After fully charging the cell the open circuit voltage was about 1.2 V and it rapidly dropped down to 0.7 V at the start of the discharge of the cell. After that voltage gradually dropped with the time. According to the calculation the total specific discharge capacity of the cell was 1.6 mA h g⁻¹.



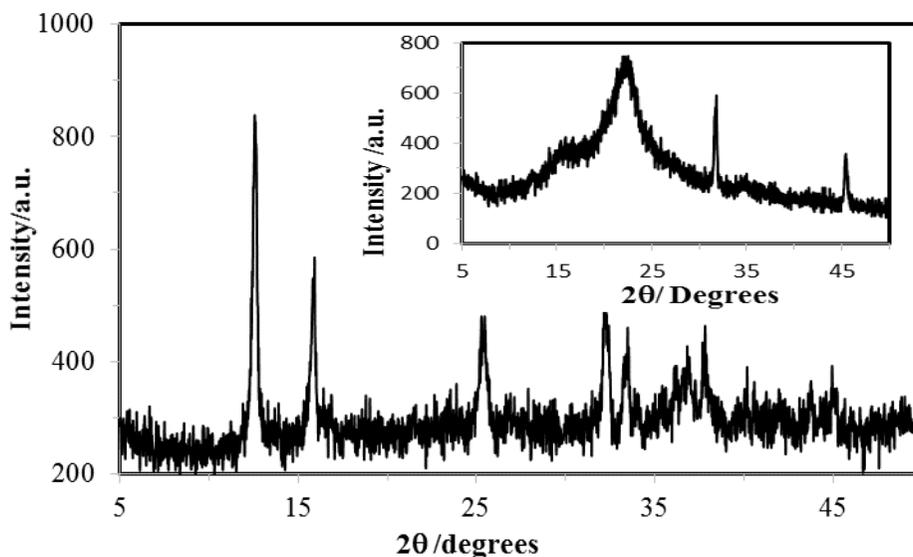


Figure 1: XRD patterns of synthesised material. Insert is the XRD pattern of SiO₂

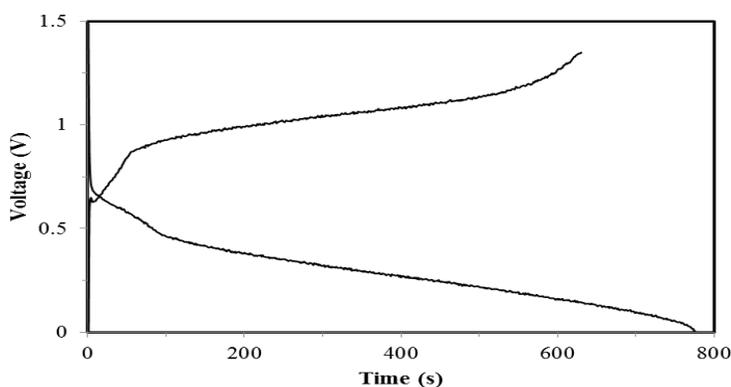


Figure 2: Charge and Discharge cycles

Electrochemical impedance measurements were performed to investigate the sodium ion migration dynamics. Figure 3 shows Nyquist plot of the fabricated cell. The impedance spectra consists of a semicircle in the high frequency region, which fits with the inserted equivalent circuit in the Figure. The linear part in the low frequency region represents typical Warburg behaviour associated with the sodium ion conductivity in the electrolyte. Series

resistance of the cell is about 200 Ω and parallel resistance of the cell is about 900 Ω.

The preliminary studies indicate that the sodium manganese orthosilicate can be used in sodium ion rechargeable batteries to reduce the overall cost of the Na⁺ rechargeable batteries. Intercalation mechanism of sodium into orthosilicates has to be further investigated to fully understand the operation of the cell.

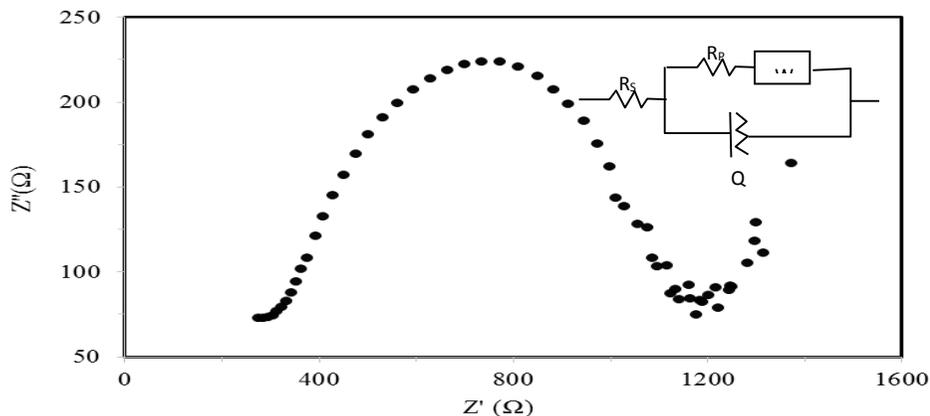


Figure 3: Nyquist plot of the cell

4 CONCLUSIONS AND RECOMMENDATIONS

XRD analysis of synthesized material indicated the formation of novel material which needs further confirmation as $\text{Na}_2\text{MnSiO}_4$. Charging and discharging capacity of the cell indicated that this is a prospective material which can be further developed. Further, it had a specific discharge capacity of 1.6 mA h g^{-1} . Since the silicates are dielectric materials, composition of carbon in the electrode also needs to be optimized. From the obtained results and the theoretical implications above it can be deduced that the orthosilicates are cost efficient materials for cathode materials used in sodium ion batteries.

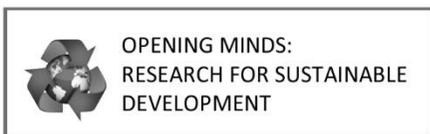
Acknowledgements

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Spatial Patterns of Trees in the Sinharaja Forest in Sri Lanka

Lakmali Ariyasena^{1*}, Uthpala Ekanayake¹, Nimal Gunatilleke², Savitri Gunatilleke², Ruwan Punchi-Manage³

¹Department of Physical Sciences, Rajarata University of Sri Lanka, Mihintale, Sri Lanka

²Department of Botany, University of Peradeniya, Peradeniya, Sri Lanka

³Department of Statistics and Computer Science, University of Peradeniya, Peradeniya, Sri Lanka

*Corresponding author: Email: 91lakmali91@gmail.com

1 INTRODUCTION

Process that maintains species diversity, species richness and species distribution are one of the central questions in ecology. There are dozens of theories proposed to explain distribution patterns of the species (e.g. Hutchison's hyper-volume concept (1957), Mc-Arthur's Broken stick model, Janzen-Connell effects, Chesson's lottery model (1981), Connells intermediate disturbance hypothesis, and Hubbell's neutral theory (Hubbell, 2001)). Spatial distribution of tree species associated with several factors (e.g. habitat heterogeneity, dispersal limitation and tree interactions). Species composition is different with respect to high elevation areas, mid elevation areas, and low elevation. Limited dispersal ability of species delay competitive exclusion not allowing superior species to reach all the favorable sites. May be facilitation and competition of species determine species distribution of species. However, facilitation in tropical forest is rare. Competition is often found at small spatial scales. Many processes operate at different spatial scales. Detail analysis of spatial distribution can reveal processes that operate at different spatial scale (Condit *et al.* 2000; Wiegand and Moloney 2004; He and Legendre 2002; Seidler and Plotkin 2006; Wiegand *et al.* 2007; Shen *et al.* 2009). In this study attempt is made to

understand the spatial distribution of species using Clarke-Evans test, Ripley's K-function, L-function, and Pair-Correlation function.

2 METHODOLOGY

Clarke-Evans Test: Clark-Evans index may be the simplest spatial measurement, used to analyze the spatial distribution of species. It measures the mean distance to its n^{th} nearest neighbor. Observed n^{th} nearest neighbor distance is compared with expected distance under random displacement of species. Simulation with different distribution can be used for thorough understanding spatial arrangement from 1m to 100 meters. The Clark and Evans (1954) aggregation index in R is a crude measure of clustering or dispersion of a spatial pattern. It measures the mean n^{th} nearest neighbour distance in the pattern to that expected for a homogeneous Poisson point process. $R > 1$ suggests dispersion, while $R < 1$ indicates clustering (Baddeley, *et al.* 2015).

Homogeneous Poisson Processes.: In a homogenous Poisson process in which the



points are independently scattered and the intensity λ of the process is constant (Fig. 1a).

Ripley’s K-function: Ripley’s K function is widely used to examine spatial point patterns. Ripley K function is better than the Clarke-Evans test because it accounts spatial arrangement of all the individuals up to a certain distance (Dixon 2001). Here we used univariate Ripley’s K-function. Ripley K function indicates average number of points within distance of a randomly chosen point (Fig. 1a). However, Ripley’s K function is little bit difficult to interpret and L-function is also used.

L-function: It is a transformed form of the Ripley’s K-function given by,

$$L_{\text{hom}}(r) = \sqrt{\frac{K_{\text{hom}}(r)}{\pi}}$$

Both of them suffer with memory effect (i.e. small scale aggregation or dispersion bring forward and mimic spatial clustering or dispersion at large spatial scales). We used pair-correlation function or O-ring statistic (Wiegand and Moloney 2004) or Omega function (Condit et al. 2002) which identifies spatial distribution at a given scale (Fig. 1c). Our null model is a homogeneous Poisson process. If observed distribution is above the homogenous Poisson process it shows clustering whereas below shows dispersion

Data: We used data from fully mapped 25-ha forest plot in *Sinharaja* Sri Lanka. In this forest all the species which are greater than or equal to 1cm at diameter of breast height were measured. Individuals were identified to species. Tree locations were given. In this forest plot nearly 200,000 individuals (approximately 220 species) were identified. In this analysis we exclude singleton species.

Statistical data analysis: All the analysis

was performed using statistical software R (R Core Team, 2017). We used the package “spatstat” in R to perform Clarke-Even’s test, Ripley’s K-function, L-function, and pair-correlation function (Baddeley and Turner, 2000).

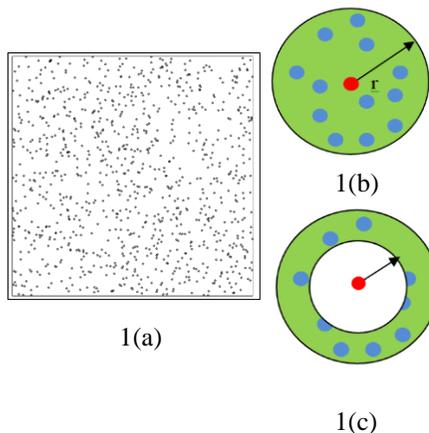


Figure 1: (a) Homogeneous Poisson process, (b) Ripley’s K-function (c) Pair-correlation function

3 RESULTS AND DISCUSSION

Following results were found. According to Clarke-Evan’s test 179 species were clustered. Only few shows disperse pattern.

Table 1. Spatial structure of number species: Clarke-Evan’s test

Spatial Pattern	No. of Species
Cluster	179
Random	31
Disperse	10

Ripley’s K-function was performed for all the species. Few results were shown in Fig. 2. Most of them show clustering even up to 100 meters (red dotted line corresponds to the homogeneous Poisson process, gray area indicates the confidence bounds, and the black line indicates the observed pattern).



We have seen that for highly abundant species, simulation envelope becomes narrow. Pair Correlation function

indicates drastic fall of clustering at large scale. It shows strong clustering at small scales (Fig. 4).

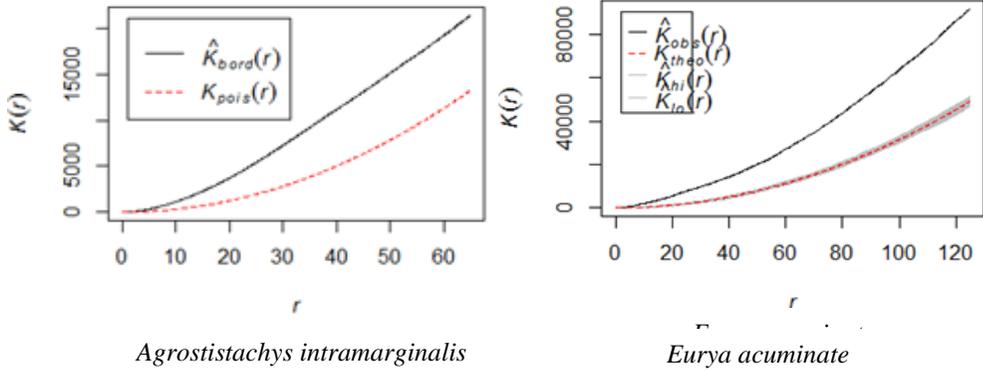


Figure 1: Ripley's K-function for some selected species in the 25-ha Sinharaja forest plot

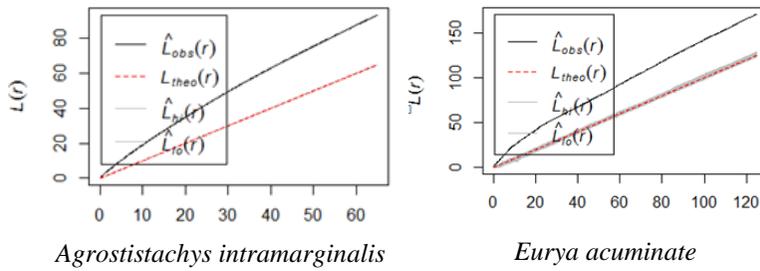


Figure 2: L-function for some selected species in the 25-ha Sinharaja forest plot

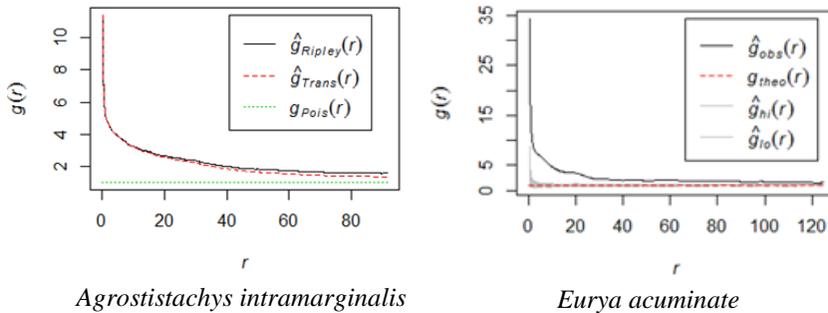


Figure 3: Pair-correlation -function for some selected species in the 25-ha Sinharaja

4 CONCLUSIONS AND RECOMMENDATIONS

However, this study has some limitations. Our statistics are first order statistic and most of the clustering is due to species habitat association or dispersal limitation (e.g. see Condit *et al.*, 2002). It is necessary to remove the effect due to habitat association and dispersal limitation to see whether any tree-tree interaction is exist (second order statistic). For example Shen *et al.* (2009), Wang *et al.* (2011) and Lin *et al.* (2012) simulated Homogenous/Inhomogeneous Poisson process and Thomas Cluster process to calculate species richness. This method can be modified little and use in a Pair-Correlation function context or one can use neighborhood approach used by Wiegand *et al.* (2007) or Pattern reconstruction (Wiegand *et al.*, 2013) to remove interaction at medium to large scales. In future we hope to extend this study along the above mentioned path to disentangle the effect at different spatial scales.

Acknowledgments

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Investigation of Applicability of Banana Pith as Electrolytic Media for Bio-Batteries

C.N. Nupearachchi*, G.C. Wickramasinghe and V. P. S. Perera

Department Physics, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: chathunilnupe@gmail.com*

1 INTRODUCTION

To face the global challenges in energy, new technologies are essential for the future which should be aligned with sustainable development. There has been quite a number of impressive research and developments over the past years with the intention of harvesting sustainable electrical energy via various methods. The usage of sustainable energy for the production of electricity mainly requires the availability of a relevant technology for production and storage of energy using batteries. However, there are many challenges facing the development of batteries that can address environmental concerns and stability with a prolonged life cycle to meet current demands. The technology of batteries has evolved over the years. One promising technology has been the use of biological tissues. Galvani [1] was one of the earliest researchers to explore the electrical properties of biological tissues. Since then, the usage of either biological tissues or fluids for power generation has attracted a number of researchers throughout the world who have conducted further research towards developing organic fuel cells [2, 3]. This has been accompanied by rapid advances for power sources for devices where portability is important.

