

Trincomalee Campus

Eastern University, Sri Lanka



Proceedings

1st International Research Conference

TRInCo-2016



14th - 15th September
2016

© Trincomalee Campus, Eastern University, Sri Lanka

Proceedings of the 1st International Research Conference

TRInCo 2016

Trincomalee Campus

Eastern University, Sri Lanka

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, transmitted in any form or by any means, electronic, mechanical, recording or otherwise, without prior permission of the publisher.

ISBN 978-955-1443-84-9

Published by

Trincomalee Campus

Eastern University, Sri Lanka

EDITORIAL BOARD

1st International Research Conference, TRInCo - 2016

Editor-in-chief

Mr. V. Kanagasingam

Editorial Board

Dr. N. Pratheesh

Dr. P. Pretheeba

Mr. V. J. Naveenraj

Mr. M. Ramanan

Editorial Assistants

Ms. L. Thanushya

Ms. S. Sefra Sanjika

Ms. Y. Kalyani

List of Reviewers – TRInCo 2016

1. Prof. Deepika Amarasinghe, University of Kelaniya, Sri Lanka
2. Prof. Liyanage Amarakeerthi, University of Peradeniya, Sri Lanka
3. Prof (Mrs). T. Mahendran, Eastern University, Sri Lanka
4. Prof. R.G.N.De.S. Munasinghe, University of Moratuwa, Sri Lanka
5. Prof (Mrs). A. Murugathas, Eastern University, Sri Lanka
6. Prof. Preethi Soysa, University of Colombo, Sri Lanka
7. Prof. P. Ravirajan, University of Jaffna, Sri Lanka
8. Prof. Saluka R. Kodituwakku, University of Peradeniya, Sri Lanka
9. Prof. Sena Nanayakkara, Rajarata University of Sri Lanka
10. Prof. R. Sivakanesan, University of Peradeniya, Sri Lanka
11. Prof. A.M. Tamara P. Athauda, Wayamba University of Sri Lanka
12. Rev. Sr. Dr. J. Josepha, Eastern University, Sri Lanka
13. Dr. Abdul Majeed Mohamed Navaz, South Eastern University of Sri Lanka
14. Dr. S.M. Ahamed Lebbe, South Eastern University of Sri Lanka
15. Dr. A.R. Ajward, University of Jeyawardenepura, Sri Lanka
16. Dr. Amal Shehan Perera, University of Moratuwa, Sri Lanka
17. Dr. Ambalam Pushpanathan, Vavuniya Campus of the University of Jaffna, Sri Lanka
18. Dr (Mrs). Anpuchelvy Sirtharan, University of Jaffna, Sri Lanka
19. Dr. T. Bhavan, Eastern University, Sri Lanka
20. Dr. Chalinda K. Beneragama, University of Peradeniya, Sri Lanka
21. Dr. A. Chamaru De Alwis, University of Kelaniya, Sri Lanka
22. Dr. Chitra Jayathilake, University of Sri Jayewardenepura, Sri Lanka
23. Dr. R.S. Dharmakeerthi, University of Peradeniya, Sri Lanka
24. Dr. Dinesha Samaratne, University of Colombo, Sri Lanka
25. Dr. D.M.W.K. Dissanayake, University of Rajarata, Sri Lanka
26. Dr. P.H.P. Fernando, University of Peradeniya, Sri Lanka
27. Dr. P.I.N. Fernando, Uwa Wellasa University, Sri Lanka
28. Dr. Gamini Hitinayake, University of Peradeniya, Sri Lanka
29. Dr. Geetha Tharanghanie, University of Sri Jayewardenepura, Sri Lanka
30. Dr. S. Gunapalan, South Eastern University of Sri Lanka
31. Dr. C N Herath, Open University of Sri Lanka
32. Dr. H.M.W.A. Herath, University of Peradeniya, Sri Lanka
33. Dr. H.M.A. Herath, Wayamba University of Sri Lanka
34. Dr. MIM. Hilal, South Eastern University of Sri Lanka
35. Dr. P. Jeyasekara, University of Sri Jayewardenepura, Sri Lanka
36. Dr. K. Kajendra, University of Colombo, Sri Lanka
37. Dr. T. Karandaketiya, Wayamba University of Sri Lanka
38. Dr. D D. Karunaratna, University of Colombo School of computing, Sri Lanka
39. Dr. N. Kengatharan, University of Jaffna, Sri Lanka
40. Dr. J. Kennedy, Eastern University, Sri Lanka
41. Dr. D. T. D. Kodagoda, University of Colombo, Sri Lanka
42. Dr. Mafasiya M.B.F, University of Ruhuna, Sri Lanka
43. Dr. S. Mahendran, Eastern University, Sri Lanka

44. Dr (Mrs). M.R.J.C. Mahendranathan, Eastern University, Sri Lanka
45. Dr. T. Mangaleswaran, Vavuniya Campus of the University of Jaffna, Sri Lanka
46. Dr. Manjula Gunarathna, University of Kelaniya, Sri Lanka
47. Dr. Manjula K. Wanniarachchige, University of Ruhuna, Sri Lanka
48. Dr. T. Mathiventhan, Eastern University, Sri Lanka
49. Dr. D.U. Mohan, University of Kelaniya, Sri Lanka
50. Dr (Mrs). D.H.N. Munasinghe, University of Ruhunu, Sri Lanka
51. Dr. AMM. Mustafa, South Eastern University Sri Lanka
52. Dr. Nadarajah Rajeshwaran, Eastern University, Sri Lanka
53. Dr. Nadira Mariyasandanam, Eastern University, Sri Lanka
54. Dr. HMM.Naleer, South Eastern University, Sri Lanka
55. Dr. Narada Fernando, University of Kelaniya, Sri Lanka
56. Dr. N. N. J. Navaratne, University of Colombo, Sri Lanka
57. Dr (Mrs). V. Paheerathan, Trincomalee Campus, Eastern University, Sri Lanka
58. Dr (Mrs). S. Pancharajah, University of Jaffna, Sri Lanka
59. Dr. Pavithra Kailasapathy, University of Colombo, Sri Lanka
60. Dr. RPIR. Prasanna, Rajarata University of Sri Lanka
61. Dr. K. Rajendram, Eastern University, Sri Lanka
62. Dr. A. Rameez, South Eastern University of Sri Lanka
63. Dr. Ramila Usoof-Thowfeek, University of Peradeniya, Sri Lanka
64. Dr. R.A. Rathanasiri, Wayamba university of Sri Lanka
65. Dr. Sepalika Welikala, Open University of Sri Lanka
66. Dr. Shamala Kumar, University of Peradeniya, Sri Lanka
67. Dr. K. Sooriyakumar, University of Jaffna, Sri Lanka
68. Dr (Mrs). M.C. Srikanthan, Trincomalee Campus, Eastern University, Sri Lanka
69. Dr. Sudath Warnakulasuriya, University of Sri Jayawardenepura, Sri Lanka
70. Dr. Sunethra Kankanamge, University of Sri Jayawardenepura, Sri Lanka
71. Dr. S. Sutharsan, Eastern University, Sri Lanka
72. Dr. K. Thabotharan, University of Jaffna, Sri Lanka
73. Dr. V.G. Tharinda Nishantha Vidanagama, Wayamba University of Sri Lanka
74. Dr. M. Thayabaran, Eastern University, Sri Lanka
75. Dr (Mrs). T. Thileepan, University of Jaffna, Sri Lanka
76. Dr. Vasthiyampillai Sivalogathasan, Open University of Sri Lanka
77. Dr (Mrs). Vivian Sathiyaseelan, University of Jaffna, Sri Lanka
78. Mr. A. Andrew, Eastern University, Sri Lanka
79. Mr. Anthonypillai Anton Arulraja, Eastern University, Sri Lanka
80. Mr. S. Jeyarajah, Eastern University, Sri Lanka
81. Mr. J.A.S.C. Jeyasinghe, University of Colombo, Sri Lanka
82. Mrs. K. Karuna, Ramanathan Academy of Fine Arts, University of Jaffna, Sri Lanka
83. Mr. M. Karunanithy, University of Jaffna, Sri Lanka
84. Mrs. F.B. Kennedy, Eastern University, Sri Lanka
85. Mr. T. Prabakaran, Eastern University, Sri Lanka
86. Mrs. R. Ragel, Eastern University, Sri Lanka
87. Mr. M. Sugirtharan, Eastern University, Sri Lanka
88. Mrs. MAC. Sulaiha Beevi, South Eastern University Sri Lanka

Organizing Committee—TRInCo 2016

Co-Chairs

Mr. V. J. Naveenraj Dr. N. Pratheesh

Secretary

Ms. K. Subramaniam

Advisory Committee

Mr. V. Kanagasingam, Rector, Trincomalee Campus, Eastern University, Sri Lanka

Prof. Shamala Subramaniam, Universiti of Putra, Malasiya

Prof. R. Venkatapathy, Bharathiyar University, India

Prof. N. Panchanatham, Annamalai University, India

Prof. A. Murugathas, Eastern University, Sri Lanka

Prof. T. Mahendran, Eastern University, Sri Lanka

Prof. T. Velnampy, University of Jaffna, Sri Lanka

Prof. P. M. C. Thilakerathne, University of Kelaniya, Sri Lanka

Dr. K. E. Karunakaran, Eastern University, Sri Lanka

Committee members

Dr. P. Pretheeba

Dr. V. Paheerathan

Dr. N. Muhunthan

Dr. T. Tharsika

Dr. R. Piratheepkumar

Ms. N. S. Jayasundara

Ms. S. Kumuthinidevi

Ms. S. Priyadharsan

Mr. T. Baskar

Mr. S. Loheeswaran

Mr. S. Thadchanamoorthy

Ms. G.A.P.K. Ganegoda

Ms. S. Praveena

Mr. M. Ramanan

Ms. D. Ravichandran

Ms. V. Leninkumar

Mr. D. R. Lakjeewa

Ms. E. W. M. S. Boyagoda

Ms. K. G. L. A. N. S. Jayawadhana

Ms. S. Kiruthika

Ms. L. Thanushya

Ms. S. Sefra Sanjika

Ms. Y. Kalyani

Mr. E.B.Veerasingam

Mr. W. Sriwathsan

Mr. S. Brinthapan

Mr. S. Sriram

MESSAGE FROM THE VICE-CHANCELLOR



Any University has a duty to hold conferences, workshops and symposia for the communication of their research and their counterparts in the country and beyond.

I am delighted to acknowledge the arduous task the Trincomalee Campus had engaged themselves to mobilize for this international conference amidst all their setbacks. I congratulate them. They had chosen the theme "**emerging knowledge for sustainable regional development**" which links the academic in terms of knowledge and the industry/people in terms of regional development. This blend is essential for the real development which could never be achieved in isolation.

I am also pleased that there are considerable number of papers from overseas which in itself a recognition. It is essential that this culture grows further into more significant outcome based targeted research and publications of corporate research.

I have seen a diversity of papers enlisted for the conference and am sure they would evoke a rich discussion at the end of each presentation.

Wishing the conference the best and the deliberations every success.

Professor. T. Jayasingam
Vice Chancellor

MESSAGE FROM THE RECTOR



I am privileged to issue this message to the first International research conference (TrInCo 2016). I would like to extend first of all, my heartfelt appreciation to those who have agreed to join hands with us to conduct a grand successful event at Trincomlaee Campus, Eastern University, Sri Lanka.

The Conference provides an opportunity for transmission of knowledge based on research which is an essential component of academic programmes of all academic institutions.

The research conference will provide an opportunity for local and International scholars and practitioners to share their own ideas and practices of researches.

The present University system encourages the academia to publish their findings on social and scientific issues; definitely this conference gives them space to publish their hypotheses.

This conference has another activity in addition to paper presentation, "A scientific dialogue on Environmental challenges for suitable regional development" which is introduced for the first time in the Eastern University, Sri Lanka. This event opens a path to fill the gaps between society and the academic institution.

I am sure that the conference will give an informative and valuable experience while giving a chance for the presenter and participants to enjoy the natural features of Trincomalee city.

I am very well aware of the fact that organizing an international conference of this nature is a big challenge and our young academics accept that challenge and conduct research at the expected standard to the level of the world academic community.

I take this opportunity to thank the organizing committee for its excellent academic contribution and wish the researchers and participants success and sincerely hope that this will be an annual event of the Trincomalee Campus calendar in the years to come.

I wish the conference grand success.

Vallipuram Kanagasingam
Rector
Trincomalee Campus, Eastern University, Sri Lanka

MESSAGE FROM THE CONFERENCE CO-CHAIRS



Dr. N. Pratheesh
Co-Chair
TRInCo-2016



Mr. V.J. Naveenraj
Co-Chair
TRInCo-2016

Organising an International Research Conference at Trincomalee Campus is our long-time dream and it is our pleasure to see that our dream has come true today with TrinCo-16

Research is the main identity of any university along with the quality teaching and learning. In that sense, we are proud to realize that this research conference has gathered the researchers to disseminate knowledge and experience in various disciplines to contribute to the regional development which is the ultimate goal of this International Research Conference.

The preparation process for this conference in the last five months has strengthened the unity and the solidarity of the Campus staff. It has created a strong confidence among us to undertake any stupendous task to complete with perfection.

We strongly believe that this research conference has revitalized the enthusiasm among the staff and the students of Trincomalee Campus to search for new research areas to bring new knowledge in order to change the life better for the local and the global community.

As co-chairs of this International Conference, we appreciate all the keynote speakers, chief guest, special guests, researchers, evaluators, research panel members and all our staff for their valuable contribution to make this conference a success.

Effect of different concentrations of Sodium Chloride on the growth and yield of Vegetable Cowpea

S.M.M.S. Himaya¹, K. Prapagar ^{*2}, S. Dasinaa³

^{1,2}Department of Agricultural Chemistry, Faculty of Agriculture, Eastern University, Sri Lanka
²komathyprapagar@gmail.com

³Department of Agricultural Engineering, Faculty of Agriculture, Eastern University, Sri Lanka
³dasin27@gmail.com

Abstract— Cowpea is an important grain legume which is widely grown all over the world. Further, it is one of the most important crops for the people who live in developing countries. Moreover, it consists of high percentage of protein and low level of anti-nutritional factors as the best supplement for human diet and enhances the soil fertility through nitrogen fixation. Even though, it is tolerant to drought and salinity, there are such impacts on its growth stages due to the salt concentration presented in the nature of soil. The present study was conducted in order to evaluate the effect of salinity stress on the growth performance of Vegetable Cowpea with the support of shade house condition. This experiment was laid out in the completely Randomized Design (CRD) with four treatments and four replicates. Vegetable Cowpea variety named as "Sene" was chosen for this experiment. The treatment groups were non-saline, 0.5% saline, 1% saline and 1.5% saline. Data were analyzed using Statistical Analytical System (SAS) and means were separated by Duncan Multiple Range Test (DMRT). Experiments revealed that the salinity made highly significant effects ($p \leq 0.05$) on branching and pod yield. No significant difference was observed among root length, plant height and plant weight. However, those treatments were significant ($p \leq 0.05$) with the control treatment during the study and analysis in shaded conditions. The findings of the study elucidate that increment of salinity level in the growth media caused the significant reduction in pod yield.

Keywords— Salinity, Plant height, Plant weight, Root length, Shoot length

I. INTRODUCTION

Soil salinity is one of the major imperative environmental concerns affecting crop yield in arid and semi-arid irrigated areas. Even though, the advanced management technologies available today, salinization of millions of hectares of land continues to reduce crop production, severely in world-wide. Currently, high soil salinity affects the agricultural production in a large proportion in the world's territorial areas. The most widely accepted definition of a saline soil has been adopted from FAO, (1997) as one that has an electrical conductivity of the saturation extract (ECe) of 4 dSm⁻¹ or more, and soils with ECe exceeding 15 dSm⁻¹ are considered strongly saline (FAO, 1997). The common cations associated with salinity

are Na⁺, Ca²⁺ and Mg²⁺, while the common anions are Cl⁻, SO₄²⁻ and HCO₃⁻. However, Na⁺ and Cl⁻ ions are considered the most important, since Na⁺ in particular causes deterioration of the physical structure of the soil and both Na⁺ and Cl⁻ are toxic to plants. (Hasegawa *et al.*, 2000).

Thus, the role of proper nutrition is important in contributing nutrient balance and plant growth. The research has shown that in response to soil salinity, seedlings growth, leaves area, root biomass and shoot biomass have all been reduced (Redmann *et al.*, 1994). There are some evidence that the salinity can reduce the fresh weight and dry weight of plants (Parida *et al.*, 2004). Salinity reduces the ability of plants to utilize water and causes a reduction in growth rate, as well as changes in plant metabolic processes (Munns, 2002).