The problems associated with bio-batteries are primarily related to the materials used to fabricate the battery electrodes as well as the electrolytes. In

the recent past, bio-battery technology has been widely optimized by the usage of new alternative materials such as tubers, yams, fruits etc. to address energy and power demands by the introduction of different structural modifications [4, 5]. A local study has conducted extensive research to explore the applicability of plantain pith as an electrolytic material for Galvanic cells [6]. The chopped plantain pith after boiling showed the best battery performance. The battery fabricated using this particular material had excellent stability and was able to light up an LED light for more than 500 hours if the electrolyte was prevented from drying. Even the inedible banana peels which serve little economic purpose are now being used as a constituent in super capacitors [7] and rechargeable batteries [8].

The current study was aimed at exploring the initial bio-battery design specification using the pith of ambun banana variety which has not been previously tested as an electrolytic media.

2 METHODOLOGY

The trunk of the ambun banana plant was mashed using a blender to form the pith. The mashed pith was kept on a hot plate set at 120 °C for 30 minutes to boil and concentrate its liquid content for usage as an electrolytic medium in Galvanic Cells.



The galvanic cell was fabricated by sandwiching plantain pith between Zn and Cu plates of area $2 \times 6 \text{ cm}^2$. Initially the separation between the Zn and Cu plates was fixed at 2 cm and plantain pith was filled in between the two plates to a height of 5 cm. Electrical properties of the cells was characterized by discharging through a 300Ω resistor. Thereafter the Zn and Cu electrode combination was checked to find the optimum cell arrangement. Different parameters of bio-battery performance were investigated to obtain a basic idea of its functionality. In this regard, separation of the two plates was varied from 1 cm to 5 cm with different heights of the electrolyte media: 1 cm, 2 cm, 3 cm, 4 cm and 5 cm which was obtained by inserting different amounts of plantain pith at each configuration. At each setting of the cell, charge transfer resistance was measured by taking Nyquist plots using AutoLab FRA 32.

3 RESULTS AND DISCUSSION

The chemical reaction responsible for the operation of the Galvanic cell to produce net electric potential is given below.

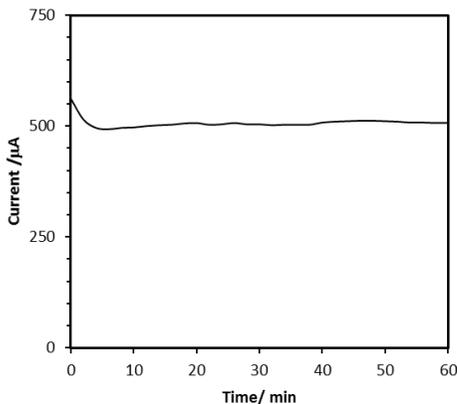


$$E_0 = 0.76 \text{ V}$$

A battery in general is used to store energy and release it at the desired time in a controlled manner to satisfy the energy demand. Particularly, a discharge curve which shows the variations in cell voltage and current with time can be regarded as an important indicator of battery performance. Therefore, discharge curve of the cell through a 300Ω resistor initially for Zn and Cu plates fixed at 2 cm apart filling the electrolytic media to a height of 5 cm was investigated. Since the width of the plates is 2 cm the active area of this configuration was restricted to 10 cm^2 . Figure 1 shows the discharge curve

of the cell for a period of one hour.

Figure 1: Discharge curve of the



Galvanic cell when plantain pith was used as electrolytic media.

The cell was capable of delivering a $500 \mu\text{A}$ current throughout the observed period across the load resistor. Electrical power of the galvanic cell of this configuration was $\sim 350 \mu\text{W}$.

The current and voltage of the cells varying the active area of the Galvanic cell was studied again using plantain pith as the electrolytic media. Figure 2(a) depicts this information when the area was varied as 2 cm^2 , 4 cm^2 , 6 cm^2 and 8 cm^2 . It could be noticed that the short circuit current of the cell increased when the area of the cell increased while the open circuit voltage of the cell decreased. But the increase of the short circuit current of the cell was not proportional to the increment of the active area of the Zn and Cu plates. Figure 2(b) shows the variation of the short circuit current and open circuit voltage of the Galvanic cell when the separation between the Zn and Cu plates were varied while keeping the active area of the cell constant at $4 \times 2 \text{ cm}^2$.

In contrast, to the increment of active area of the cell, short circuit current of the cell decreased and open circuit voltage of the cell increased when the separation of the two electrodes was increased.



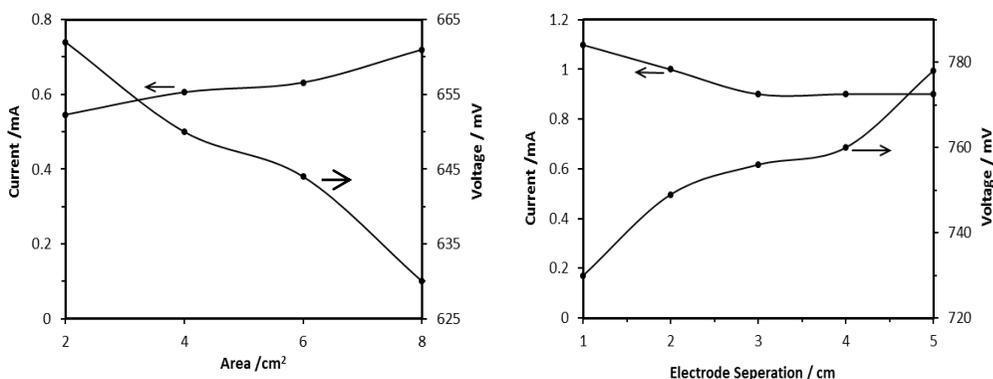


Figure 2: Variation of short circuit current and open circuit voltage of Galvanic cell with (a) the active area of the cell (b) electrode separation (cell area 4 x 2 cm²)

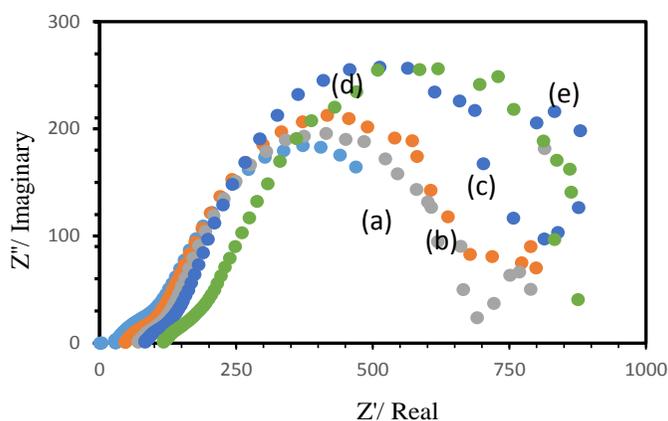


Figure 3: Variation of Nyquist plot of the cells with electrode separation for a constant active cell area of 2 x 2 cm² (a) 1 cm (b) 2 cm (c) 3 cm (d) 4 cm (e) 5 cm

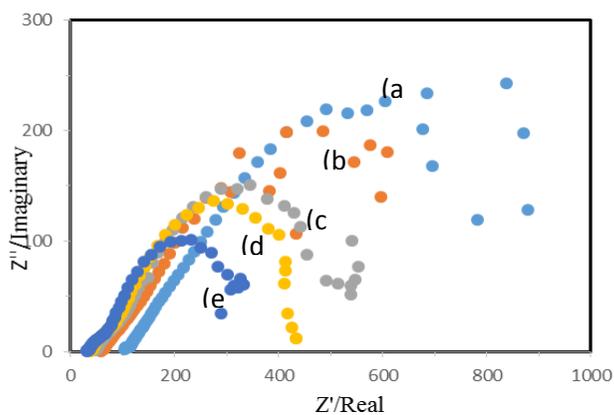


Figure 4: Variation of Nyquist plot of the cells with the area for a constant electrode separation of 2 cm (a) 2x2 cm² (b) 2x3 cm² (c) 2x4 cm² (d) 2x5 cm²

The impedance of different cell configurations was analyzed with Impedance Spectroscopy (IS). With the IS data it is possible to find out the charge transfer resistance at each electrode and the series resistance of the Galvanic cells. With this data, an equivalent circuit for the cell can be simulated which will give important information on each configuration of the cells.

Figure 3 shows the Nyquist plots of the cells when the distance of separation of the Zn and Cu electrodes was varied. It can be observed that two semicircles are appearing in these plots. The semicircle at lower frequency end of the plot corresponds to the charge transfer resistance at the Cu electrode and electrolyte interface which happens at a low reaction rate and produces hydrogen gas. The semicircle at the high frequency end is for the charge transfer resistance at the Zn electrode and electrolyte interface where the electron transfer rate is quite high. It can be observed that the series resistance of the cells as well as the parallel resistances increases when the separation was increased.

Figure 4 shows the Nyquist plots of the cells when the area of the electrodes was varied at constant electrode separation. It can be noticed that the series resistance of the cells as well as the parallel resistance of the cells decrease when the area of the cell is increased.

4 CONCLUSIONS AND RECOMMENDATIONS

Short circuit current delivered by a Galvanic cell that uses plantain pith electrolytic media increased while open circuit voltage decreased when the active area of the cell is increased. With the increment of the separation of electrodes, open circuit voltage increased while short circuit current decreased. The Nyquist plots of the cells were also helpful to

identify the charge transfer characteristics of the cell. Further investigations are necessary to improve the cell performance of bio-batteries.

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OPENING MINDS:
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Sea Level Variability in the East Coast of Male, Maldives

K.W. Indika^{1*}, E.M.S. Wijerathne², G. W. A. R. Fernando³, S.S.L.Hettiarachchi⁴

¹National Aquatics Resources Research and Development Agency, Sri Lanka,

²School of Civil, Environmental and Mining Engineering, University of Western Australia,

³Department of Physics, Open University of Sri Lanka, Nugegoda, Sri Lanka

⁴ Department of Civil Engineering, University of Moratuwa, Katubedda, Sri Lanka

*Corresponding author: Email: iweligamage@yahoo.com

1 INTRODUCTION

This paper discusses the variation of sea level with different time intervals in the East coast of Male, Maldives. Sea level is the mean water level, at which the oceans exist when averaged between high and low tides which is associated with many kinds of forcing agents in the sea caused by astronomical and hydrological forces. Estimated average annual global mean sea level rise was 2.8 to 3.6 mm yr⁻¹. Volume of ocean was increased causing warming of the ocean, loss of glaciers and ice sheets, and reduction of liquid water storage on land (Intergovernmental Panel on Climate Change 5th Assessment report 2013). Sea level variation can be classified according to the time scale in which variability occurs from hours to hundreds of years such as seiches, tsunamis, tides, storm surges, continental shelf waves, annual, inter-annual and sea level rise. Such variations under temporal dimension consist as hours, days, weeks, and months, seasonal, annual and inter-annual while spatial dimension can be classified as meso-scale, synoptic, global scale followed by local, regional and global scale respectively. The trend of mean sea level variation inferred from altimetry in Northern Indian Ocean (NIO) is 5±0.4 mm/year for the period of 1993-2012 (Indika *et al.*, 2016). Sea level changes related to density change of

specific volume due to change of temperature and salinity is caused by seasonal changes in precipitation, evaporation and heat fluxes which referred to steric height variability (Tomczak and Godfrey, 1994). The seasonal sea level range around the lower part of the northern Indian Ocean waters is about 0.2-0.3 m responding to the fresh water inflow, heat flux and other factors that are linked to climate change processes (Wijeratne and Pattiarachchi, 2006, 2011). Meanwhile some extreme variations are governed by sudden changes of atmospheric conditions in disturbed weather systems such as Meteotsunami. Exploration of Sea level dynamic is important for future challenges induced with global change to sustainable use of the ocean resources for navigation, harvesting of ocean recourses and coastal development planning for Maldives as an Island country.

2 METHODOLOGY

Global Sea Level Observing System (GLOSS) is an international programme conducted under the auspices of the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), where the station data are transmitted via



satellite communication systems across the world. The gauge data used were collected from sea level monitoring station at Hulhule, Male which is maintained under the Maldives Meteorological Department while satellite data were used from Achieving, Validation and Interpretation of Satellite Oceanography (AVISO). The spring and neap tidal range were calculated using quantified tidal constituents according to the methodology of Hicks (2006). The tide pattern was analyzed quantitatively using the ratio of (K1+O1) to (M2+S2). Here the K1 is Luni-solar declinational diurnal constituent and O1 is Principal Lunar Declinational diurnal constituent. The astronomical effects produced by the moon and the Sun (semidiurnal lunar - M2 and the semidiurnal solar - S2) were calculated separately. Then the spring and neap tide variation in the western coast of Male’ Maldives was calculated. The seasonal and long term variations were analyzed separately, using monthly mean values of high frequency tide gauge data and satellite data. The final results of both tide gauge and satellite were superposition for the accuracy of different data sources.

3 RESULTS AND DISCUSSION

3.1 Quantification of tidal constituent

The astronomical effect removed residual sea level variation was obtained reducing tide gauge time series by the tidal component time series. The tidal constituents were quantified using one minute frequency tide gauge data obtained during eight years from 1990 to 1998. The T_TIDE harmonic analysis function of time series analysis in MATLAB’ software was used to quantify the tidal constituents.

3.2 Determination of tidal pattern

The resulted main tidal constitute and their amplitudes of M2, S2, K1, O1 is shown in Table 1. The results reveal that M2 is the main tidal constituent with amplitude of 0.207 (m). These figures are in line with the findings of Wijeratne (2006, 2008) which stated that the value of M2 super is positioned in-between 0.200 - 0.235 m depending on the site. The second largest contributor for the tidal effect was S2 where the amplitude and the phase were 0.119 and 270.431 respectively. Furthermore, minute effects compared to M2 and S2 were made by K1 and O1.

Table 1: The resulted tidal constituents obtained quantitatively by harmonic analysis

Station	ID 28	Maldives
M2	A (m)	0.207
	g^0	37.923
S2	A (m)	0.119
	g^0	270.431
K1	A (m)	0.096
	g^0	348.527
O1	A (m)	0.049
	g^0	166.371
Spring Tide	$2(M_1+S_2)$	0.652
Neap Tide	$2(M_2-S_2)$	0.176

Figure 2 shows sea level change within synodic month, which was referenced to the sun or phase of moon with a length of 29.53 days. The graph visualized the pattern and the range of tides in the east cost of Male, Maldives. The form factor was derived using the ratio of major tidal constituents (K1+O1) and (M2+ S2). The pattern of tide was mixed semi diurnal with two high tide and two low tides per day with different strength according to the form factor (0.44) classification. The variation of tide was shown within about 6 hours of time period in unequal two cycles for a day (Hicks, 2006).