Due to the increasing world's population and food needs, it is necessary to use available soil and water resources optimally; as well as, using ignored resources such as saline soil. Plant survival on saline soil has been widely used to evaluate the tolerance of native species growing on uncultivated lands. Cowpea is an important grain legume which is widely grown in arid and semiarid regions of the world Ehlers and Hall, (1997) and it is one of the most important crops for people living in developing countries. Cowpea is inherently more drought tolerant than other crops but it still suffers considerable damage due to frequent drought and salinity stresses in different regions where rainfall is scanty and irregular (Singh, 2003). Researchers have shown that among crop species, legumes are considered as the most salt sensitive (Maas and Hoffman, 1986). But little information is available about the effect of soil salinity on growth parameters in Cowpea. Therefore, this study was initiated with the following objective to provide such approaches in its cultivation.

A. Objective of the study

- I. To study the effect of different NaCl concentrations on the growth parameters of vegetable cowpea.
- II. To compare the influence of different salinity conditions on the yield attribute of vegetable cowpea.

II. MATERIALS AND METHODS

A. Treatments and experimental designs

The treatments consisted of four levels of NaCl concentrations (non-saline, 0.5%, 1%, and 1.5%). The non-saline treatment (T1) contained 0g/L of sodium chloride; the 0.5% saline treatment (T2) contained 5g/L of sodium chloride; the 1% saline treatment (T3) contained 10g/L of sodium chloride, and 1.5% saline treatment (T4) contained 15g/L of sodium chloride. The concentrations were equivalent to 0dS/m, 3.5dS/m, 7.0dS/m and 10.5dS/m respectively. As the result, experiments were laid out in the complete randomized design (CRD) with four replications of each treatment.

B. Soil sampling and preparation

Non saline soil samples were collected randomly from 0-15cm depth using an auger at crop farm located in Eastern University of Sri Lanka. Collected soil samples were brought to the laboratory and spreaded on trays and kept for two days for the air drying. In order to minimize soil heterogeneity, the samples were mixed thoroughly and sieved through 2mm sieve.

The treatment groups were: non saline, 0.5% saline, 1% saline and 1.5% saline. To achieve these soil salinities, 6 kg of dry potting soil was saturated with the treatment of different sodium chloride concentrations and which were filled in plastic buckets.

Five seeds of "Sene" variety of cowpea was planted in each plastic buckets and kept under the shade house. Plastic buckets were spaced 0.5 m x 0.5 m and the treatments were irrigated with respective salt solution until the seedlings develop its primary leaves. Two weeks after sowing, seedlings were thinned to three plants per pot.

C. Data collection

Growth parameters and pod yield of vegetable cowpea were measured from each treatment as per the procedures mentioned below.

Plant height (cm): was measured in centimetres from the soil surface to the tip of matured leaf in the plant at maturity by using foot ruler.

Plant fresh weight (g): was measured in grams using electronic balance.

Root length (cm): was measured in centimetres from the soil surface to the tip of tap root.

Number of branches: Number of branches per plant was counted manually.

Mean Pod Yield: Mean Pod Weight was weighed in each salinity level.

D. Data analysis

The data were subjected to analysis of variance (ANOVA) using SAS version 9.1. Duncan Multiple Range Test (DMRT) was used to separate significantly differing treatment means after the main effects were found significant at $p < 0.05$.

III. RESULTS AND DISCUSSIONS

A. Root length of plants

The effect of different soil salinity levels on the root length from one month old plants are presented in Table I.

TABLE I. EFFECT OF DIFFERENT SALINITY LEVELS ON ROOT LENGTH OF VEGETABLE COWPEA

Treatments	Mean Root Length(cm)
T1 (Control)	4.47 ^a
T2 (0.5% Salt Concentration)	2.37 ^b
T3 (1.0% Salt Concentration)	2.15 ^b
T4 (1.5% Salt Concentration)	2.02 ^b

Table 1 shows that the increased salt concentration of the experimental plants by the means of root length was decreased up to 2.02 cm while plants treated with non-salt solution showed significant promotion in root lengths. Growth decline due to salinity was mostly recognized towards the scarcity of water due to lowered water potential in root medium, nutritional imbalance and specific ion toxicity arising from higher concentration of Na^+ and Chlorate (Eisa *et al.*, 2012).

Fresh water, along with vitamins and minerals found in the soil; flow freely to the roots and up to the stem, leaves and other parts of the plants distributing the nutrients effectively. When salt is present in the soil, it tends to play tug of war with the roots. The roots pull in the available water while the salt pulls out the water. High salinity may also inhibit root and shoot elongation by slowing down the water uptake by the plant (Ghoulam *et al.*, 2002). Neumann (1995) indicated that salinity can rapidly inhibit root growth and hence capacity of water uptake and essential mineral nutrition from soil. Hence, we could conclude that it is obvious salinity reduces root growth of plant (Neumann, 1995).

B. Fresh weight

The effect of different soil salinity levels on fresh weight of one month old plants are presented in Table II. The greatest mean plant weight (4.12 g) was obtained from the control treatment which was significantly different from those of the other treatments. There was no significant change in plant weight among the treatments T2, T3 and T4.

TABLE II. EFFECT OF DIFFERENT SALINITY LEVELS ON FRESH WEIGHT OF VEGETABLE COWPEA

Treatments	Mean Fresh Weight (g)
T1 (Control)	4.12 ^a
T2 (0.5% Salt Concentration)	2.65 ^b
T3 (1.0% Salt Concentration)	2.60 ^b
T4 (1.5% Salt Concentration)	2.20 ^b

Salinity-induced the reduction of fresh weight was a common phenomenon for most of the cultivated crop plants and trees. Behzadifar *et al.* (2013) have described the very high significant reduction of fresh weight of *Catharanthus roseus* at high salinity level (Behzadifar, 2013). Further, that the reduction of biomass increased with the increasing salinity which was obvious in this study because of the disturbances in physiological and biochemical activities under saline conditions that may reduce leaf area and leaf numbers (Craine, 2005). These results for fresh weight agreed with the results presented by some other researchers named Andriolo *et al.* (2005). The increasing NaCl concentration in the rooting media significantly ($p<0.05$) reduced the roots, stems and leaves dry weights of cowpea cultivars (Levitt, 1980).

C. Plant height

The result showed that the mean plant height was decreased with increasing salinity levels and the degree of reduction was varied with the salinity levels (Table III). The maximum plant height (33.42cm) was raised from control treatment, and the shortest plant height was raised from 1.5% treatment, (17.1cm). There was no significant change in plant height among the treatments T2, T3 and T4.

TABLE III. EFFECT OF DIFFERENT SALINITY LEVELS ON PLANT HEIGHT OF VEGETABLE COWPEA

Treatments	Mean Plant Height (cm)
T1 (Control)	33.42 ^a
T2 (0.5% Salt Concentration)	22.75 ^b
T3 (1.0% Salt Concentration)	22.17 ^b
T4 (1.5% Salt Concentration)	17.10 ^b

The salinity greatly reduced plant height of all plants at 1.5% NaCl (Khadri *et al.*, 2001). Plant heights of all plants were affected by salinity at 1.5% NaCl even at the lowest salinity treatment (0.5%) which were significantly declined compared to the control. The elongation of the stem, while treating with low concentrations of salts may induce osmotic adjustment activity in the plants, which may improve the plant growth. On the other hand, a noticeable decrease in the length of the stem (also due to treatment with sodium chloride solution) could be due to the negative effect of this salt on the rate of photosynthesis, the changes in

enzyme activity (that subsequently affects protein synthesis), and also the decrease in the level of carbohydrates and growth hormones, both of which can lead to inhibition of the growth (Mazher *et al.*, 2007). Moreover, the uses of low concentrations of sodium chloride study on cowpea, *Vignaunguiculata* L., led to increases in plants lengths, whereas higher concentrations caused shortage (Memon *et al.*, 2010).

D. Number of branches

The result indicated that the mean numbers of branches were generally decreased with increasing salt concentration and the degree of reduction was significant among treatments (Table IV). The highest numbers of branches were observed with control, while, the lowest number with T4.