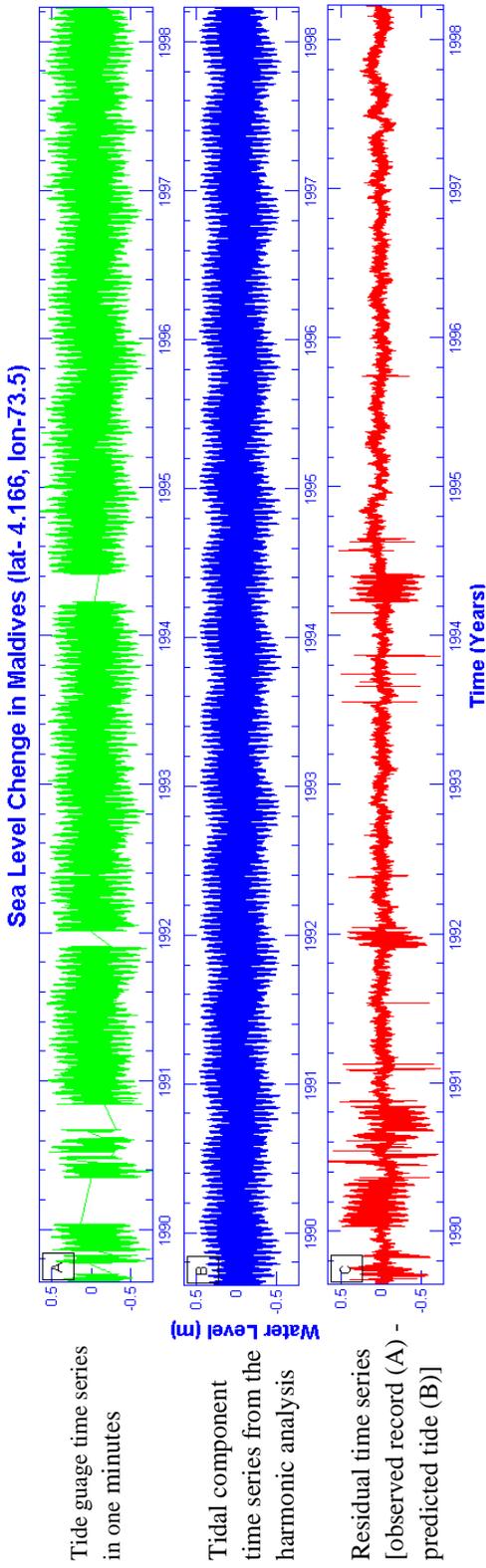


Figure 1: Obtaining of residual sea level vation by separating tidal component

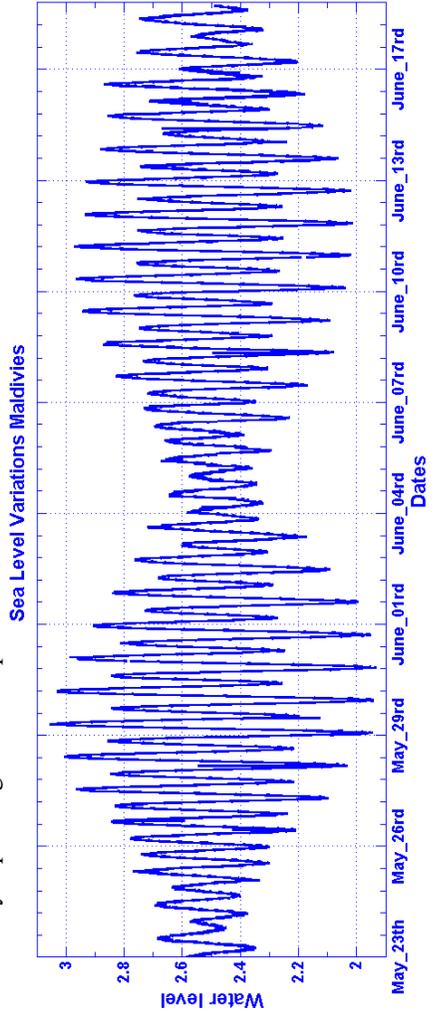


Figure 2: Tide variation within a month period in the east coast of Male, Maldives



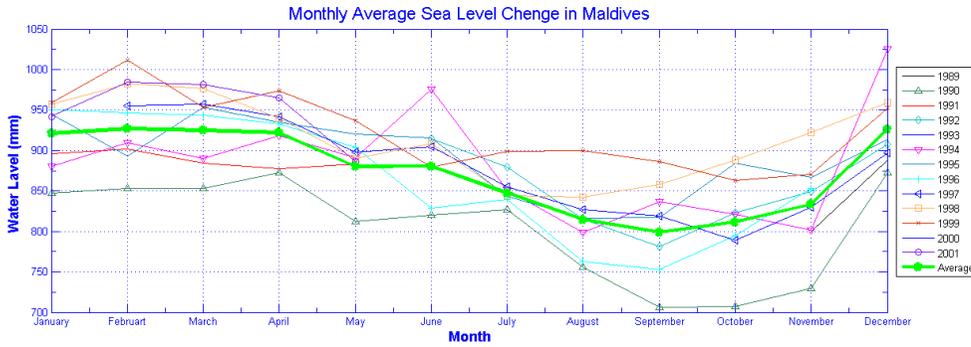
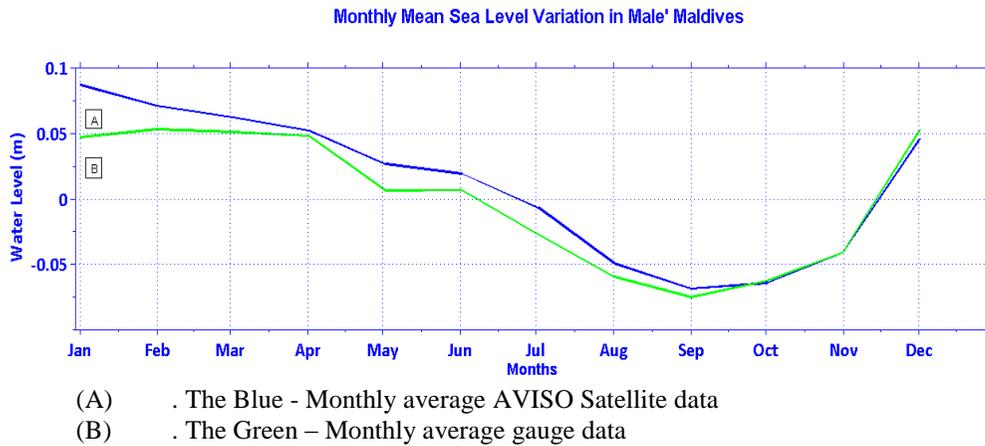
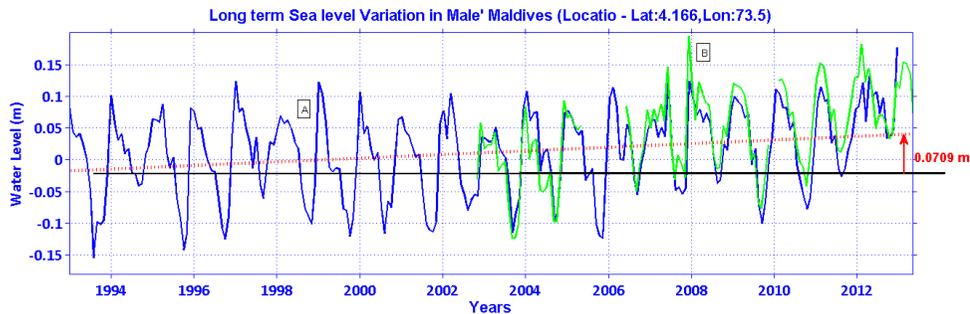


Figure 3: Seasonal sea level variation in the east coast of Male, Maldives



- (A) . The Blue - Monthly average AVISO Satellite data
- (B) . The Green – Monthly average gauge data

Figure 4: Comparison of seasonal sea level Variation in the east coast of Male’ Maldives



- (A) Long term variation plotted using satellite data in the West Coast of Sri Lanka.
- (B) Long term variation using tide gauge data in the West Coast of Sri Lanka.
- (C) The trend of the sea level variation during considered period

Figure 5: Long term Sea level changes in east coast of Male, Maldives. Blue line shows satellites data from 1993 to 2013 and Green line shows tide gauge record from 2006 to 2013.



4 CONCLUSIONS AND RECOMMENDATIONS

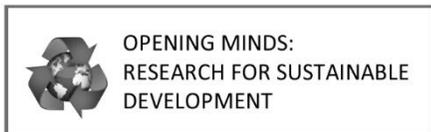
According to tide classification of Hicks (2006), tides on the east coast of Male, Maldives is in the category, 'Mixed Semidiurnal' with two high tides and two low tides per day with different strengths. The spring tidal range and the neap tidal range were 0.652m and 0.176 respectively under the category of 'Micro tide'. In line with the results of Wijerathne (2006), the monthly mean sea level ranged between 8-15 cm. The maximum mean sea level change was recorded between December and January while the minimum level was recorded during September to October where those changes were significantly caused by the 'steric effect'. Long term sea level variation signifies a positive trend of about 3.40 mm per annum which is influenced by the effects of global climate change.

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Nano Structures of Tin (iv) Oxide Coated with Thin Layer of Silica Using Silicic Acid Synthesised from Rice Husk Ash

N.F. Ajward*, J.C.N. Rajendra and V.P.S. Perera

Department Physics, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: nf2010.ajward@gmail.com*

1 INTRODUCTION

The nano structures of composite materials contribute to many device applications due to their novel physical and chemical properties when compared with pure materials. At some specific ratios these materials exhibit unusual characteristics that are not to be seen in pure form (Nupearachchi and Perera, 2014). There is much research done regarding this fact and composite films of semiconductors have been employed even in Dye Sensitized Solar Cells (DSSC) to improve their efficiency. One of the technological developments that took place in DSSCs during the past decades is the replacement of nano-crystalline TiO_2 photo of these cells with composite semiconductor materials where composite happen to consist of either mixtures of two semiconductor materials or semiconductor with some dielectric material as a core shell structure. The study of mixtures of nano crystalline of SnO_2 and ZnO for photo anodes of DSSCs have shown that the efficiency of the composite film of SnO_2/ZnO at 50 % by mass is higher than the films of pure SnO_2 or ZnO (Tennakone *et al.*, 2001). Also SnO_2 and Al_2O_3 were used in various compositions and the research has concluded that the composite film of SnO_2 crystallites coated with ultrafine particles of Al_2O_3 generates an exceptionally high open-circuit voltage when compared to a

cell made only from SnO_2 (Kumara *et al.*, 2001). The research on composite of SnO_2 and MgO demonstrated that the cell fabricated with SnO_2 film only delivered very low photocurrent and photovoltage, while the cell made of SnO_2 and MgO composite delivered a short circuit photocurrent of $\sim 2.5 \text{ mA cm}^{-2}$ with an open circuit voltage of $\sim 500 \text{ mV}$ (Tennakone *et al.*, 2001).

In our previous research study, through the Impedance Spectroscopic (IS) analysis we found that impedance of the film made of 30% of SiO_2 in the SnO_2 and SiO_2 composite exhibited the maximum impedance, which was one order of magnitude higher than the impedance of the SiO_2 film. Even the dielectric loss of the film was minimal at this composition. Therefore, we concluded that the permittivity of the composite reaches a maximum value at this specific ratio of SiO_2 and SnO_2 (Ajward *et al.*, 2016). Even the dielectric loss of these films was minimal at this composition. In that study, nano silica was extracted through the reaction of Rice Husk Ash (RHA) with NaOH followed by acidification. Rice husk is an agricultural waste rich in silica that comprises more than 20%. The carbonaceous compounds in the rice husk can be easily eliminated by burning them



to produce RHA which contain more than 90% of silica.

Here we report on the extraction of silica in RHA by using Sodium hypochlorite (NaClO). NaClO reacts with silica in RHA and Silicic acid could be obtained. Silicic acid is a compound that contains silicon, oxygen and hydroxyl groups. The general formula of silicic acid is $[\text{SiO}_x(\text{OH})_{4-2x}]_n$. In our study, orthosilicic acid has been used to coat a thin film of SiO_2 on nano crystalline films of SnO_2 which will be a prospective photo anode for DSSCs. The composite films were characterized with impedance spectroscopy and Mott-Schottky measurements.

2 METHODOLOGY

2.1 Preparation of RHA and Synthesis of silicic acid

Rice husks collected from a rice mill were washed thoroughly with tap water followed by distilled water and dried in an oven at 120 °C. 100 g of dried rice husks was burnt at 700 °C to obtain RHA. 20 g of RHA was stirred 2 hours with 250 ml of sodium hypochlorite solution at temperature of 80 °C. Then it was left to cool down to room temperature and filtered. The filtrate was crystallized by using the rotary evaporator. The crystals were grinded using agate mortar and pestle. 1.20 g of this powder containing Silicic acid was dissolved in 100 ml of distilled water.

2.2 Deposition of SnO_2 films on CTO glass plates

2.6 g of SnO_2 (particle size 20 nm, Alpha Acer) was mixed with 1.5 g of ethyl cellulose and 5.9 g of α -terpineol. The mixture was grinded 20 minutes using a mortar and pestle. The paste was spread by doctor blade method on the Conducting Tin Oxide (CTO) glass plates cut into the size of 1.5cm \times 3cm which were cleaned in an ultrasonic bath using detergent and

distilled water prior to the deposition. After that the SnO_2 coated films were dried on a hot plate and sintered in a furnace at 450 °C for 30 minutes.

2.3 Coating thin SiO_2 layer on SnO_2 films

The prepared SnO_2 films were dipped in 10 ml of silicic acid solution for 30 minutes and the plates were kept on a hotplate at a temperature of 70 °C for drying and they were sintered in a furnace at 450 °C for 30 minutes.

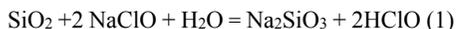
2.4 Characterization techniques of the films

Deposited films were electrochemically characterized by impedance spectroscopic measurement techniques. The shift in the flat band potential of the SnO_2 films after coating SiO_2 layer was determined with Mott-Schotky measurements. The charge transfer resistance of the films was calculated by potentiostatic measurement of impedance in the frequency range 0.1 Hz to 1 MHz using Auto Lab FRA 32.

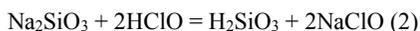
3 RESULTS AND DISCUSSION

3.1 Reaction chemistry

When RHA is reacted with sodium hypochlorite, sodium silicate is produced dissolving silica in RHA according to the following reaction.



Hypochlorous acid formed in this reaction bring down the pH of the medium to a lower value. Since hypochlorous acid is a weak acid, sodium silicate produced in equation (1) converts into orthosilicic acid as in the following reaction.



But when we consider both the reactions together, overall reaction is to produce orthosilicic acid according to the following reaction by hydrogenation of



silica which is the natural occurring process of silicic acid in the earth's crust.



Although silicic acid can be produced by acidification of sodium silicate, it readily loses water to form polymeric silica gel. But that is avoided here because Hypochlorous acid is a weak acid. But if we keep this aqueous solution exposed to air for several days, precipitation of SiO_2 at the bottom of the container could be noticed. Therefore, immediately after the dissolution of silica, water has to be removed to obtain the white powder containing orthosilicic acid. This powder completely dissolved in water, indicating that the removal of water does not convert the silicic acid in the powder to silica. However, there can be unreacted sodium

hypochlorite contained in this white powder.

3.2 Determination of flat band potential

The shift in the flat band potential of the SnO_2 films after coating SiO_2 layer was determined with Mott-Schottky measurements. Figure 1 shows the flat band potential of SnO_2 film and SnO_2 film after coating a thin layer of Silica by dipping the SnO_2 coated films in a solution containing orthosilicic acid. Measurements were taken changing the biasing voltage for two frequencies of 1000 Hz and 2000 Hz.

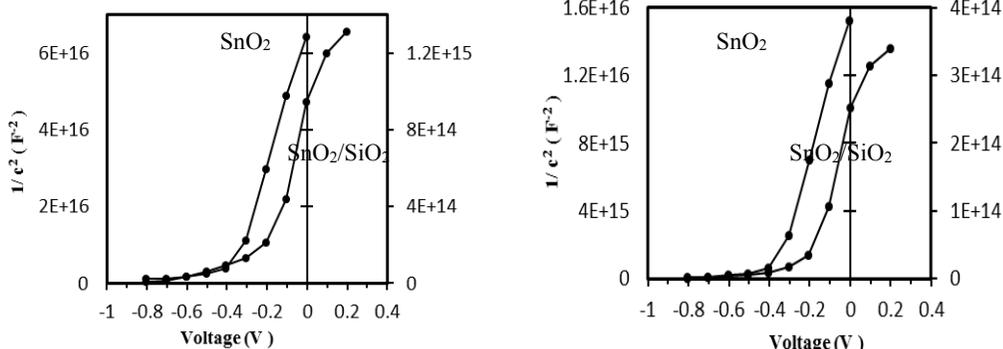


Figure 1: Mott-Schottky plots of SnO_2 films and SnO_2 films coated with SiO_2 layer measured with (a) 1000 Hz and (b) 2000 Hz frequencies.