TABLE IV. EFFECT OF DIFFERENT SALINITY LEVELS ON NUMER OF BRANCHES OF VEGETABLE COWPEA

Treatments	Mean Plant Branches
T1 (Control)	3.50 ^a
T2 (0.5% Salt Concentration)	2.50 ^b
T3 (1.0% Salt Concentration)	1.75 ^c
T4 (1.5% Salt Concentration)	1.00 ^d

The results were in conformity with the results of Javed *et al.*, (2002) who observed a decrease in plant height in tomato under the salinity stress (Javed *et al.*, 2002). Furthermore, at T4 (1.5 %) salinity levels, all plants were botched to produce adequate number of branch at maturity level because of high salinity concentration which hampered the growth of branch on the individual plant and hindered photosynthetic activity of the plant as result the plant exposed to deficiency of important mineral and food to survive and the plant become die.

Also, similar result was reported by (Islam *et al.*, 2012) who found that decrement of branch number of lentil under salinity level (Islam *et al.*, 2012). This might be due to salinity inhibits the formation of new branch and facilitating the aging of old branch at various degrees. The sprouting of the lateral buds was due to a breakdown of hormone induced apical dominance, a phenomenon implicated previously in salinity damage of plants (Waisel, 1972) as well.

E. Pod yield

Analysis of variance for mean pod yield of cowpea revealed that pod yield production of cowpea significantly influenced by NaCl treatment and responded differently for different salinity level.

There was no significant change in pod yield between the treatments T1 and T2 and the influence was much more pronounced at T3 and T4. Control plants were performed well and produced the highest pod yield (2.28g) than the other treatments that were tested. Whereas, the yield performance of T4 plants were zero and this may due to the high salt stress.

The results (Table V) were full agreement with studies in wheat explained that salt stress, imposed while the shoot apex is in vegetative stage, can adversely affect spike development and decrease yields of wheat (Maas and Grieve, 1990). Salt stress decreased the yield potential mostly by reduction the number of spike-bearing tillers. This conclusion was also reached by El-Hendawy *et al.* (2005). The action of these salts can go beyond a simple decrease in soil water potential to cellular injury caused by oxidative stress in plants, and these effects together result in reduced productivity. The presence of salts, due to development of osmotic potential, in soil water hinders extraction of water by plant roots in required amount to meet their evapotranspiration demand even though sufficient quantity of water is present in soil and thereby effects on crop yield.

Decreased fruit weight with increasing salinity was reported by Singh *et al.* (1988) respectively. The findings of the study elucidate that increment of salinity level in the growth media cause significant reduced in pod yield. Similar results were reported by Islam *et al.*, (2012) in lentil reported that decrement in the pod yield of lentil as consequence of increasing salinity. This may be due to salinity adversely reduced in leaves per plant, chlorophyll content and leaf water content and high leaf temperature which result in decrement of pod yield of plants (Nasir Khan *et al.*, 2007).

TABLE V. EFFECT OF DIFFERENT SALINITY LEVELS ON MEAN POD YIELD OF VEGETABLE COWPEA

Treatments	Mean Pod Weight (g)
T1 (Control)	2.28 ^a
T2 (0.5% Salt Concentration)	1.96 ^a
T3 (1.0% Salt Concentration)	0.64 ^b
T4 (1.5% Salt Concentration)	0.00 ^c

IV. CONCLUSION

Present study revealed that the growth parameters of the controlled plants were greatly varied from plants which were treated with different concentration of salt in soil as the treatments. Growth parameters considered in this study such as root length, plant weight, plant height were not affected by different concentration of salt. But Branching and pod yield was affected by salinity. In conclusion 0.5 % salinity level can be considered as suitable salt tolerance level for vegetable cowpea.

REFERENCES

- [1] FAO. (1997). Soil map of the world. Revised Legend. World Soil Resources Report, Rome.
- [2] Hasegawa, P.M., Bressan, R.A., Zhu, J.K. and Bohnert, H.J. (2000). Plant cellular and molecular responses to high salinity. *Annu. Rev. Plant Physiol. Plant Molecular Biology*. 51: 463-499.
- [3] Redmann, R.E., Qi, M.Q. and Belyk, M. (1994). Growth of transgenic and standard canola (*Brassica napus*) varieties in response to soil salinity. *Can. Journal of Plant Science*. 74: 797-799.
- [4] Parida, A.K., Das, A.B. and Mittra, B. (2004). Effects of salt on growth, ion accumulation, photosynthesis and leaf anatomy of the mangrove, *Bruguiera parviflora*. *Trees-Structural Function*. 18: 167-174.
- [5] Munns, R. (2002). Comparative physiology of salt and water stress. *Plant Cell Environ.* 25: 239-250.
- [6] Ehlers, J.D. and Hall, A.E. (1997). *Cowpea (Vigna unguiculata L. Walp)*. *Field Crops Res.* 53: 187-204.
- [7] Singh, B.B., Hartmann, P., Fatokun, C., Tamo, M., Tarawali, S. and Ortiz, R. (2003). Recent progress on cowpea improvement. *Chronica Hortic.* 43: 8-12.
- [8] Maas, E.V. and Hoffman, G.J. (1986). Crop salt tolerance-current assessment. *J. Irr. Drain Div.* 103:115-134.
- [9] Eisa, S.S., Ibrahim, A.M., Khafaga, H.S. and Shehata, S.A. (2012). Alleviation of Adverse Effects of Salt Stress on Sugar Beet by Pre-Sowing Seed Treatments. *Journal of Applied Sciences Research*. FAO. 8(2): 799-806.
- [10] Ghoulam, C., Foursy, A. and Fares, K. (2002). Effects of salt stress on growth, inorganic ions and proline accumulation in relation to osmotic adjustment in five sugarbeet cultivars. *Environmental Experimental of Botany*. 47: 39-50.
- [11] Neumann, P.M. (1995). Inhibition of root growth by salinity stress: Toxicity or an adaptive biophysical response, In: Baluska F., Ciamporova M., Gasparikova, 76 O., Barlow P.W. (Eds.). *Structure and Function of Roots*, Kluwer Academic Publishers, the Netherlands. Pp. 299-304.
- [12] Behzadifar, M., Chehراzi, M., and Aboutalebi, A. (2013). Effect of salt stress by using unconventional water on some morphological characters and ajmalicine alkaloid amount in the roots of *Catharanthus roseus* Cvs. Rosea and Alba. *Annals of Biological Research*. 4 (8): 229-231.
- [13] Craine, J.M. (2005). Reconciling plant strategy theories of Grime and Tilman. *Journal of Ecology*. 93 (6): 1041-1052.
- [14] Andriolo, L.D., Gean, H.W., Maiquel, D.S.G. and Rodrigo, O.C.B. (2005). Growth and yield of lettuce plants under salinity. *Hortic. Bras.* 23 (4): 931-934.
- [15] Levitt, J. (1980). *Responses of Plants to Environmental Stresses*. Water, Radiation, Salt, and other stresses, Academic Press, New York. Pp.365-488.

- [16] Khadri, M., Pliego, L., Soussi, M., Luch, C. and Ocana, A. (2001). Ammonium assimilation and ureide metabolism in common bean (*Phaseolus vulgaris*) nodules under salt stress. *Agronomie*. 21: 635-643.
- [17] Mazher, A.M.A., El-Quesni, E.M.F. and Farahat, M.M. (2007). Responses of ornamental and woody trees to salinity. *World Journal of Agricultural Science*. 3 (3): 386-395
- [18] Memon, S.A., Hou, X. and Wang, L.J. (2010). Morphological analysis of salt stress. Response of pak Choi EJEAFChe. 9 (1): 248–254.
- [19] Javed, A., Tanveer, U.H. and Muhammad, S. (2002). Effect of salinity on yield, growth and nutrient contents of tomato. *Pakistan J. Agril. Sci.* 39(2): 76-79.
- [20] Islam, M.T., Jahan, N.A., Sen, A.K. and Pramanik, M.H.R. (2012). Effects of Salinity on Morpho Physiological attributes and Yield of Lentil Genotypes. *International Journal of Sustainable Crop Production*. 7(1): 12-18.
- [21] Waisel, Y. (1972). *Biology of Halophytes*. Academic Press, New York.

Impact of Sulphate of Potash (SOP) and Partially Burnt Paddy Husk (PBPH) on Phosphorus Availability in a Salt-affected Paddy soil.