The Mott-Schottky relationship involves the apparent capacitance measurement as a function of potential under depletion condition given by the equation,

$$\frac{1}{C^2} = \frac{2}{\epsilon\epsilon_0 e N_d} \left[(V - V_{FB}) - \frac{kT}{e} \right]$$

where, C is the capacitance of the space charge region, ϵ is the dielectric constant of the semiconductor, ϵ_0 is the permittivity of free space, N_d is the donor density, V is the applied potential, V_{FB} is the flat band potential, k is the Boltzmann Constant, and T is the absolute temperature. The donor density can be calculated from the slope of the $1/C^2$ vs. V curve, and the flat

band potential can be determined by the intersection point of the graph with the voltage axis. It can be clearly seen that the flat band potential of SnO_2 films after coating a thin layer of SiO_2 shifts towards more positive potentials with respect to the Ag/AgCl reference electrode. The flat band potential of SnO_2 film is at -0.32 V and it is at -0.28 V when thin layer of SiO_2 was coated. These values are same for the both frequencies, i.e. for 1000 Hz and 2000 Hz used in this measurement.

3.3 Charge transfer resistance

Nyquist plots for SnO_2 films and SnO_2 films coated with SiO_2 layer are shown in figure 2. It is obvious that the charge transfer resistance of the film at the



electrolyte interface increase after coating a thin layer of SiO₂.

The impedance of the SnO₂ film alone is about 40 KΩ and it is about 100 KΩ when thin layer of SiO₂ was coated on SnO₂ film. By coating a thin layer of SiO₂ on the

films of SnO₂ supposed to suppress recombination of electrons in conduction band of SnO₂ with the reducing agents in the electrolyte. Therefore, these films could be employed in DSSCs as prospective photo anodes to increase their efficiency.

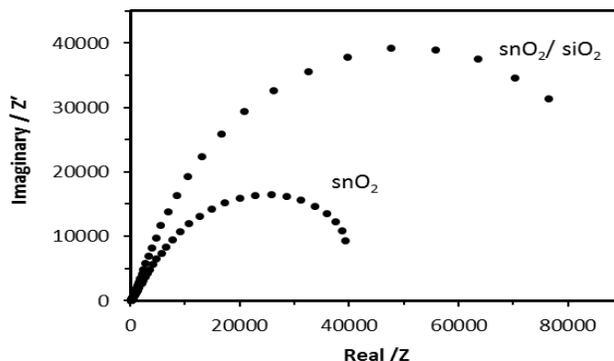


Figure 2: Nyquist plot of (a) SnO₂ films and (b) SnO₂ films coated with SiO₂ layer

4 CONCLUSIONS

Orthosilicic acid was synthesized reacting rice husk ash with sodium hypochlorite. A thin layer of silica is coated on nano crystalline SnO₂ films by dip coating silicic acid on SnO₂ films. Coating thin layer of SiO₂ on SnO₂ nano crystallites films shift the band gap of SnO₂ films by 0.04 mV. The Nyquist plots of the films reveal that the charge transfer resistance of the film is also increased two-fold. These surface modified films are prospective candidates for photo electrodes of DSSCs.

Acknowledgments

The authors wish to thank the faculty of Natural Sciences of the Open University of Sri Lanka for the financial support.

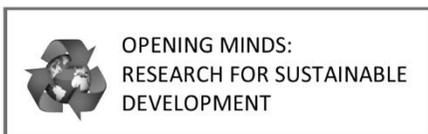
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Construction of Dye Sensitized Solar Cell Using Natural Dye Extraction from Petals of *Erabadu* Flower

G. C. Wickramasinghe*, D.L.N. Jayathilaka and V.P.S. Perera

Department Physics, The Open University of Sri Lanka, Nugegoda, Sri Lanka

**Corresponding author: Email: gim.chathu@gmail.com*

1 INTRODUCTION

In the present century demand for energy has risen immensely whilst the world is left with a handful of energy sources. With the industrialization of world many products demand more energy for their operations with new technologies (Rosana *et al.*, 2014). This demand for energy and deficit of naturally existing resources has paved the way to introduce or invent new technologies to equalize the demand and supply of the energy requirements. One such method is to convert solar energy directly to electrical energy by using Dye Sensitized Solar Cells (DSSCs).

Solar power is the most abundant, plentiful and economical source available with relatively minimum constraints. Capability of utilizing the total energy in the visible spectrum is one of the factors which determines the efficiency of DSSC. Therefore dye sensitizer in DSSCs plays an important role for harvesting solar energy and converting it to electrical energy with the aid of a high band gap semiconductor photoanode. Thus cell performance mainly depends on the type of dye used as the sensitizer (Monzir *et al.*, 2015). Organic and organo-metallic dyes are used as dye sensitizers in DSSCs. Synthesis of organo-metallic dyes is more expensive than the organic dyes. In this context the use of natural dyes that are suited for DSSCs to work efficiently is

one of the most economical ways to get electricity from DSSCs.

In this research we found that DSSC are more approachable and low cost by replacing the currently used synthetic dyes with a natural dye. The dye used here is eco-friendly, cost effective and reachable (Neil, 2006; Calogero *et al.*, 2009). In this study a dye is extracted from the petals of the Erabadu (*Erythrina fusca*) flower to aqueous media and used as a sensitizer in DSSCs.

2 METHODOLOGY

2.1 Preparation of Natural dye solution

30 g of Petals of Erabadu flower were cut into small pieces and boiled with 100 ml of distilled water in a beaker on a hot plate at 150 °C until the appearance of pieces of red petals turned to pale pink colour. After that the dark purple colour of dye extracted from Erabadu petals was collected into an amber coloured bottle and it was stored in the refrigerator at 4 °C until use. Mixture of dye solution was prepared by adding 1 ml of acetic acid and 0.5 ml of ethanol into 6 ml of dye extraction in a test tube.



2.2 Optical characterization of the dye

The analysis of chemical functional groups of the dye extracted into distilled water were characterized using FTIR spectroscopy after removing the water and the moisture. The absorption spectrum of extracted pigment in the aqueous solution were obtained using UV-Vis spectrometer.

2.3 Fabrication of the DSSC

Fluorine Doped Tin Oxide (FTO) conducting glass sheets in the size of 1.5 cm × 3 cm were cleaned respectively by using tap water, detergent and distilled water for 5 minutes at each step in an ultrasonic bath and dried. After cleaning, adhesive tape was applied on the conducting side opening 1 cm² on the glass plates to restrict the size and the thickness. Titanium dioxide (TiO₂) paste was prepared by using the commercial TiO₂ powder (Degusa P25). 0.5 g of TiO₂ powder was ground in a porcelain mortar and 0.1 ml of acetic acid, 0.2 ml of ethanol, 1 drop of terpenol and 1 drop of triton-x-100 was added. The mixture was ground for 15 minutes in a mortar using a pestle until a thick paste was obtained. The paste was spread on the open area of the conducting glass sheets by the doctor blade method. Then after removing the adhesive tapes, TiO₂ Film on the glass sheets were sintered in a furnace at 450 °C for 30 minutes. After cooling down the sintered TiO₂ film, they were immersed in the dye solution in the test tube for 12 h. Finally electrode was withdrawn from the dye solution and dried to be used as the photo electrodes.

Counter electrode was prepared by coating chloro platonic acid in ethanol solution (0.05 M) on conducting side of the FTO glass sheet and sintering in a

furnace at 450°C for 30 minutes. To prepare the electrolyte for DSSCs, 0.83 g of potassium iodide (KI) and 0.127 g of iodine (I₂) were added into 10 ml volumetric flask. Then solution containing acetonitrile and ethylene carbonate at 8:2 ratios were added into the flask and stirred until the complete dissolution of solid materials.

The conducting side of counter electrode and dye coated TiO₂ film were placed face to face and held with clamps. The capillary space in between the two electrodes was filled with the electrolyte.

2.4 I-V Measurements of the cell

The photovoltaic measurements of the DSSCs were taken under 100 mW cm⁻² light illumination using a computer controlled galvanostat/potentiostat (Autolab) with the help of Nova 2.1 software.

3 RESULTS AND DISCUSSION

3.1 UV-visible absorption spectrum

The absorption spectrum of pigments in petals of Erabadu flower is shown in figure 1. The absorption measurement was carried out in the visible range from 400 nm to 800 nm. The peak corresponds to maximum absorption was found around 500 nm. The absorption of the dye was spread throughout the range from 400 nm to 620 nm.

3.2 FTIR absorption analysis

FTIR absorption spectrum of the dye extracted from petals of Erabadu flower is shown in figure 2. FTIR spectra for the natural pigment in the dye extraction was recorded in the range from 600nm to 3900nm. A strong band at 3288 cm⁻¹ is due to the -OH stretching and broad absorption in the range from 3035 cm⁻¹ to 3736 cm⁻¹ is for wide variety of hydrogen



bonding. The peak around 1045 cm^{-1} indicates the presence of C-O-C bonds. Therefore hydroxyl groups of pigment molecules in dye extraction of petals of Erabadu is possibly contributing to attach the pigment to the TiO_2 photo anode.

investigations are needed to identify the pigment in the Erabadu petals which is responsible for the sensitization of TiO_2 photo anodes that is supposed to be an anthocyanin dye with the present available information.

3.3 IV characteristic of the DSSC

The photovoltaic performance of photochemical cell under 100 mWcm^{-2} light illumination is illustrated in Figure 3. The photocurrent and photovoltage of FTO/ TiO_2 /dye /electrolyte /pt cell were respectively 966 μA and 459 mV. Fill factor and efficiency of the cell were calculated using IV curve were 45.8 % and 0.21 % respectively. Further

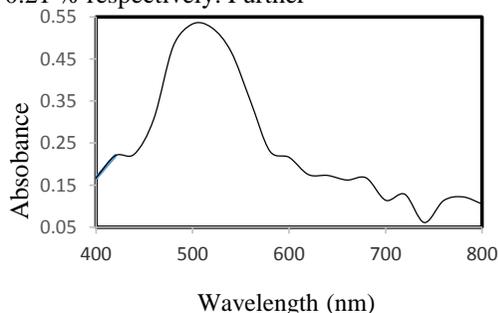


Figure 1: UV- Visible absorption spectra of natural pigment extracted from petals of Erabadu flower in distilled water.

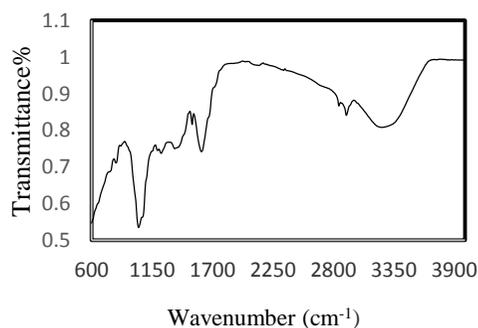


Figure 2: The FTIR spectra of the dye from petals of Erabadu flower

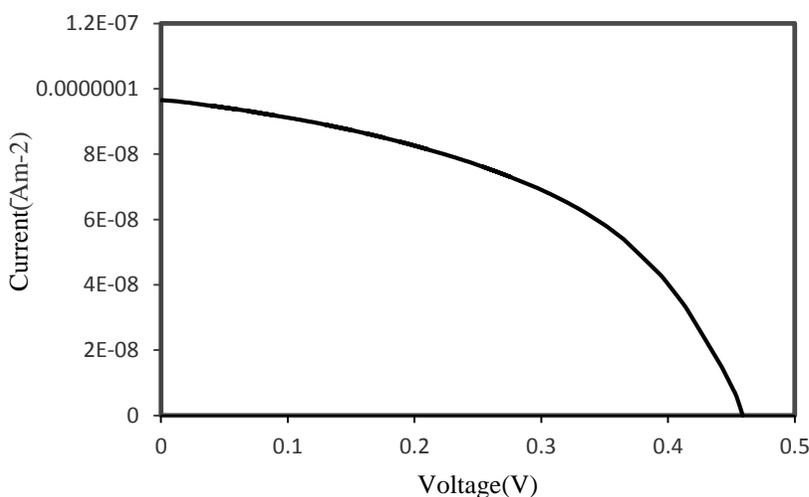


Figure 3: I-V characteristic curve of DSSC coated with the dye extracted from petals of Erabadu flower.

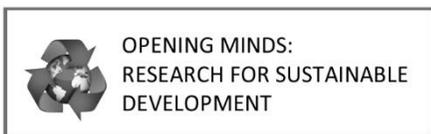
4 CONCLUSIONS

UV- visible absorption spectrum of the dye extracted from petals of Erabadu (*Erythrina fusca*) flower into aqueous medium broadly extend in the visible region where the maximum is at around 500 nm. The existence of the hydroxyl groups were confirmed by the FTIR measurements. The pigment absorbs visible light in a wide range. The efficiency of the photochemical cell fabricated using this dye with the configuration FTO/TiO₂/dye/electrolyte/Pt was 0.21%.

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Challenges of Space Debris and Site Selection Criteria to Install Optical Telescope to Observe Space Debris in Sri Lanka

T. Chandana Peiris*

Arthur C Clarke Institute for Modern Technologies, Katubedda, Moratuwa., Sri Lanka

**Corresponding author: Email: gim.chathu@gmail.com*

1 INTRODUCTION

Since the Soviet Union launched the world's first artificial satellite, Sputnik 1, in 1957, thousands of satellites have been sent into space to orbit around the earth. Today, thousands of active satellites are in place in mainly Low Earth Orbit (LEO), Medium Earth Orbit (MEO), Geostationary Orbit (GEO) and High Earth Orbit (HEO).

The usages of satellite for different purposes include earth observation/remote sensing, communication, military, surveillance, navigation and earth science/meteorology, astrophysics, etc. All man-made satellites launched since 1957, which no longer serve a useful purpose are known as space debris. These space debris continuously collides with each other and starts a chain reaction that generates more junk. Their increasing growth has become a threat to the operational satellites and spacecraft. Even 1 cm space debris could cause severe damage to a valuable satellite with a force of a hand grenade. Aside from threatening satellites it poses a danger to a long-term orbital mission like the International Space Station, hence this situation could cause serious problems for future space launches.

Mitigation and removal are the main two ways to reduce space debris. Reducing the creation of new debris is known as "Mitigation", whereas "Removal" means amputating space debris either naturally or actively. Natural removal can occur by atmospheric drag and active removal can be by human-made systems. Trajectories,

altitude and size of each and every space debris item must be analyzed for the active removal from human-made system. Space debris need to be detected and catalogued either using Radar or Optical measurements for the safety of operational satellites.

The main objective of this research paper is to identify the most suitable site to establish a new Optical Telescope to initiate space debris observation in Sri Lanka. Five convenient locations were selected. The target is to identify the optimum location to fix the Optical Telescope, while evaluating all five locations under the Technical, Infrastructure, Incentive and Financial factors. With the use of an Optical Telescope debris can be detected when the debris object is in the sunlight while the sky background is dark. The project planned to observe debris in geosynchronous orbit because the observation can continue during the entire night. Debris at LEO are the closest to earth, but difficult to concentrate because observation period is limited to an hour or two just after sunset or before sunrise.

These facilities can be used to observe asteroids, which are harmful to the earth and minor planets also.



2 METHODOLOGY

Sri Lanka is divided into three climate zones base on rainfall. These climate zones are designated as Wet zone, Dry zone and Intermediate zone. Five convenient locations were selected in order to choose the best location to establish an observatory for the proposed optical observation for searching space debris. Three sites were from the Dry zone and two sites from Intermediate zone. Among the selected sites, three sites are situated at national universities and the other two sites situate at national wildlife parks. Namely the sites are Rajarata, Wayamba, Sabaragamuwa universities, Maduruoya and Wilpattu.

The main objective is achieved based on the available literatures, data sets and gathered information from the astronomers and educated civilians at the selected locations.

Based on the literature the present study has identified four key areas to be assessed in the locations using the data collected by various methods. They are, “Technical factors” extended by the main technical requirement for optical observations, the “Infrastructure factors” available infrastructure to establish an observatory easily, the “Incentive factors” pertaining to acquisition of land and requirement of human resources to carry out continuous optical observations and “Financial factors” to build up the observatory and

continuous operation and maintenance cost. Finally, analysis of all factors led to the selection of the best site to establish the optical observatory for the space debris observations.