M.Kanimoly^{*1} and P. Premanandarajah^{*2}

^{*Department of Agricultural Chemistry, Faculty of Agriculture, Eastern University Sri Lanka}

¹kanimolym@yahoo.com

²puni_prem@yahoo.com

Abstract— Salinity is a significant constraint to rice production in many inland and coastal rice growing areas in Sri Lanka. A pot culture experiment was conducted at Eastern University, Sri Lanka to examine the impact of Sulphate of Potash (SOP) and Partially Burnt Paddy Husk (PBPH) on available soil phosphorus and phosphorus content of rice in a saline soil. The experiment was conducted in completely randomized, 2×4 factorial design with three replicates. Treatments comprised, four rates (0, 18, 36 and 72 kg/ha) of SOP and two rates (0 and 625 kg/ha) of (PBPH). After planting soil samples were collected periodically and analyzed for phosphorus availability. There was a positive impact of rate of SOP and PBPH on soil available phosphorus content. The results revealed that, at 2 weeks after incubation the soil available phosphorus content was significantly higher in treatments received PBPH. Soil phosphorus content was higher at 72 kg K₂O/ ha application in both PBPH amended and non-amended soil. The highest plant phosphorus content was recorded at 72 kg K₂O/ ha application in both amended and non-amended soil and was 4.5 and 3.7 mg/g dry weight respectively. The results of this study suggested that by incorporating PBPH with increasing rate of SOP, soil phosphorus availability and plant phosphorus content can be increased in paddy grown in saline soils.

Keywords— Phosphorus, partially burnt paddy husk, Sulphate of potash, saline soil, Sri Lanka

I. INTRODUCTION

Salinity is gradually spreading in the rice lands of Sri Lanka as well, both in the coastal regions and inlands. Spread of salinity has the potential to reduce national rice production significantly as rice is one of the most salt-sensitive crops (De Costa *et al.*, 2012). Soil and environmental factors contribute to the accumulation of salts in soil layers, and the level above 4 dS/m may cause adverse effect on crop production.

Phosphorus (P) plays an important role in early vegetative growth stages, because it promotes tillering and root development (Mahmood *et al.*, 2013). Low phosphorus availability and uptake by plants are major constraints in salt-affected soils (pH>7). Increasing phosphorus availability and enhancing phosphorus nutrition of plants through fertilization and amelioration may enhance plant salt tolerance and growth. Amending the soil in the initial rooting zone of plants may be an alternative form of reclaiming saline soils.

Adequate regulation and supply of mineral nutrition may help to improve plant growth under saline conditions (Akhtar *et al.*, 2003). With appropriate fertilizers application methods, salinity conditions can reduce its harmful effects and increased productivity of salinized soils.

Potassium (K) plays an important role in mitigating the adverse effects of high salt concentrations in soils through its roles in stomatal regulation, osmoregulation, maintaining the membrane ion charge balance, cellular energy status, and protein synthesis and the stress tolerance of crops can be enhanced by optimizing potassium nutrition (Romheld and Kirkby, 2010). Among the available forms of potassium fertilizer, studies indicated that sulphate of potash (50% of K₂O and 18% S) is the most preferred potassium source in salt-affected soils. The use of KCl can enhance the damaging effects of salinity because of its high chlorine content (48%). So sulphate of potash (50% of K₂O and 18% S) is the most preferred potassium source in salt-affected soils (Elkholy *et al.*, 2003).

The combined use of organic and inorganic fertilizers in crop production has been widely recognized as a way of increasing yield and improving productivity of the soil (Mamaril *et al.*, 2009). Organic materials usually have a large cation exchange capacity, enabling them to retain K⁺ effectively (Silva and Uchida, 2000). Previous studies showed that partially burnt paddy husk improved soil properties by decreasing soil bulk density and increasing organic carbon, cation exchange capacity (CEC), available nutrients in saline soil and increase rice yield and yield components (Masulili *et al.*, 2010).

The aim of the present study was to investigate the impact of sulphate of potash (SOP) and partially burnt paddy husk on phosphorus nutrition availability to the rice in saline soils.

II. MATERIAL AND METHODS

A pot experiment was conducted during *Yala* season at Eastern University Sri Lanka. Composite soil sample was collected from 0-20 cm depth from salt-affected paddy land at Vaharai, Koralai pattu North D.S. division, Batticaloa where the soil is saline. It's analyzed for pH (soil: water, 1:5), electrical conductivity (soil: water, 1:2), available phosphorus and extractable potassium by using pH meter (HANNA HI 98130), EC meter (HANNA HI 86303), Olsen's phosphorus method respectively. Accordingly the soil was alkaline (pH of 8.3), highly saline (EC 19.1 dS/m), and had a low level of P (9.69mg/kg). Partially burnt paddy husk was collected at Saththurukkondan Agricultural farm and its available P (0.12%) was analyzed using spectrophotometer (colorimetric).

The experiment was laid out in a completely randomized 2×4 factorial design with three replicates. The treatments comprised two levels of partially burnt paddy husk as; 0 and 625 kg/ha and four rates of potassium as; 0, 18, 36 and 72 kg K₂O/ha in the form of sulphate of potash to saline paddy soil. The treatment that did not receive partially burnt paddy husk or K fertilizer (0 kg/ha for both amendments) were served as control.

According to the treatment combinations, air dried crushed and sieved (2mm) PBPH was mixed with the air dried and sieved (2mm) soil. It was filled (20 kg) into the poly bags (0.07 m²) and kept at moist condition for two weeks. Common basal applications of N and P as 225kg/ha urea (N 46%), 55kg/ha triple super phosphate (TSP) (P₂O₅ 46%) were applied respectively. Potassium was applied in the form of sulphate of potash (K₂O 50%) to each bag just before sowing according to the treatments. Fifteen pre-soaked paddy seeds (BG250) were spread into each poly bag. After two weeks seedlings were thinned to ten per bag. All the agronomic practices except fertilizer application were followed as suggested by Department of Agriculture.

Soil available phosphorus was analyzed at 2 weeks interval from 2 weeks after incubation. At the heading stage, whole plants from each treatment were uprooted, cleaned, dried at 65°C for 2 hours, powdered and analyzed for their phosphorus content.

Statistical Analysis

All data were statistically analyzed by using Statistical Analysis System (SAS 9.1 version) software statistical package and the mean separation was done using Duncan's Multiple Range Test at 5% level.

III. RESULTS AND DISCUSSION

1. Soil available Phosphorus

The results pertaining to the effect of sulphate of potash application on available phosphorus content of soil at harvest was significantly influenced by PBPH. The results revealed highest available phosphorus content in sole 72 kg K₂O/ha application (19.47 mg/kg at harvest, but was significantly lowest in control treatment (4.28 mg/kg). This may be due to the impact of salinity on phosphorus availability in control. Kausar and Gull (2014) observed adverse effect of salinity on the availability of phosphorous and the impact of potassium on the increases in the concentration of phosphorous under saline soil. In PBPH amended soil, 72 kg K₂O/ha in the form of sulphate of potash application, recorded the highest available phosphorus (74.673 mg/kg) content and 36 kg K₂O/ha was the second best source. Application of organic amendment may increase phosphorus availability in salt-affected soil due

to chelating effect of organic compounds. It was supported by several studies in salt-affected soil, that the addition of organic matter increased phosphorus availability (Uyanoz et al., 2006; Walker and bernal, 2008).

The break through curves obtained at two weeks interval for different rate of sulphate of potash in PBPH non-amended soil is shown in figure: 1(A), the available phosphorus content was increased and reached to a peak at 2 weeks after planting. It might be due to the application of triple super phosphate (TSP) at the time of planting as the phosphorus was in readily available form in fertilizer.

Among the treatments 72 kg K₂O/ha exhibited high phosphorus content at two weeks after planting and was on par with 36 kg K₂O/ha application. Lower value was obtained in 0 kg K₂O/ha. After two weeks the available phosphorus content was decreased. High soil pH may convert the available phosphorus into unavailable form therefore the available phosphorus may be converted to less available form when soil pH is above 7.5.

The break through curves obtained in PBPH amended soil is shown in figure: 1(B). The available phosphorus content was increased and reached to a peak at two weeks after planting and then reduced. It might be due to the application of triple super phosphate (TSP) at the time of planting. It may be due to the readily available form of phosphate in fertilizer and the decomposition of PBPH. The results revealed that among the rate of SOP application the phosphorus content of soil was higher in 72 kg K₂O/ha where it was followed by 36 kg K₂O/ha. This may due to chemical fertilizers enhance decomposition of soil organic matter. Adhikari and Chen (2011) also observed that the potential benefit of combination treatment (organic manure+ Chemical fertilizer) was increased recovery relative to that in chemical fertilizer treatment. Although there was a reduction in phosphorus content at four weeks after planting in all rate of potash application the reduction was higher in PBPH non-amended soil. This may be due to the fixation by soil colloids and the impact of high pH on phosphorus availability for their growth and development.