Data captured through various methods was tabulated and then were ranked using a qualitative classification having four class groups identified as Threshold (Very High), High, Medium and Low. The qualitative classification of the quantitative data captured was judgmental. Past experiences were also utilized for the assessment of each and every site.

Each class identified as Threshold, High, Medium and Low was then assigned a numerical value as 5, 3, 2, and 1, respectively. This enabled the identification of corresponding percentages indicators ranging from 0 - 100%.

3 RESULTS AND DISCUSSION

Fourteen sub factors were considered under the four main factors to find a suitable location to establish an optical telescope observatory to initiate space debris research in Sri Lanka. Past as well as the most recently available data of different five sites were carefully analysed.

Annual rainfall, clear night, particle scattering and light pollution were considered under the Technical Factors.

Table 1: Figures which has considered under the technical factors

	Annual Rainfall (mm)	Clear Night/Year	Light Pollution (10^{-9} W/cm ² * sr)	Annual Temperature Variation (°C)
Rajarata University	1200	High	1.5	4
Wayamba University	1400	High	1	4
Maduruoya	1600	Very High	0.3	4
Wilpattu	1200	Very High	0.7	4
Sabaragamuwa University	2300	Moderate	1	4



In 2011 the US National Oceanic and Atmosphere Administration (NOAA) launched the Suomi NPP satellite with camera called Visible Infrared Imaging Radiometer Suite (VIIRS). Using these data they published Light Pollution Map of the world. The light pollution data of the selected areas were calculated from this map.

Sri Lankan climate mainly depends on the monsoon and the rainfall pattern, the number of photometric cloudless sky condition directly related with the monsoon season. For astronomers, amateur or professional, the percentage of photometric nights is a key factor when deciding where to build an observatory for optical observations. The temperature differs slightly depending on the seasonal movement of the sun in Sri Lanka and particle scattering is not a key factor for space debris observation. Artificial light at night is one of the key factors influencing optical observations. Wilpattu and Maduruoya sites are the best places considering only Light Pollution maps. With the consideration of Technical Factors the best place is Wilpattu to establish the new observatory to initiate space debris observations. The second best place is Maduruoya and third best place is Rajarata University.

Site selections for the telescope become more complex with consideration of infrastructure, incentive, and financial factors. Security, road, power and internet facilities were considered under the Infrastructure Factors. Security becomes an added issue and important for the operation of any observatory. If the observatory situated in the national park the situation becomes worse and it is necessary to take actions to protect observatory from wild animals. Road access facilities and internet coverage are not available at the Maduruoya and Wilpattu sites while readily available at the other three sites situated at the national

universities. New roads have to be constructed if either Maduruoya or Wilpattu is selected.

Electric Power is another most essential key factor for the operation of the research equipment and other infrastructure requirements. Power is not available at the national wild life parks sites situated at Maduruoya or Wilpattu, and it would require alternative energy sources to generate electricity. Possible alternative energy sources are either solar or environment friendly low noise generator to fulfil the power requirement of the observatory. All sites at national universities have electric power facility.

With the consideration of infrastructure factors good sites are Rajarata University, Wayamba University and Sabaragamuwa University, to establish a new observatory to initiate space debris observations. Maduruoya and Wilpattu sites represent very low rank for infrastructure availability.

Acquisition of land, disasters, accommodation for observers and maximum usage possibility were considered under the Incentive Factors.

Allocation of land to build an observatory at the wild life conservation national park is extremely difficult, as national parks are reserved by the government of Sri Lanka for conservation of wildlife heritage for present and future generations.

Sri Lanka is mostly affected by natural disasters. Floods are mostly due to monsoonal rain. Wilpattu site is flooded during monsoon seasons. Buildings and other infrastructures must be built considering the flooding situation. Lodging facilities for observers is also very important. If a site selected to build observatory is at national park, food, accommodation and transport for observers is a big challenge. There are no



such challenges if the site is situated at any university premises.

Present government promotes research with collaboration of government sector, universities and private sector. This project plans collaborate with the International Scientific Optical Network (ISON), Russia and one of the national universities in Sri Lanka. Hence this is a great opportunity to involve in international research for university students in Sri Lanka. Rajarata University is conducting B.Sc. - 4 year degree in Chemistry and Physics. Sabaragamuwa University is conducting B.Sc. (Applied Sciences) Special Degree in Applied Physics (4 years). The students of these two universities and other interested university students can get involved for the research if the observatory is situated within a university.

Rajarata University or Sabaragamuwa University is the best site considering incentive factors.

Initial cost, operation and maintenance is high if the observatory is to be built at either Maduru oya or Wilpattu national parks. The cost is comparably low if the site is to be built at any site in either of the national universities.

Most of the developed countries have built optical observatories to observe space debris managing the light pollution. Light pollution is worse in developed countries than in Sri Lanka. One best example is the Bisei Spaceguard Center, Bisei, Japan where the light pollution is $1.5 \times 10^{-9} \text{ W/cm}^2 \cdot \text{sr}$, which is very similar to Rajarata University or Sabaragamuwa University, Sri Lanka. One of the main objectives of the Bisei Spaceguard Center is to discover new asteroids and space debris. Zimmerwald Observatory, Switzerland where the light pollution is $3 \times 10^{-9} \text{ W/cm}^2 \cdot \text{sr}$, which is used for searching minor planets and space debris.

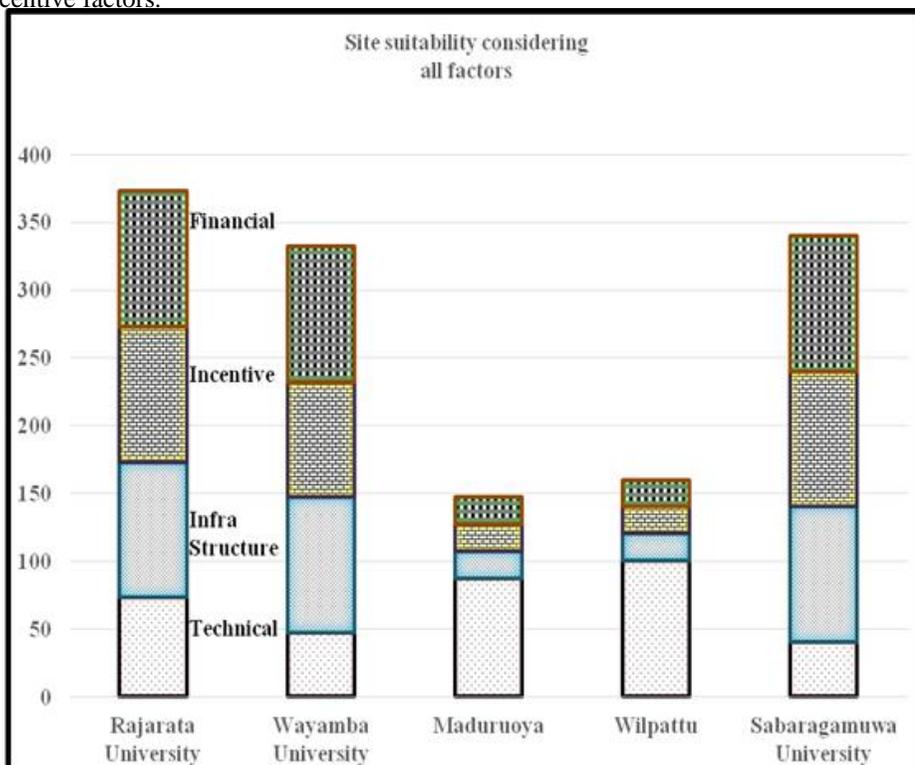


Figure 1: Rank of selected locations considering all fourteen Factors



4 CONCLUSIONS AND RECOMMENDATIONS

Deterioration of space environment with space debris is becoming a serious problem. To protect active satellites in orbits, space debris must be precisely monitored before taking any actions for its removal. Ground based telescope can detect GEO debris down to 10 cm in size and can be analysed based on the trajectories and altitude of GEO debris.

To select the most suitable location to install an optical telescope is very important and more complex when considering Technical, Infrastructure, Incentive and Financial factors for the selected three locations from Dry Zone and two locations from Intermediate Zone in Sri Lanka. Three locations are situated at national universities, which are Rajarata, Wayamba and Sabaragamu universities and other two locations are national wildlife parks which are Maduruoya and Wilpattu. This paper describes the methodology which was carried out for the site selection survey.

Considering all factors in qualitative and quantitative classification the best location is Rajarata University to establish an optical telescope for the observation/discovering the available or new asteroids / space debris or minor planets. The second best location is Sabaragamuwa University. Figure 1 indicates the rank of selected locations considering all fourteen factors.

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S. Sankalpa^{1*}, U. Ekanayake¹ and Ruwan Punchi-Manage²

¹*Department of Physical Sciences, Rajarata University, Sri Lanka*

²*Department of Statistics and Computer Science, University of Peradeniya, Sri Lanka*

*Corresponding author: Email: toshashirana@gmail.com

1 INTRODUCTION

Employees are considered as one of the key elements of an organization. Success of an organization vastly depends on the Employees contributions to the organization. However, employee contribution to the organization depends on his/ her job satisfaction. Locke (1976) defines job satisfaction as "a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences". Especially in the Banking sector, where employees are more susceptible to routine work this may increase the level of dissatisfaction. If employees are not satisfied with their job then it may increase cost, reduce efficiency of the work flow, decline turnover (or profit), and waste time (Zeffane et al. 2008) and also result in customer dissatisfaction. Mike Jeram proposed that promotions and personal professional development of employees will be useful to gain competitive advantage over their competitors. Sowmya and Panchanatham (2011) and Devi and Suneja (2013) performed studies to identify the job satisfaction of employees in private sector and public sector banks while others investigated overall job satisfaction associated with demographic factors (Jahufer, 2015). In

this study, we investigate the effect of factors on the job satisfaction of employees in the Banking sector (Sri Lanka). Our objectives are to analyse the effect of economic factors (i.e. Net salary, Monetary benefits, Non-monetary benefits, Retirement monetary and non-monetary benefits, Recreational facilities), demographic factors (i.e. Gender, Age, Marital states, Religion, Educational level, Distance, Number of dependents), organizational factors (i.e. Freedom to use own judgments, Job rotation, Recreational facilities, Monotonous duties assign in the job, Experience in banking sector, Work load) and social factors (i.e. Relationship with the Boss, Relation among co-workers, Personal and family problem, Psychological stress, social status).

2 METHODOLOGY

2.1 Questionnaire design

There were 32 questions in the questionnaire. The questionnaire was structured into two sections. Section-1 consisted of demographic information and section-2 collected information on economic factors, organizational factors,

and social factors in a five-point scale (extremely satisfied, very satisfied, satisfied, not satisfied and highly dissatisfied). The questions were designed to facilitate the respondents to identify the various variables contributing towards Job satisfaction of employees.

2.2 Study area and the data collection scheme:

The total sample size was 150. The questionnaire was handed over to the employees in four banks in the private sector and three banks in the public sector in the Kandy district. Sample size was selected in a way that includes all types of employees in the banking sector (see Table 1). 75 employees from each sector were selected.

Table 1: Sample proportions sector and staff grade.

Banking Sector in Kandy District (Sample size %)	Staff Grade
Public Sector (50%)	Staff Assistant Level (60%)
	Executive Level (30%)
	Management Level (10%)
Private Sector (50%)	Staff Assistant Level (60%)
	Executive Level (30%)
	Management Level (10%)

2.3 Multinomial logistic regression:

We performed correlation test, independence test, and multinomial logistic regression analysis. In our study Y_{ik} is the satisfaction level ($k = 1, 2, \dots, 5$) of the i^{th} individual that can take one of the several discrete values.

$\pi_{ik} = \Pr\{Y_{ik} = k\}$ denotes the probability that the i^{th} individual falls in the k^{th} category. Therefore, Y_{ik} is an indicator variable with two values either zero or one. Multinomial logistic regression uses a linear predictor function;

$$\ln\left(\frac{\pi_{ik}}{\pi_{ib}}\right) = \beta_{0,k} + \beta_{1,k}x_{1,i} + \beta_{2,k}x_{2,i} + \dots + \beta_{31,k}x_{31,i}$$

Where b denotes the baseline category.

$$\Pr(Y_i = k) = e^{\beta_k X_i} / \sum_{k=1}^K e^{\beta_k X_i}$$

Analysis was performed using R (R Core Team, 2017).

3 RESULTS AND DISCUSSION

Figure 1 shows correlation among variables (highly correlated variables are shown in dark blue (positive) and dark red colors (negative)).

Y	Job Satisfaction
X1	Sector
X2	Gender
X3	Age
X4	Marital state
X5	Religion
X6	Education level
X7	Present position
X8	Current position experience
X9	Banking sector experience
X10	Distance
X11	Dependents
X12	Come from home
X13	Net salary
X14	Feeling social status
X15	Monetary benefit
X16	Non-monetary benefits
X17	Retirement monetary
X18	Opportunity use skills
X19	Work environment
X20	Promotion opportunities
X21	Union activities
X22	Training programme
X23	Work load
X24	Job rotation



X25	Job freedom	X28	Relationship of co-workers
X26	Recreational facilities	X29	Personal and family problems
X27	Boss-subordinate relationship	X30	Monotonous duties
		X31	Psychological stress

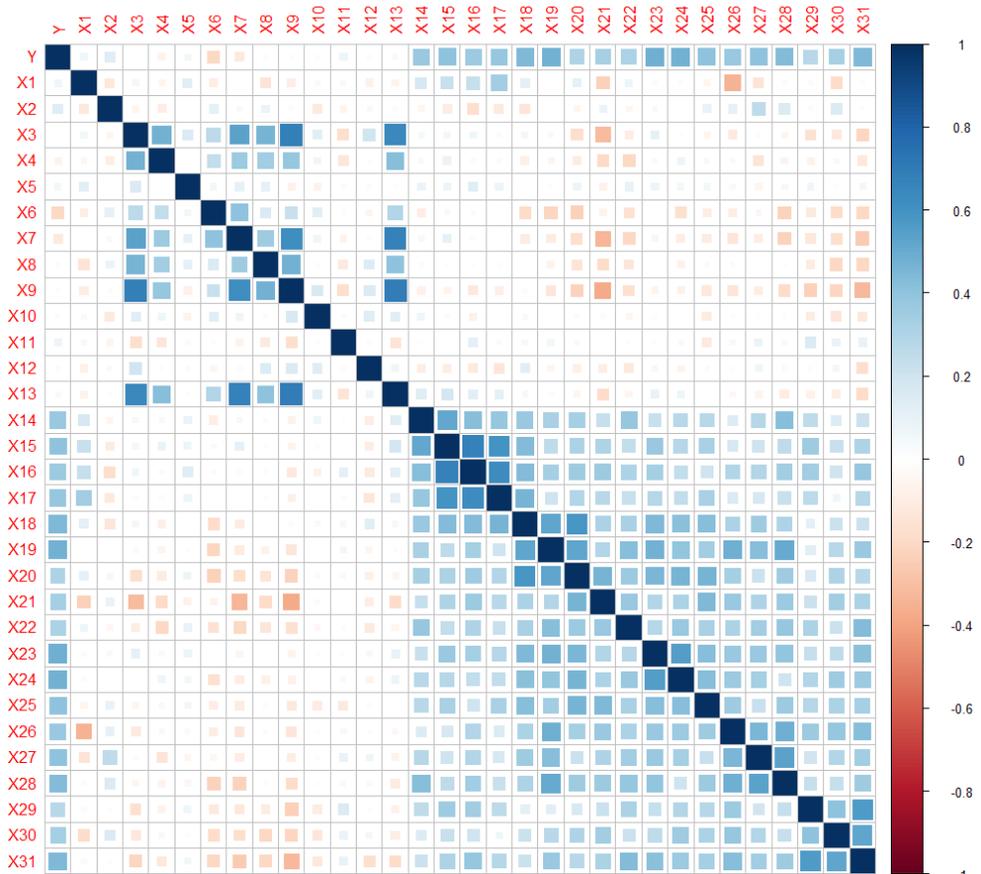


Figure 1: correlation matrix for 32 variables (one response and 31 explanatory variables)

Variable	Description	P-value	
X1	Sector	0.03247	*
X8	Current position experience	0.02452	*
X11	Dependents	8.39×10^{-12}	***
X14	Feeling social status	1.41×10^{-6}	***
X15	Monetary benefit	0.000124	***
X16	Non-monetary benefits	0.0003988	***
X17	Retirement monetary	1.44×10^{-5}	***
X18	Opportunity use skills	3.06×10^{-8}	***
X19	Work environment	4.46×10^{-9}	***
X21	Union activities	3.32×10^{-7}	***
X22	Training programme	0.003935	**
X23	Work load	8.11×10^{-11}	***
X24	Job rotation	1.08×10^{-8}	***
X25	Job freedom	7.48×10^{-6}	***
X26	Recreational facilities	7.90×10^{-7}	***
X27	Boss and subordinate relationship	3.46×10^{-11}	***
X28	Relationship among co-workers	1.69×10^{-6}	***
X30	Monotonous duties	4.02×10^{-6}	***
X31	Psychological stress	7.89×10^{-11}	***

Table 1. Chi-square independent test for variables

Note: Only significant results were shown * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 2: Multinomial logistic regression model coefficients

Explanatory variable	Level	Response variable (Satisfaction)			
		2	3	4	5
Intercept		-11.02	-20.85	-21.40	-18.22
Marital	4	-13.69***	-1.46***	12.50***	1.20***
Religion	3			-6.89***	-0.19***
Religion	4	30.34***	-11.76***	1.55***	
Dependents	3			-2.34***	-1.26***
Dependents	5			-11.64***	19.43
Social status	4		8.27***		
Monetary benefit	4				2.36***
Non-monetary benefits	5				0.60***
Retirement benefits	2				-2.34***
Skills	5	2.02***			-0.27***
Environment	5		5.70***		
Promotion	2			-2.47***	
Work load	5				-5.99***
Job rotation	5	-10.89***		-4.78***	
Relationship workers	co- 5		0.61***		

Note: only significant results were shown ** $p < 0.05$: *** $p < 0.01$



Table 2 presents logit coefficients relative to the baseline category. For example, if workload increases by one unit then logit coefficient for extremely satisfied employee relative to extremely unsatisfied

will decrease by 5.99. Initially we had very large values for relative risk ratios. We divided the coefficients by 100 to get the values in Table 2.