The results revealed that the phosphorus availability was higher in the PBPH amended soil than in the non-amended soil (figure: 2). In PBPH amended soils increases in phosphorus availability are usually attributed the organic acids and chelates produced during microbial decomposition of organic residues. These organic acids help in the solubility of native phosphorus as a result of which increase in available phosphorus content in wheat (Tomar et al., 1984). Applied organic manure leads to the formation of coating on the sesquioxides because of which the phosphorus fixing capacity of soil was reduced (Seshadri Reddy, 2005).

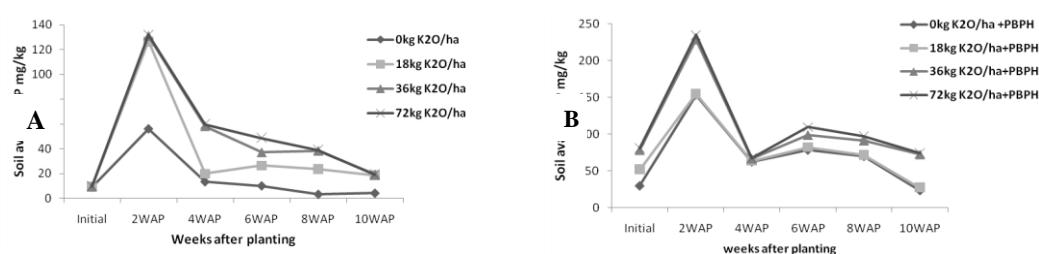


Figure 1: Changes on soil available phosphorus content with time in A) PBPH non-amended condition B) PBPH amended condition with different rates sulphate of potassium

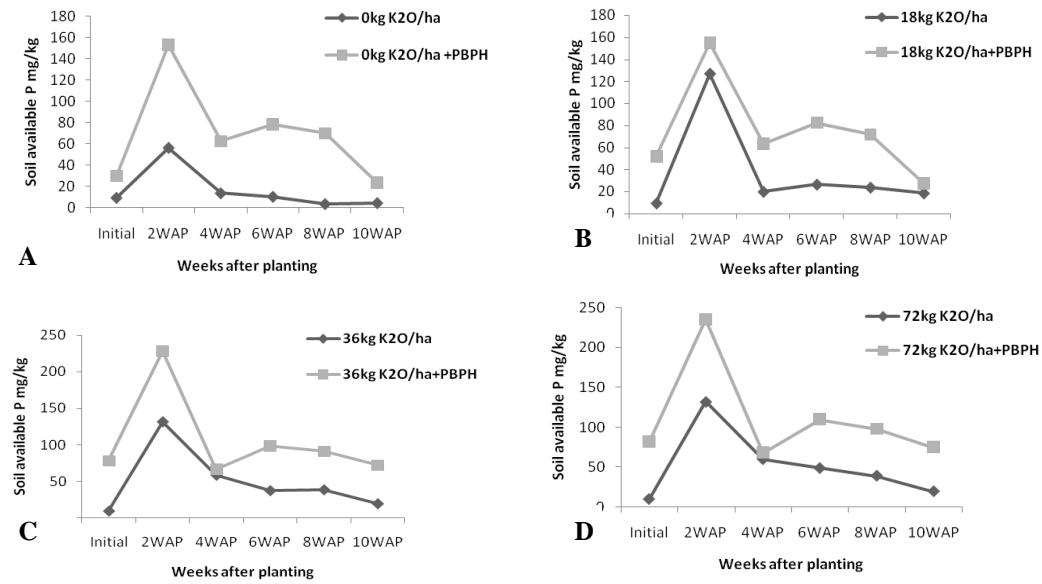


Figure.2: Changes in soil available phosphorus content of soil with time in (A.) 0 kg K₂O/ha, (B.) 18 kg K₂O/ha, (C.) 36 kg K₂O /ha and (D.) 72 kg K₂O/ha applied soils at both PBPH level

2. Plant Phosphorus content

The results showed to the application of PBPH and potassium (Table.1) indicated a significant influence on phosphorus uptake in rice ($p<0.05$). Plants in soils with sulphate of potash and no PBPH indicated that the application of potassium increased the concentration of plant phosphorus content. The maximum content (3.721 mg/g DW) was observed in 72 kg K₂O/ha application and was followed by 36 kg K₂O/ha (3.041 mg/g DW) application. In both conditions, plant.

Phosphorus concentration was increased significantly ($p<0.05$) with the increase in its rate from 0 to 72 kg K₂O/ha. It might be due to the impact of potassium on higher availability of phosphorus content in soil solution for the uptake by plants under saline condition. This may be attributed to low salt index of potassium sulphate in the root zone, which caused an increase in the uptake of phosphorus. This result was supported by Kausar and Gull 2014 that potassium fertilization had a significant effect on phosphorus content in wheat.

Combining PBPH with SOP significantly increased the phosphorus uptake in plants than non-amended soil. This may be due to the influence of potassium application and the favourable effects of PBPH on the release and availability of phosphorus in soil solution. It might have improved the nutrient retention in soil and increase the nutrient use efficiency. Among the different rates of application, 72 kg K₂O/ha showed highest phosphorus content (4.536 mg/g DW). This may be due to the high concentration of available phosphorus in soil solution by potassium application and the release of nutrients from organic amendment. Masulili *et al.* (2010) reported that the application of rice husk biochar increased available phosphorus content in soil thus increases the phosphorus uptake by plants.

TABLE I.: EFFECT OF SOP AND PBPH ON PLANT PHOSPHORUS LEVEL (mg/g DW).

PBPH application	Rate of Potassium (SOP)	Plant P level (mg/g DW)
Zero application	0 Kg K ₂ O/ha	1.182±0.002 ^d
	18 Kg K ₂ O/ha	2.052±0.023 ^c
	36 Kg K ₂ O/ha	3.041±0.018 ^b
	72 Kg K ₂ O/ha	3.721±0.003 ^a
625 kg/ha	0 Kg K ₂ O/ha	2.871±0.003 ^d
	18 Kg K ₂ O/ha	3.207±0.003 ^c
	36 Kg K ₂ O/ha	3.884±0.004 ^b
	72 Kg K ₂ O/ha	4.536±0.020 ^a
Amendment		P<0.05
SOP		P <0.05
Interaction		P<0.05
CV		0.754

The values are means of replicates ± standard error.

Means with the same letter(s) are not significantly different from each other according to the Duncan multiple range test at 5% significant level.

IV. CONCLUSION

Combining partially burnt paddy husk with sulphate of potash (SOP) increased the soil phosphorus availability and plant phosphorus content. Highest soil available phosphorus content was recorded at 72 Kg K₂O/ha application the form of sulphate of potash in PBPH amended and non-amended soil. The results of this study suggested that by incorporating partially burned paddy husk with sulphate of potash soil phosphorus availability in saline soil can be improved.

REFERENCES

- [1] Adhikari, KR & Chen, ZS 2011, 'Combining compost with urea: Nitrogen and phosphorus recovery by cabbage and leaching under imposed high rainfall condition in the greenhouse', *Sci Res Essays*, vol.6, no.4, pp.819-829.
- [2] Akhtar, ME, Saleem, MT & Stauffer, MD 2003, 'Potassium in Agriculture. A Hand Book', Pakistan Agriculture Research Council, Islamabad.
- [3] De Costa, WAJM, Wijeratne, MAD, De Costa, DM & Zahra, A.F 2012, 'Determination of the appropriate level of salinity for screening of hydroponically grown rice for salt tolerance', Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Peradeniya. *J.Natn.Sci.Foundation Sri Lanka*, vol.40, no.2, pp.123-136.
- [4] Elkholi, MH, El Hadi, AH & Saleh, SHZ 2003, 'Effect of rates and forms of potassium fertilization on rice crop under salt affected soil conditions at northern delta of Egypt', *Soil, Water and Environment Research Institute, ARC, Giz*, Egypt.
- [5] Kausar, A & Gull, M 2014, 'Effect of Potassium Sulphate on the Growth and Uptake of Nutrients in Wheat (*Triticum aestivum* L.) Under Salt Stressed Conditions', *Journal of Agricultural Science*, vol.6, no.8, pp.101.
- [6] Mahmood IA, Ali, A, Aslam, M, Shahzad, A, Sultan, T & Hussain, F 2013, 'Phosphorus Availability in Different Salt-Affected Soils as Influenced by Crop Residue Incorporation', *International Journal of Agriculture and Biology*, vol.15, no.3, pp. 472-478.
- [7] Masulili, A, Utomo, WH & Syechfani, MS 2010, 'Rice husk biochar for rice based cropping system in acid soil 1. The characteristics of rice husk biochar and its influence on the properties of acid sulfate soils and rice growth in West Kalimantan, Indonesia. *Journal of Agricultural Sciemcem*, vol.2, no.1, pp.39.
- [8] Romheld, V. and Kirby, E. (2010). Research on potassium in agriculture: needs and prospects. *Plant Soil*, vol.335, pp.155-180.
- [9] Seshadri Reddy 2005, 'Effect of different organic manures on available NPK status and organic carbon after harvest of ground nut', *Crop Res*, vol.30, no.1, pp.26-29.
- [10] Silva JA and Uchida R, editors 2000, 'Plant Nutrient Management in Hawaii's Soils, Approaches for tropical and subtropical agriculture. Honolulu (HI): University of Hawaii.
- [11] Tomar, NK, Gupta, AP, & Khanna, SS 1984, 'Evaluation of rock phosphate superphosphate mixtures by inoculation in organic manure for efficient use in Wheat', *Ferti.News*, vol.29, pp.37-38.
- [12] Uyanoz, R, Çetin, U & Karaarslan, E 2006, 'Effect of organic materials on yields and nutrient accumulation of wheat, *Journal of plant nutrition*, vol.29, no.5), pp.959-974.
- [13] Walker, DJ & Bernal, MP 2008, 'The effects of olive mill waste compost and poultry manure on the availability and plant uptake of nutrients in a highly saline soil', *Bioresource technology*, vol.99, no.2, pp.396-403

Production of Palmyrah Leaf Based Products in Eravur Town DS Division of Batticaloa

J. F. Raasitha^{*1}, Thivahary Geretharan^{*2}, G. Hariharan^{*3}

^{*}Department of Agricultural Economics, Faculty of Agriculture, Eastern University, Sri Lanka

¹jfraasitha@gmail.com

²tgeretharan@yahoo.com

³gharryh25@gmail.com

Abstract— **Palmyrah** (*Borassus flabellifer*) tree has a great capacity to produce several products of economic importance. Among them, leaf based products have provided a livelihood for rural societies in several areas in Sri Lanka and chiefly in Batticaloa district. A questionnaire survey was carried out in Eravur Town Divisional Secretariat division of Batticaloa district using 100 randomly selected palmyrah leaf producers as sample. Data were analysed using the SPSS package and the chi-square analysis was used for testing associations. The study revealed that, all (100%) the producers were female. Majority of the population (53%) were between 25 to 35 years of age, married (67%), completed their primary education (63%), belonged to low income group (66%), had lesser than 12 years of experience (48%) and were having 1-3 members (77%) as a household size. Furthermore, the study showed that most of the respondents (53%) were using both young and mature leaves to make trays and baskets. Majority of respondents (68%) were using knife and scissors for their production process. Further, only 15% of responders were producing all available products such as trays, boxes and mats. About 55% of the respondents were producing 3-4 products per day. Around 55% of the respondents were doing the production seasonally; most of respondents (86%) were doing the production process based on their own experience. The monthly expenditures made by majority of respondents (39%) were Rs. 850 - 1450, and majority of respondents (36%) were getting monthly income of Rs. 3300 - 5400. The results of Chi-square analysis revealed that there was significant ($p < 0.05$) association between the quantities of production per day by the palmyrah leaf based product producers and their age, type of work, family monthly income levels and expenditures on palmyrah. This study suggested that reasonable margin price should be given to the leaf based products and there should be a fixed price for them. Further, the producers should be trained to do other handicrafts related products to have more diversified palmyrah leaf based products.

Keywords— Chi-square analysis, palmyrah leaf, production

I. INTRODUCTION

Palmyrah (*Borassus flabellifer*) palms are mainly distributed in Northern and Eastern provinces of Sri Lanka (Arulmageswaran *et al.*, 2007) and it is recognised to be a valuable economic plant. In Sri Lanka, the palm is mostly found on agriculturally unfertile and marginal lands and the

people destined to live on these poor soils depended on the palm for the livelihood (PDB, 1998). There are varieties of palmyrah products available in the local and international market. Palmyrah is a multipurpose tree as every part of the tree can be used. Therefore, it has been called "the tree of life" and "Katpahatharu", which denotes its immense usefulness to the life of the people, contributing in numerous ways to food and nutrition, shelter and fuel and income generating activities (Chandrasiri, 1997).

According to the Palmyrah Development Board (PDB), in an area of 70,000 hectares in 11 districts of Sri Lanka, there were 11 million Palmyrah trees in 2013 (Dissanayaka, 2013). There were around a million Palmyrah trees scattered across the land in and around towns such as Trincomalee, Puttalam, Hambantota and Batticaloa (UNDP, 2014). Palmyrah is a tree, which can engage human labour in the industries around it irrespective of gender or age. Youngsters gather raw materials; prepare utility articles and handicrafts (PDB, 1998). Over 8,000 families depend on the palmyrah industry in the Batticaloa district. They get an income of about Rs. 6,000 to Rs. 12,000 per month (Jamaldeen, 2014). In the North and East parts of Sri Lanka, one hundred thousand families are direct dependent while the balances are indirect dependents on palmyrah industry. The Palmyrah Development Board (PDB) has helped to institutionalise the people and groups involved in the industry so that their activities could be promoted and assisted through organised institution.

Production of Palmyrah based products has an important place in the economy of Batticaloa district. Palmyrah based products in Batticaloa district includes sap based products, fruit based products, food based products, tender leaf based products, fibre based products, and tuber based products. Among those, production of palmyrah leaf based products is significant among the women in the Eravur Town DS division of Batticaloa district. Palmyrah leaves are used for thatching, mats, hats, different handicrafts, stalks are used to make fence, and black timber is used in constructions (Velauthamurty *et al.*, 2015). Nowadays, the alarming and remarkable feature is that except for palmyrah leaf handicrafts, sales of other leaf-based handicrafts have increased quite promisingly. The reason could be easily attributed to the shortage in supply (Rupasena and Chandrasiri, 1995). This is no doubt a crucial issue for the authorities to be concerned this agribusiness cottage industry.

People have been engaged in this cottage industry from a long period. Nevertheless, public awareness about this cottage industry is very low and there are only few numbers of public websites and public resources available related to the production of these particular products. In addition, it is difficult to find evidences and researches regarding the

Palmyrah leaf based products. Taking the importance and need into consideration this investigation was designed to study about the socio-economic status, present production and constraints of Palmyrah leaf based products producers in the Eravur Town DS division of Batticaloa district.

II. METHODOLOGY

A. Study area and Selection of sample

This study was conducted in selected GN divisions of Eravur Town, Batticaloa District, Eastern Province, Sri Lanka. There are 17 GN Divisions in the Eravur Town DS Division in where there are many people engaged in production of Palmyrah based products. In Eight (08) GN Divisions, there are 295 Palmyrah leaf based products producers in the Eravur Town DS division. A stratification was done based on the type of leaf based products produced by the producers; Mats Producers (116), Tray Producers (94) and Box Producers (85). From those 295 Palmyrah leaf based products producers, 100 producers were randomly selected. The frequency of data collected in the GN divisions are showed in the below Table I.

TABLE I. DATA COLLECTION FROM EACH GN DIVISIONS

GN Divisions	Frequency	Percentage
Eravur 01A	08	08.00
Eravur 01B	12	12.00
Eravur 02C	13	13.00
Eravur 03	17	17.00
Eravur 03A	11	11.00
Eravur 06	19	19.00
Michnagar	09	09.00
Meerakerni	11	11.00
Total	100	100.00

B. Data collection

Structured and pre-tested questionnaires were used to collect the primary data regarding general information and Palmyrah leaf based production related information in the Eravur Town DS division. Secondary data necessary for the study were collected from various sources such as, progressive and experienced palmyrah leaf producers engaged in palmyrah based production, library materials such as journals, research papers, reports and books, publications of Batticaloa district statistical branch and publication of Department of Census and statistics, Sri Lanka.