Table 3. Relative risk ratios for multinomial logistic regression (significant results*)

<i>Explanatory variable</i>	<i>Level</i>	<i>Response variable (Satisfaction)</i>			
		<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Marital	4	0.872***	0.986***	1.133***	1.012***
Religion	3			0.933***	0.998***
Religion	4	1.354***		1.016***	
Distance	4			1.001***	
Dependents	3			0.977***	0.988***
Dependents	5			0.890***	
Social status	4		1.086***		
Monetary benefit	4				1.024***
Non-monetary benefits	5				1.006***
Retirement benefits	2				0.977***
Skills	5	1.020***			0.997***
Environment	5		1.059***		
Promotion	2			0.976	
Work load	5				0.942***
Job rotation	5	0.897***		0.953***	
Relationship workers	co- 5		1.006***		

Table 3 presents relative risk ratios. For example, keeping all other variables constant, if workload increases by one unit, an employee is 0.942 times more likely to stay in the extremely satisfied category compare to extremely unsatisfied category.

4 CONCLUSIONS AND RECOMMENDATIONS

Our results indicate that promotion, monetary benefits, job rotation, skill enhancement, retirement benefit, relationship with co-workers and environment can increase the level of job satisfaction of an employee significantly. When hiring an employee it is worthwhile for the organisation to consider employees marital status and distance to

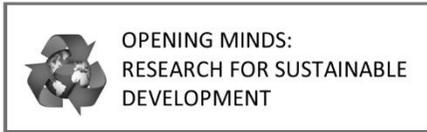
workstation. In our study we had 32 variables each having at least two groups. Our sample size is 150. Usually multinomial logistic regression needs larger sample sizes than the binary logistic models. Large relative risk ratio values arise due to complete or quasi-complete separation (Hauck-Donner effect) or small sample sizes where model become unstable due to very few or zero cases in most of the cells of the cross tabulation table.



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Temporal Patterns Analysis of Paddy Production in Sri Lanka

N.B.W.I. Udeshika* and T.M.J.A. Cooray

University of Moratuwa, Katubedda, Sri Lanka

**Corresponding author: Email:imaliudeshika88@gmail.com*

1 INTRODUCTION

Rice is the main crop cultivated by the majority of farmers in rural areas and it is the staple food of approximately 20 million inhabitants in Sri Lanka. Hence, rice sector makes a significant contribution to the economy of Sri Lanka. About 30% of the crop sector contribution to the agricultural GDP (Gross Domestic Product) is from the rice sector. Approximately 800,000 farm families, which are about 20% of the population, depend on paddy cultivation for their livelihood (Statistics. (2017).

In Sri Lanka paddy cultivation is mainly divided into two seasons (time periods) known as “Maha” and “Yala” which are associated with the two monsoons. Maha season is the main season in paddy cultivation associated with the north-east monsoon during the period of September to March. Yala is the secondary season which is associated with south-west monsoon during the period of May to August (Statistics. (2017). However, the whole area devoted for paddy is not being cultivated due to number of reasons such as shortage of water during the seasons, the prevailing unsettling conditions on the ground, etc.

2 METHODOLOGY

2.1 Seasonal Autoregressive Integrated Moving Average (SARIMA) Model

Log transformation is applied to the data series to remove the non-constant variance of the series. Four SARIMA models are developed for log transformed series. Numerous statistics such as AIC, SBC, R^2 , DW are used to identify the most adequate model among formed SARIMA models. Validity of the assumptions of the fitted model are checked by considering results of the hypothesis tests specifically; Box –Pierce test, Serial Correlation LM Test and Histogram Normality Test.

2.2 Vector Error correction (VEC) model

Integration order of the secondary data series is investigated to build up a multivariate approach for the paddy production. Consequently Vector Error correction model (VEC) is fitted including disequilibrium term. VEC Lag exclusion wald test, Portmanteau Test for Autocorrelations and Lagrange Multiplier test are used to examine the goodness of fit of the formed VEC model.



3 RESULTS AND DISCUSSION

Table 1: Parameter Estimates of SARIMA Model

Model	AIC	R ²	DW	Q Statistic*	Test1**	Test 2***
SARIMA (011)(010) ₂	-0.3798	0.4747	1.8767	Sig	Not sig	Sig.
SARIMA (010)(011) ₂	-0.4210	0.4959	2.8174	Not sig	Not Sig	Sig
SARIMA (011)(011) ₂	-0.7958	0.6592	1.8811	Not Sig	Not Sig	Not Sig
SARIMA (111)(011) ₂	-0.7108	0.6249	2.0179	Not Sig	Not Sig	Not Sig

* Ho: No serial correlation up to lag 12 of residual series, H1: There exists serial correlation up to lag 12 of residuals series

** Normality Test (H₀: Residuals are normally distributed, H₁: Residuals are not-normally distributed)

*** Correlation Test (H₀ : Residuals are uncorrelated, H₁: Residuals are correlated)

When comparing four models, SARIMA (011) (011)₂ model has taken smallest AIC value, largest R² value. Further DW statistic value of that model is much closer to 2. Q statistic, Normality Test and

correlation Test have given insignificant results. Hence SARIMA (011) (011)₂ model can be selected as the most adequate model to capture the trends and seasonal patterns of the paddy production series.

3.1 Diagnostic checking of SARIMA

(011)(011)₂Model

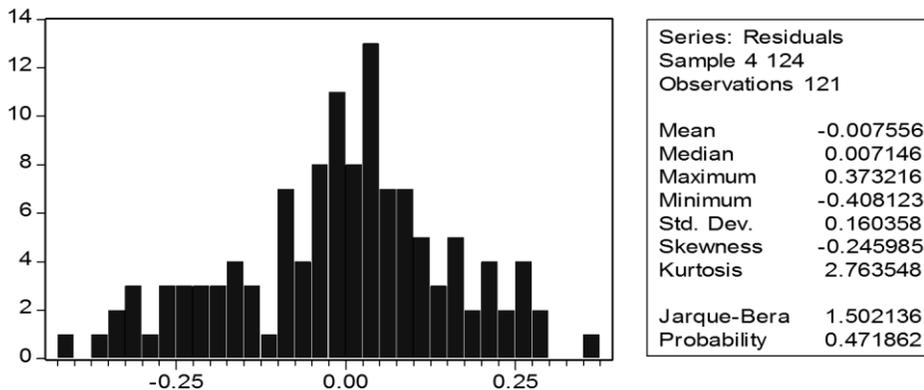


Figure 1: Histogram of Normality Test

When considering the model adequacy of the fitted model, residuals are fairly normally distributed when the few large

and small values are not considered. Results of the Correlation LM test is given that no correlations among residuals. Q-



statistics of the correlogram of standardized residuals are not significant. Hence there

is no serial autocorrelation among residuals of the fitted model.

3.2 Model Equation

$$(1 - B)(1 - B^2)lny_t = (1 - 0.784903.B)(1 - 0.967740.B^2)e_t \dots\dots\dots(1)$$

yt = Paddy production in season t
 B = Backshift Operator

3.3 Validating the requirements for Multivariate Model

Table 2: Results of unit root test for logarithmic variables (1953-2013)

Variable	Probability of log series	Significant	Order
Paddy production (y)	0.4516	Not Sig.	Cannot identified
Harvested Area(y ₁)	0.2587	Not Sig.	
Rain fall (y ₂)	0.002	Sig.	I(0)
	Probability of 1 st difference of log series		
Paddy production (y)	0.0000	Sig.	I(1)
Harvested Area(y ₁)	0.0000	Sig.	I(1)

The Table 2 illustrates that paddy production(y) and harvested area(y₁) logarithmic series have taken equal orders(I(1)) while rain fall (y₂)

logarithmic series has taken order 0. Therefore only y and y₁ variables can be used to build Multivariate time series model.

3.4 Test for Cointegration

According to the cointegration rank test at most one cointegration equation exists at 5% level of significance and the cointegration by maximum Eigen value indicates same results. Thus there exists a cointegration equations and it implies that

variables are cointegrated. A Vector Error correction model has to be fitted including the disequilibrium term. So disequilibrium terms are added to the model as explanatory variables.



3.5 The vector Error correction estimates

Table 3: Results of ECM for LNY and LNY1 (1952-2013)

Variables of Error Correction Model	D(LNY)	D(LNY1)
CointEq1	0.450530*	0.479370*
D(LNY(-1))	-1.398502*	-0.807413*
D(LNY(-2))	-0.519834*	-0.483595*
D(LNY1(-1))	1.082698*	0.535566*
D(LNY1(-2))	0.796267*	0.760925
C	0.037602*	0.021614

*Significant at 5%, LNY= log(y), LNY1= log (y1)

3.6 Diagnostic checking of VEC Model

Residual Portmanteau Tests for Autocorrelations is indicated that residuals of the model are uncorrelated. Residual Portmanteau Tests for Autocorrelations is also concluded the adequacy of the model. Residual plots are indicated that residuals are randomly

distributed (not white noise). Apart from the very few data points most of the data points of the correlograms are inside the bandwidth, showed that the auto correlation function support the stationary of the model.

3.7 Model Equation

$$d(\ln y) = 0.4505297098*(\ln y(-1) - 2.723984106*\ln y1(-1) + 9.17796832) + 1.398502266*d(\ln y(-1)) - 0.5198337118*d(\ln y(-2)) + 1.082697997*d(\ln y1(-1)) + 0.7962672213*d(\ln y1(-2)) + 0.0376020718 \tag{2}$$

$$d(\ln y1) = 0.4793701563*(\ln y(-1) - 2.723984106*\ln y1(-1) + 9.17796832) - 0.8074134735*d(\ln y(-1)) - 0.4835952083*d(\ln y(-2)) + 0.5355655228*d(\ln y1(-1)) \tag{3}$$

In above equations 2 and 3, the cointegrating variables are estimated together, alternating dependent variable and independent variable. The model is fit to the first differences of the non-stationary variables, but a lagged error-correction term is added to the

relationship. Since two variables exist here, error correlation term is the lagged residual from the cointegrating regression, of one of the series on the other in levels. It expresses the prior disequilibrium from the long-run relationship, in which that residual would be zero.



3.8 Forecasting and Model Comparison

Table 4: Actual versus forecasted values

Year	Season	Actual Value (Ha.000)	Forecast Value of SARIMA Model (Ha.000)	Forecast Value of VEC Model (Ha.000)
2014	Yala	1145	1147.086	1412
2014	Maha	2877	2683.481	2456
2015	Yala	1942	1616.341	1764
2015	Maha	2902	2756.867	2433
MAPE			7.16%	15.81%

SARMA model has given smallest MAPE value.

4 CONCLUSIONS AND RECOMMENDATIONS

SARIMA (011)(011)₂ model is the best model which can be used to forecast the paddy production in Sri Lanka based on MAPE value. The best model which was developed for paddy production data captures 65.92% of variation ($R^2=0.6592$) of the original log series.

Since order of the series is equal, paddy production data and harvested area data can be used to develop a multivariate model; however, rain fall data cannot be included in the model due to uneven order.

The data set consist of only 124 data points, if it can increase to a larger value it will could support the development of a long-term forecasting model. The VEC model was fitted using Eviews software and it does not have an option to forecast just for next few data points exclusive of all data points of the fitted model. As future works VEC model can be improved with new software

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OPENING MINDS:
RESEARCH FOR SUSTAINABLE
DEVELOPMENT

Application of Classical Time Series Decomposition Method and Wavelet Decomposition Method to Predict the Monthly Temperature in Sri Lanka

S. Basnayake* and Ruwan Punchi-Manage

Department of Statistics and Computer Science, University of Peradeniya, Sri Lanka

**Corresponding author: Email: schamanib@yahoo.com*

1 INTRODUCTION

Joseph Fourier found that superposition of sines and cosines can be used to understand the spectral behaviour of a signal called “Fourier transformation”. However, it needs full knowledge of the signal in time domain. One of the deficiencies of the Fourier transformation is that a small alteration in the signal may affect the entire domain (Chui, 1992). In time series analysis short time Fourier transformation used a static window that moved with time. As a result, it cannot capture low frequencies and high frequencies simultaneously. Wavelet transformation is a good method to observe the data with periodic nature and sharp spikes at different scales. This method allows to capture both large scale patterns and small scale patterns at the same time by dilating the mother wavelet using a scaling vector.

In Sri Lanka there is evidence from the department of meteorology that Sri Lankan monthly average temperature has some seasonal variation. Many of them have studied the variation of temperature using classical time series decomposition method. Seasonal Autoregressive Integrative Moving Average models (SARIMA) is a familiar method to forecast the monthly temperature. However, only

few studies used a continuous wavelet-based time series analysis to analyse the monthly temperature. Here we performed a classical time series decomposition method (SARIMA) and univariate continuous wavelet-based analysis for monthly temperature of Sri Lanka. We used Morelet wavelet to analyse the frequency structure of the monthly temperature in Sri Lanka. Then we compared the forecasted values and residuals from the above two methods (SARIMA and Wavelet decomposition) to compare the accuracy of those two models.

2 METHODOLOGY

2.1 Data

The study is based on the monthly temperature data of Sri Lanka for 115 years from 1901-2016 obtained from the World Bank climate portal (<http://sdwebx.worldbank.org/climateportal>). We used only 90% of the data to fit the time series models. 10% of the most recent data was used for the validation of the model.



2.2 Classical Time Series Decomposition Method

Here we used a Seasonal Auto-Regressive Integrated Moving Average model (SARIMA) to forecast the monthly

temperature values in Sri Lanka. In general, SARIMA (1, 1, 1) (1, 1, 1)₁₂ model is given by,

$$\underbrace{(1 - \phi_1 B)}_{\text{Non-Seasonal AR(1)}} \underbrace{(1 - \Phi_1 B^{12})}_{\text{Seasonal AR(1)}} \underbrace{(1 - B)}_{\text{Non-seasonal difference}} \underbrace{(1 - B^{12})}_{\text{Seasonal difference}} y_t = \underbrace{(1 + \theta_1 B)}_{\text{Non-Seasonal MA(1)}} \underbrace{(1 + \Theta B^{12})}_{\text{Seasonal MA(1)}}$$

In classical time series approach, first the data set was decomposed and the seasonality and trend components were identified. Since the data set exhibited a seasonality component we used Seasonal Auto Regressive Integrated Moving Average (SARIMA) model. The best fitting parameters were identified using the auto.arima function in R based on Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values. The residual analysis was carried out to check whether the model performed well with the data. In the

second step we tested whether residuals are normally distributed around zero mean and constant variance. Box-pierce test is performed to test whether residuals follows a white noise series with zero mean. Then the SARIMA model with the best fitting parameters was used to forecast the temperature for the next 12 years. Actual and fitted value plots were used to see how well the model behaves for the forecasted period. All analysis were performed using the Package “forecast” and “tseries” in (R core team, 2016).

2.3 Wavelet Method:

In the mother Morelet wavelet is given by,

$$\psi(t) = \pi^{-1/4} e^{i\omega t} e^{-\frac{t^2}{2}}$$

The Morelet wavelet transform of a time series (x_t) is defined as the convolution of the series with a set of “wavelet

daughters” generated by the mother wavelet by transition in time by τ and scaling by s

$$Wave(\tau, s) = \sum_t x_t \frac{1}{\sqrt{s}} \psi^* \left(\frac{t - \tau}{s} \right).$$

The position of the particular wavelet is determined by τ (localizing time parameter) and s is the wavelet coverage in the frequency domain.

S has a number of octaves (mother Wavelet is double with each octave) and number of voices per octaves (see details for Roesch and Schmidbauer, 2014).



3 RESULTS AND DISCUSSION

According to classical time series decomposition method a clear trend is observed (tr_t) (Figure 1a). A seasonal

fluctuation (S_t) is observed with every 12 time period (Figure 1a).

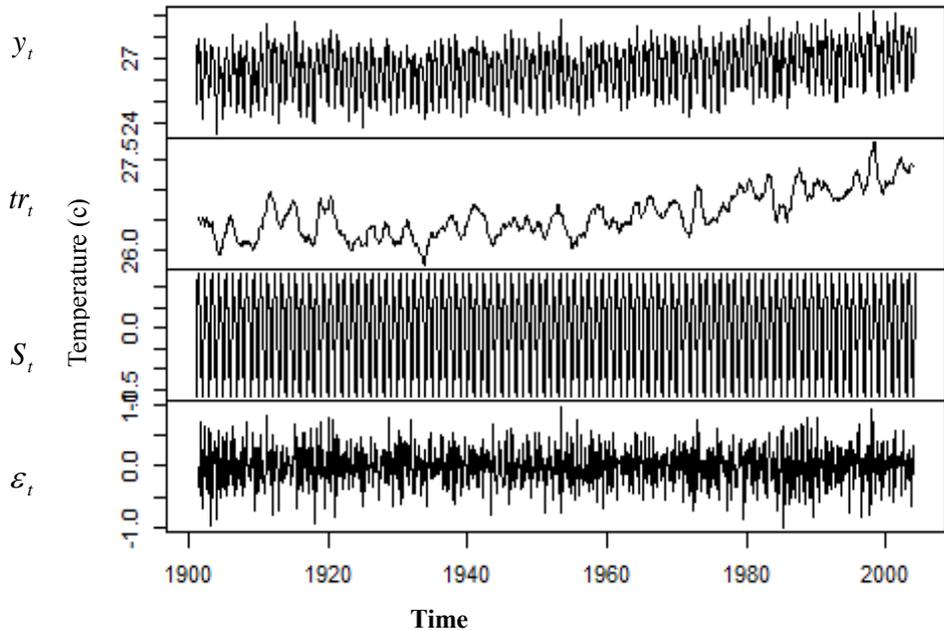


Figure 1a: Time series decomposition using R

Residuals fluctuate around a constant zero mean and constant variance (Fig. 1a). We found that the best model is SARIMA (5, 1, 0) (1, 1, 0)₁₂. Box pierce test statistic

(Chi. Sq. value 0.084987, df = 1) gives the p value of 0.7706. This indicates that residuals follow a white noise series with a zero mean and constant variance.

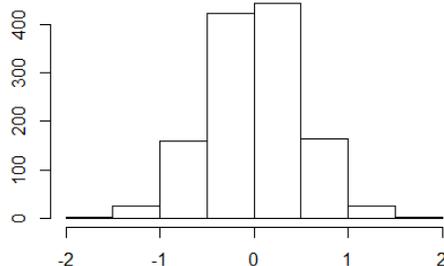


Figure 1b. Histogram for the errors

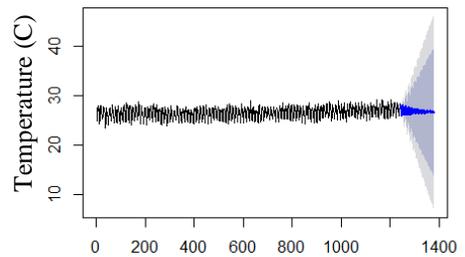


Figure 1c. Forecasting

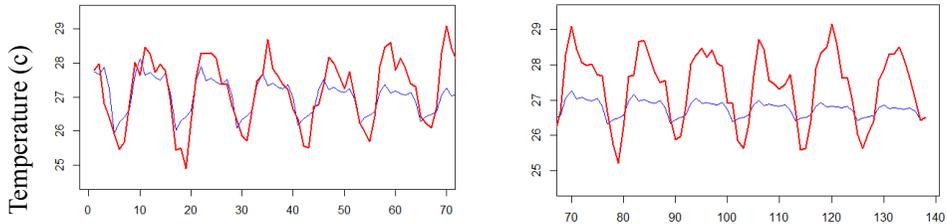


Figure 1d: Fitted values (in blue) and observed values (in red).

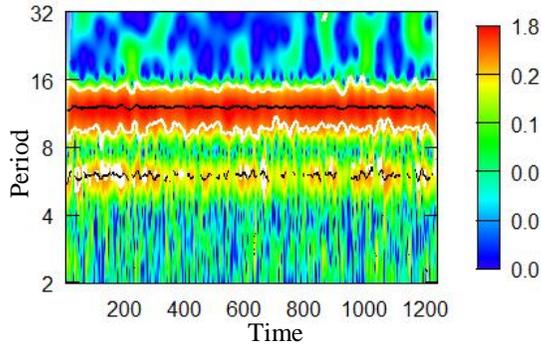


Figure 2a: Wavelet decomposition

(Power spectrum of the series, method= “white noise”)

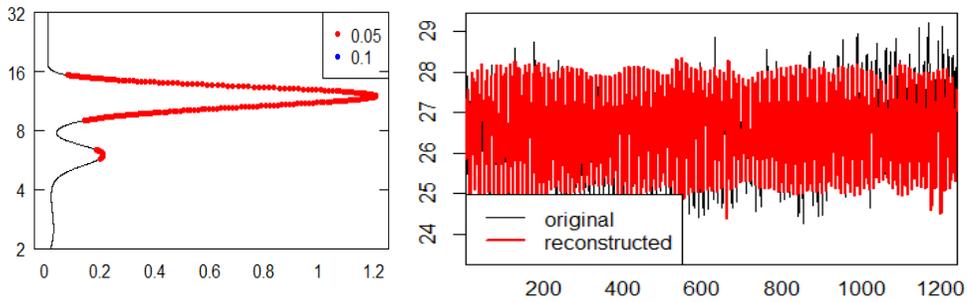


Figure 2b: Average power series **Figure 2c:** Reconstruction of time series using wavelet.

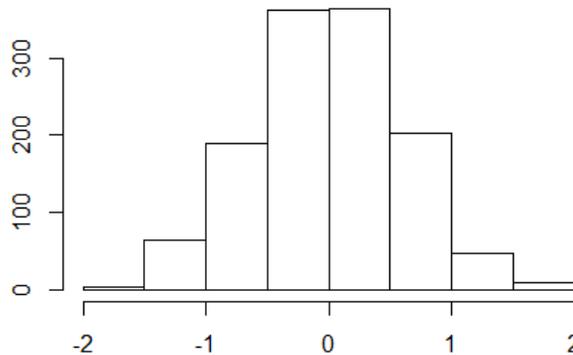


Figure 2d: Histograms of errors from wavelet decomposition meth



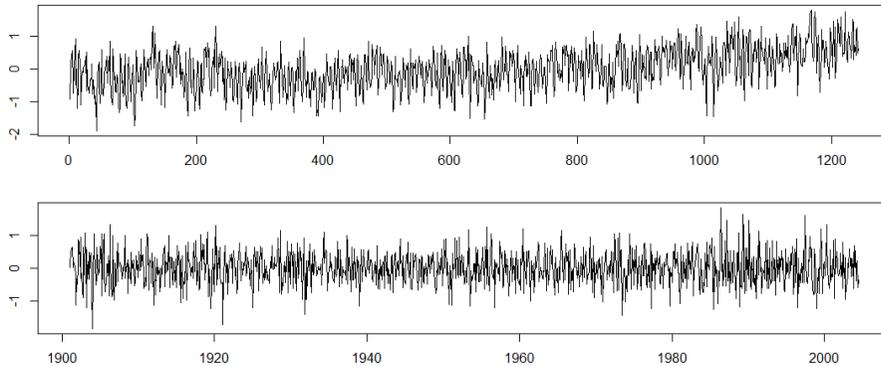


Figure 2c: Upper panel: residuals from classical time series decomposition.
Lower Panel: residuals from wavelet decomposition method.

According to the wavelet method we found that the average power series peaked at the 12th period. Seasonality at 12th period is expected (Fig. 2b). Because in classical best fitted SARIMA model $s=12$. However, we noticed that the average power series peaked at 6th period as well. We hadn't observed this from the SARIMA models. The reconstructed time

series using the wavelet method is showed in Fig 2c. We test the residuals obtained from the wavelet method to see whether they distributed with a zero mean and constant variance (Fig 2d). Box-pierce test for residuals gives p value of 0.08148 which do not reject the null hypothesis that residuals follow a white noise series.

4 CONCLUSIONS AND RECOMMENDATIONS

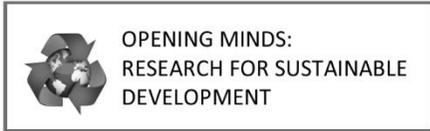
In classical time series analysis seasonality was tested by auto correlation (ACF) and partial auto correlation function (PACF). However, wavelet transformation outperforms classical time series

decomposition when data contains two or more seasonal super-positions of a data. This indicates that wavelet method is useful alternatively to understand multiple seasonality of a time series.

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Identifying Factors that Affect the Downtime of a Production Process

W. Nallaperuma^{1*}, U. Ekanayake¹, Ruwan Punchi-Manage²

¹*Department of Physical sciences, Rajarata University, Sri Lanka*

²*Department of Statistics and Computer Science, University of Peradeniya, Sri Lanka*

**Corresponding author: Email: waruni.nallaperuma@gmail.com*

1 INTRODUCTION

In this competitive world, manufactures always try to make their productions a top priority. Production efficiency is vital in this regard. Unplanned downtime is the major contributing factor for loss of profit even with new technologies. Unplanned downtimes occur by machine breakdown, delaying materials, failures, and defects. The overall production depends on the effective operation of machineries, tools and etc. Equipment downtime occurs mostly due to unplanned actions. To maximize profits, companies have made operational efficiency a top priority. Even if a company had installed new technological methods, more often the planned production does not exceed 50%. This may be due to the downtime of failures, defects, and machinery problems. However, the unplanned stops are the most common unexpected factors that effect on the overall productivity. The requirements of outstanding performance force, companies need to reduce their total downtime frequency. In this study we used six sigma tools to understand the major factors that affect the total down time of a production process of a world class apparel manufacturer in Sri Lanka.

2 METHODOLOGY

In this study we received data from a world-class apparel manufacturer

operating in Sri Lanka who is engaged in product design, development, execution and marketing to global super brands. We used three year production performance evaluation data, in this case total down time per month since 2014 January to 2016 December. There are 31 downtime types including this data set (including the responsible department) as well. There are nine departments.

Downtime (target<2%): We defined the downtime as “the period during which an equipment or machine is not functional or cannot work”. We have noticed that technical failures, machine adjustments, maintenance and missing raw materials, labor and power. The required production capacity and efficiency is not achieved due to the total downtime (Table 1).

The fishbone diagram: Fish bone diagram is a six sigma tool that used for statistical process control. This can be used to understand the major causes behind the effect. In a fish bone diagram the problem statement (effect) is written first. A circle is drawn around it and horizontal arrow running into it. Major categories (causes) were discussed. Usually, Methods, Machines, People, Materials, Measurement, Environment are the major bones of the fish diagram. Sub-causes are branching off the major causes.

Pareto Charts: Pareto Analysis is a simple technique that used 80:20 Rule. Pareto (1897) assumed that 80% percent



of the effects are due to 20% of causes and vice versa. Pareto analysis is very useful in the control phases of the Six Sigma methodology. In Pareto analysis cumulative percentage are given in a line chart and percentage of causes explain by each effects are plotted in bars. Causes are listed in the X-axis and percentage of effects is given in the Y-axis (Scrucca, 2004).

ABC-Analysis: ABC analysis is an extension of the Pareto chart that groups causes in to three groups. A stands for the most important causes (important few), B for moderate and C for least important. Two axis's X and Y represent effort (E_i) and yield (Y_i) respectively. The algorithm is based on an ABC analysis and calculates these limits on the basis of the mathematical properties of the distribution of the analyzed items. The ABC analysis compares the increase in yield

(importance) to the required effort. Let X_1, X_2, \dots, X_n be a set of n positive values ($X_i > 0$) of n different variables of an empirical data set with respect to the property important. The distribution of the values x_i is unequal (few large values and many small values (Thrun, Lotsch and Ultsch 2017).

x_i 's are sorted in descending order ($X_i > X_{i+1}$). The fraction of the first i elements to n represent the effort ($E_i = i/n$) and yield is represented by

$$Y_i = \frac{\sum_{k=1}^i x_k}{\sum_{i=1}^n x_i}$$

All the analysis were performed using software R (R Core Team 2017).

Table 1: Downtime type department wise.

Department	Downtime Type
Engineering	Bundle time due to machine problem, machine adjustment, thread unbalance, uneven measurement. needle cut and needle hole, needle breakages, burn mark and lue mark, Tape unbalance, cracking, stain ,skip, uneven edge, stain, bundle time due to machine problem,
Cutting	Input delay, cutting defects
Planning	No input, planning issue
Material and Quality Assurance (MQA)	MQA defect
Raw Material Warehouse (RMW)	RMW defects, accessory delay ,label delay ,
Customer service	External operations issues, customer service issue, development issues,
Production	Layout changes, NSU bonding issues , machine try out time ,soup time ,
CTP	Planning issues, under production, no input ,
Production development Center (PDC)	Technical issues ,development issue
Purchasing	Purchasing issue, material development issue
FGW	FGW delays
IT	SAP issue
PNA	Power failure
WRK	General downtime



3 RESULTS AND DISCUSSION

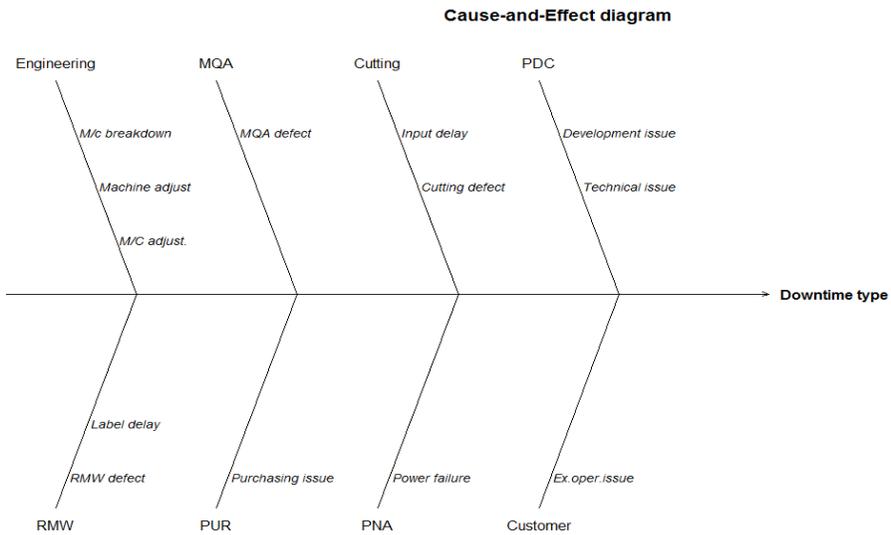


Figure 1: Fishbone diagram (Departments are listed in main bones, down time types are listed in sub bones)

According to fishbone diagram (Figure 1) we noticed eight departments contributed for downtime in year 2014. Engineering and

Raw Material Warehouse shows number of down times. However, department contribution to the total downtime hour is not clear.

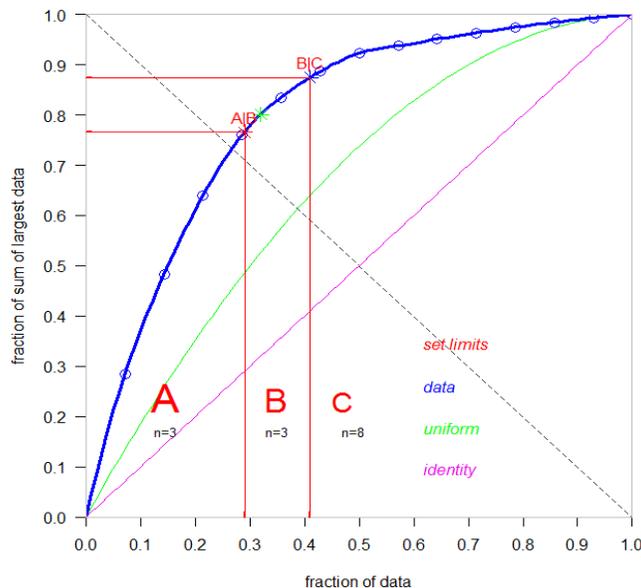


Figure 2: ABC plot under different distributions. Observe distribution (blue line), Proportional (magenta line), uniform distribution (green line). The Break-Even point: point at slope of the ABC curve at this equal to one (green star). The limits of three sets A, B and C for the downtime data (red lines) (Thrun *et al.*, 2017).



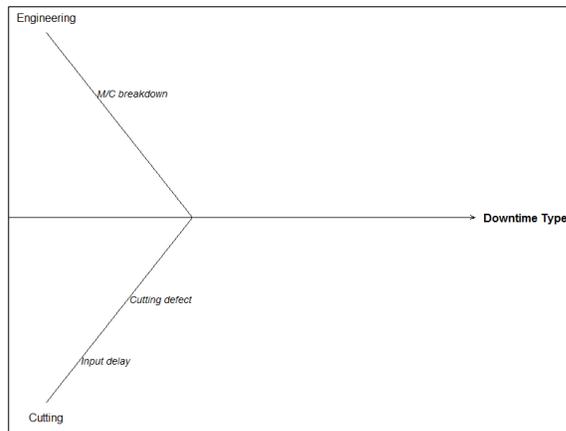


Figure 3: Revise fishbone diagram after with vital few down types (in Engineering and Cutting)

ABC analysis is performed for year 2014 and we found that three down types contribute for more than 75% of the total downtime (Fig. 2) and other eight down types contribute for 10% total downtime. Figure 3 shows fish bone diagram for revised analysis (after ABC) with three vital breakdowns three namely, M/C breakdown, cutting defects and input delay from two departments Engineering and Cutting. Pareto chart is given in

Figure 3 and we found that three downtime types (i.e. B3, L1 and C3) contribute to 75% of the total down time. Figure 4 shows downtime as a percentage of total production hrs. We noticed that out of 36 months eight months their downtime percentage is higher than the Bootstrap upper and lower control limits (see, Efron, B. 1979).

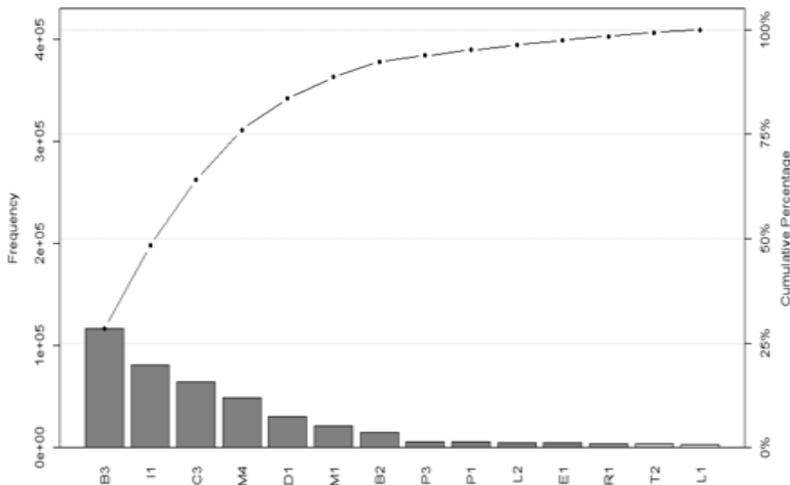


Figure 3: X Axis: Pareto chart for 14 down types. Y Axis: Down time as percentage of total down time.



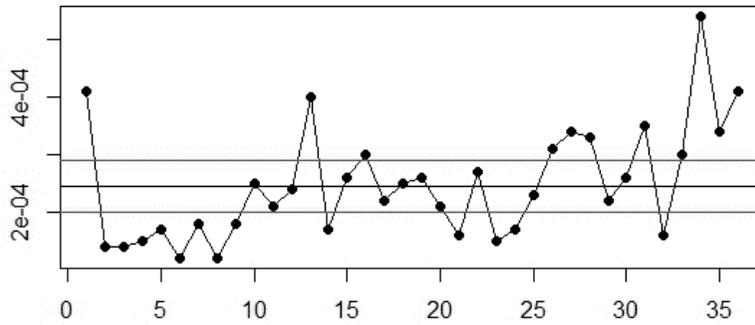


Figure 4: Percentage of down time for each month (2014-2016 years) and their bootstrap confidence intervals.

4 CONCLUSIONS AND RECOMMENDATIONS

Our study indicates that most of the downtimes are due to few vital down types. Therefore, a company can increase its downtime efficiency to 75% by controlling 3 down types. It is necessary to perform detail an analysis to understand out of control signals in the control chart.

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AUTHOR INDEX

- Abeyratna K.H.P. 225
Abeysekera M.S.S.K. 219
Abeysekera N. K., 43,393,397
Abhayawickrama B.P., 485
Adikari I. N., 103
Ajward N. 519
Alahakoon C.N.K., 343
Alahakoon T., 501
Alwis, Anoma, 37
Alwis G., 167
Amarasinghe K.I.C., 429
Ameratunga S., 163
Anuruddhika B.G.H., 1,37
Arachchi A.A.E., 277
Ariyaratne A., 79
Ariyasena L., 505
Aththiligoda V.G.A.A., 203
Ball P., 233
Bandara R.M.C.S., 301,407
Bandara R.M.U.S.,
Bandara A.V.V.S., 137
Bandarage G., 21
Basnayake S., 545
Bogamuwa I.N.J., 43
Booso K., 49
Buddhika R.B.J., 181
Careemdeen J.D., 67
Chamari A.D., 203
Chandanie W.D.C., 153
Chandrasekera B.S.G., 455,493
Chandrasena R.S.S., 481
Colombage K.S.A, 33,273
Cooray K., 289
Cooray T.M.J.A., 363,539
Darmarathne S.D., 197
De Costa M.N., 387
De Mel P.K.J.,
De Silva B.S.S., 203,237,241,255,307
De Silva K., 489
De Silva K.G.U., 273
De Silva C.S., 429, 439,445,451,471
De Silva Y.M.S.H.I.U., 407
Dellysse J., 497
Devini S.N.M., 255
Dhanapala T.D.T.L., 37
Dharmathilaka A.W.D.S., 307
Dilsha R.A.N., 181,213
Dilshani A.D., 241
Direckze D., 73
Dishani P.T.N., 429,445
Dissanayaka H.M.M.K.K.H., 407
Dissanayaka D.M.L.C., 415
Dissanayake D.M.O.K.B., 435
Dissanayake U.M., 247
Dunusinghe P., 323
Dushanan R., 461
Fernando V.A.S., 237
Fernando M.N.C., 1
Fernando G.W.A.R., 509
Fernando D.I.,119
Fernando T.T.D.D., 295
Fernando U.C.P., 171
Fonseka T.S.N., 171
Galagedarage T.M.,
Gamage G.P., 33
Gamini L.P.S., 393,397
Gamlath, G.G.A.W., 289
Ganegoda A.T.L., 301
Gangodagamaarachchi R.P., 113
Gimhani D.R., 485
Gonsalkorale L.R., 17
Gunadasa P.A.C.R., 289
Gunarathna T.A.D.K., 99
Gunarathne, G.A.M.I.L., 209
Gunasena A.S.S., 93
Gunatilleke N., 167,505
Gunatilleke I.A.U.N., 411,477,481
Gunatilleke C.V.S., 411,477,481
Hemachandra R.P.D.H., 435
Hemamala V., 73
Herath C.N., 123,147
Herath H.M.S.P., 241,255,307
Hettiarachchi P., 261
Hettiarachchi S.S.L., 509
Hewavitharane H.M.P., 425
Himali P.A.D., 277



- Iddamal goda V.L., 197
Iddawala G., 225
Indika K.W., 509
Irugalbandara A.I., 1
Janarththany V., 175,255
Jayakody L.K.R.R., 429
Jayasekara V.R., 133
Jayasinghe H.A.K.G., 283
Jayasinghe P.P., 171,197
Jayasooriya J.A.A.P., 411
Jayasooriya H.T.R., 425
Jayathilaka D.L.N., 523
Jayathilaka S., 113
Jayatilleke B.G., 05
Jayawardena K.P.R., 01
Jayawardena K.P.D.N.S., 213
Jayawickrama D., 157
Jeewanthi H.V.R., 213
Jinendri G.H.U., 455,
Kalavani R., 255
Kalimuththu S., 393,397
Kalpage L.U., 363
Kandearachchi K.A.M.S.P., 171
Kanthi, H.W.K., 191
Karunanayaka K.D.S.V., 181
Karunanayaka S.P., 79
Karunatilaka K.M.C.R., 373
Katupitiya U. I., 141
Kaushalya P.G., 147
Kehelpannala K.V.C., 123
Ketheeswaran K., 37
Kirushanthy K., 383
Kodithuwakku K.K.J.I., 267
Kottarachchi N.S., 485
Kousthupamany K.,
Krishanpillai A., 471
Krishanthi M.H.T.D., 213
Kugamoorthy S., 1,61,67
Kulathunga K.M.D.S., 197
Kumara W.V. L., 99
Kumara W.A.A., 197
Kumara, H.T.R., 203
Kumari E.V.P., 241
Kumari W.B.O.N., 451
Kumari R., 301
Kuruppu N.R., 219,277,289
Kuruppu S., 37
Kuruppuarachchi J., 497
Lakmali H.T.P., 307
Lekamge G D.,1
Lekamwasam S., 167
Lenora J., 167
Madhavi A.V.P., 209,277
Madubashini G.T., 313
Madubashini K.G.R., 493
Maduka W.S.N., 229
Madurapperuma B., 497
Madushani A.G.M., 267
Mahesh K.H.D., 233
Maheswaren P., 465
Malani Munasinghe., 37
Malwenna L.I., 191
Manathunga C., 501
Mangaleswarasharma R., 55
Marakanda S.N., 267
Masakorala K., 225
Medagedara N.T., 107
Medawattegedara L., 355
Meedin G.S.N., 141
Miranda S.T., 175
Miriya galla U.P., 369
Monika K., 209
Morrissey H., 233
Mudannayake A., 401
Munidasa P., 225
Nallaperuma W., 551
Nanayakkara B.J.M., 133
Navaratnam B., 323
Nijamdeen T.W.G.F.A., 419
Nilakkarawasam N., 415
Nishantha K.P., 377
Nupearachchi C., 515
Nuwansala H.U.C., 283
Opatha N.W.K.D.V.P., 85
Palihakkara J.M., 241
Pasqual H., 113
Pathirana B.D.D., 369
Pathirana K.P.S.D., 295
Peiris T.C., 527
Peiris-John R., 163



- Pemasinghe K.A.M.S., 171
Peerera H.A.C.M., 119
Perera M.A.I., 119,129,153
Perera M.E.R., 93
Perera M.D.I., 191
Perera R.A.C.N., 219
Perera K.G.S.K., 79
Perera V.P.S., 501,515
Perera W.A.U., 213
Piumali P.L.W.G.S.D., 333
Premaratne G.R., 425
Premawardana V.D.C., 237
Priyadarshini G.H.K.A., 267
Priyankara H.D.N.S., 137
Priyantha W.S., 435
Priyanthi W.N., 283,283,289,295,301
Pullenayegem J.C.N., 27
Punchi-Manage R., 477,505,533,545,551
Rajaguru A.U.B., 11
Rajakulasooriya B.S.S., 307
Rajendra J.C.N., 519
Ramachandra R.B.B.S., 295
Ranasinghe C., 415
Ranasinghe D.D.M., 141
Ranawaka G.R., 425,461
Ranaweera S., 349
Rathnayaka D.T., 333,337
Rathnayake A., 157
Rathnayake T.H., 337
Ratwatte H., 73
Ruberu T.L.M., 477
Rukshani B.M.M., 229
Ruwan P.M.S.A., 411,481
Sakalasoorya M.B., 247
Sakalasoorya S.S.N.D., 289
Samarakody P., 439
Samarakoon G.R.N.D., 229
Samarasekara P.W.G.D.P., 175,181,191,213,273
Sampath S.A.C., 273
Sandamali S.,
Sandamali W.W.L.S., 277
Sankalpa S., 533
Sanath W.A., 317
Saparamadu M.D.J.S., 425
Senadheera A.S.P.L., 203,229,295
Senthilnithy R., 461
Silva P., 49
Silva K.A.S.H., 175
Sirisena D.N., 451
Siriwardana D., 49
Sivalogathan V., 349,401
Solomons T., 187
Somaratne S., 343,355,415
Sooriyaarachchi M.P., 283
Sriyani K.A., 219,229,267
Subasinghe H.W.A.S., 233
Subasinghe S.M.C.J., 295
Sudarshana M.L., 17
Tanuja R.W.N., 181
Tennakoon V., 163
Tharanga T.G.C., 237
Tharanganie S.D.N., 295
Thillakahetti S.S., 191
Thushari E.A.G., 241
Tilakawardana S., 359
Udeshika N.B.W.I., 539
Vidanage D., 261
Vijayakumar T., 255
Vithanage V.M.D., 171
Waldeniya W.G.W.P.K., 197
Wanasinghe W.M.S., 67
Wanniarachchi W.M.P., 191
Wasalathanthri S., 261
Weerakoon W.M.S., 67
Weerakoon S.R., 415
Weerasekara M.P.N.P., 219
Weerasekara K.D.S.N., 307
Weerasinghe S., 461
Weerasundera R., 233
Weragoda W.A.D.M., 107
Wickemasinghe R., 163
Wickramasinghe M.C.T., 237
Wickramasinghe G., 523
Wickramasinghe P.C., 273
Wickramathunga W.S., 301
Wijayarathna P.G.S.S., 289
Wijayarathne H.G.I., 209
Wijekoon A.I.K., 283
Wijerathne E.M.S., 509
Wijesekara G.G.W.C., 05,209



Wijesena B.V.T.N., 219
Wijesingha R.A.N.S., 129
Wijesinghe H.V., 327
Wijesinghe S., 317
Wijesinghe W.A.N.M., 203
Wijesinghe H.W.M.S.S.H., 283
Wijesundara W.A.T.N., 277
Wijewardene D.C., 133
Wijeweera S., 489
Wimalaweera W.A., 147
Wimalasena W.A.A.D.S.S., 175
Witharana D.D., 435





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