C. Data analysis

Collected data were analysed using SPSS (Statistical Package for Social Sciences) version 16.0 Software package. Chi-square analysis was done to find out the association between quantity of production per day and selected socio-economic characteristics of those palmyrah leaf producers.

III. RESULTS AND DISCUSSIONS

A. Data on Socio-economic status

Personal and socio-economic characteristics of palmyrah leaf product producers in Eravur DS division of Batticaloa district are shown in Table II. It is apparent from the Table II that the all of the palmyrah leaf based product producers in selected GN division of Eravur Town were female and

that majority of the respondents were between the age ranges of 25-35 years. The study also indicated that all of the male are being act as the helpers for the production. Apart of that, majority of the females were married (67 %), 22% of them were single, 3 % of them were divorced.

Further, the most of respondents (63%) were finished their primary education, 23% of respondents were with no schooling and 14% of respondents were completed their secondary education. It was observed that the majority of the respondents' (66%) monthly income was 5000- 10000 Rupees per month. There were only 3% of respondents who gained 15000-20000 Rupees per month. This is because additional income from other sources probably contributed much to their total income and this industry gives not enough income to people leads to very high percentage of the respondents belonged to low income group. Most of the palmyrah leaf product producers (48%) had below 12 years of experience, 26 percentages of respondents had 12-23 years of experience, 23 percentages of respondents had 24-35 years of experience, and 3 percentages of respondents had 36-47 years of experience. The data furnished in table also indicates that majority of respondents (77%) were having their household size between 4-6 members.

TABLE II. SOCIO-DEMOGRAPHIC PROFILES

S/N	Personal and socio-economical characteristics	Categories	Frequency/ Percentage
1	Age (Years)	25-35	53
		36-55	36
		56-75	11
2	Gender	Male	0
		Female	100
3	Marital Status	Single	22
		Married	67
		Divorced	3
		Separated	8
4	Educational attainment	No schooling	23
		Primary	63
		Secondary	14
5	Type of engagement	Full time	87
		Part time	13
6	Average Monthly Income (Rs.)	5000-10000	66
		10000-15000	31
		15000-20000	3
7	Experience (Years)	Less than 12	48
		12 to 23	26
		24 to 35	23
		36 to 47	3
8	Household size	1 to 3	19
		4 to 6	77
		More than 7	4

A. Data related to production of palmyrah leaf based products

1. Kind of leaves selection for the palmyrah leaf industry

The Fig. 1 indicates the kinds of palmyrah leaves used for the production.

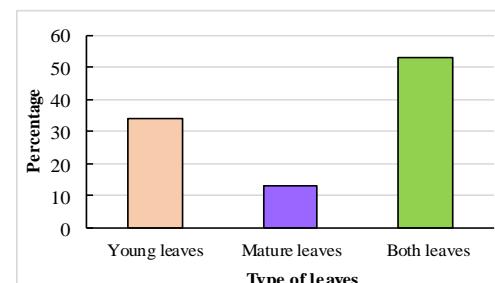


Figure 1. Types of leaves used for production

The majority of respondents (53%) were using both young leaves and mature leaves to make trays and baskets. Here they were using mature leaves to make the edges for trays and baskets. The mature leaves are just below the young leaves not at the bottom (see Fig. 1).

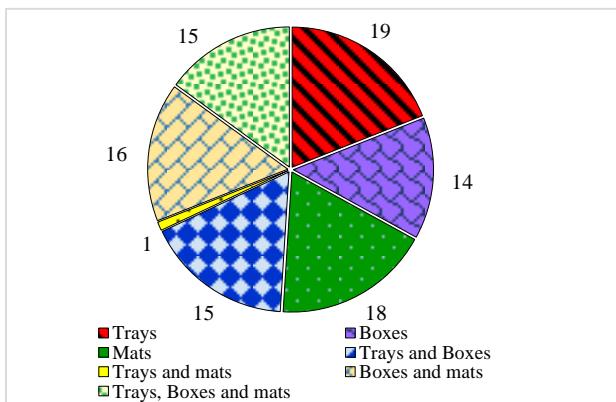
2. Equipment used and Type of products

Knife, scissors, and machine are the main equipment used by the respondents to produce palmyrah leaf based products as shown in the Table III. The majority of respondents (68%) were using knife and scissors for their production process, 21 percentages of respondents were using machine and scissors for their production process, and 11 percentages of respondents were using machine, knife and scissors for their production process. The reason for not using machines by majority of respondents was the higher price.

TABLE III. DISTRIBUTION OF RESPONDENTS ACCORDING TO THE EQUIPMENT USED

Category	Frequency	Percentage
Machine and Scissors	21	21.00
Knife and Scissors	68	68.00
Machine, Knife and Scissors	11	11.00

The common palmyrah leaf based products were mats, trays and boxes but the production pattern was different from one to another.

**Figure 2. Type of the leaf based products**

The Fig. 2 shows the list of products with respects to the frequencies or percentages of the surveyed producers. It indicates that 19% of respondent were producing only trays, 14% of respondents were producing only boxes, 18% of respondents were producing only mats, 17% of respondents were producing trays and boxes, 1% of respondents were producing trays and mats, 16% of responders were producing boxes and mats and 15% of responders were producing all products; trays, boxes and mats.

3. Quantity of production per day

The quantity of the production/ day is mainly depending on the speed or experience of the producer and time availability to do the production work since they have

doing the work as a part time job. The results from the Table IV indicates the majority of respondents (55%) were producing 3-4 quantities of products per day. 22% of responders were producing 1-2 quantities of products per day and 23% of responders were producing 5-6 quantities of products per day.

TABLE IV. DISTRIBUTION OF RESPONDERS ACCORDING TO THE QUANTITY OF PRODUCTION PER DAY

Category	Frequency	percentage
1-2 products/ Day	22	22.00
3-4 products/ Day	55	55.00
5-6 products/ Day	23	23.00

4. Period of production

The study on period of production highly indicated that majority of respondents were doing the production process only on seasonal basis. Because, during the rainy period they were facing difficulties in getting the resources. About 35 percentages of respondents were doing the production process throughout the year. Only 7 percentages of respondents were doing the production process on seasonal basis and whenever necessary.

5. Production based on training and own experience

The Table V indicates the majority of respondents (86%) were doing the production process with their own experience. It could be the reason this job is continuing from generation to generation. Around 14 percentages of respondents were doing the production process based on training provided.

TABLE V. DISTRIBUTION OF RESPONDERS ACCORDING TO THEIR EXPERIENCE AND TRAINING

Category	Frequency	Percentage
Own Experience	86	86.00
Training Provided	14	14.00

The study indicated that the producers have learnt the methods through the trainings obtained by family members, friends or the neighbours.

6. Labour use

The household palmyrah leaf based production activity is almost used the family members as their labours. Because, the revenue is very low from this production. Therefore, they cannot use hired labours for their production process. The majority of respondents were doing the production process with the help of their children and other members like mothers, grandmothers and their husband.

7. Monthly Expenditure and Income

The Table VI shows that the monthly expenditures and income due to the production of palmyrah leaf based products. The expenditure made by the majority of respondents (39%) were Rs. 850-1450 per month, expenditures made by the 26 percentages of respondents

were Rs. 250-850 per month and expenditures made by the 35 percentages of respondents were Rs. 1450-2050 per month. Most of respondents (36%) were getting the monthly income from sale of palmyrah leaf based products between Rs. 3300-5400 per month, 33 percentages of respondents were getting the income from palmyrah products between Rs. 1200-3300 per month, 23 percentages of respondents were getting the income from palmyrah products between Rs. 5400-7500 per month, 8 percentages of respondents were getting the income from the sale palmyrah products between Rs. 7500-9600 per month.

TABLE VI. MONTHLY EXPENDITURE AND INCOME OF THE PRODUCERS

S/N		Catergory	Frequency /Percentage
1	Monthly Expenditure (Rs)	250-850	26
		850-1450	39
		1450-2050	35
		1200-3300	33
2	Monthly Income (Rs)	3300-5400	36
		5400-7500	23
		7500-9600	08

B. Results of Relational analysis

The Table VII explains the association between the quantity of production per day and selected socio-economic characteristics such as age, type of work, Total family income and expenditure made on palmyrah leaf based production of palmyrah based product producers. Those associations are discussed below.

1. Age

Considering the association between the variable age and quantity of production per day, there was a significant association ($p < 0.05$) observed. Among the total producers involved in palmyrah product industry 73.9 percentages were under the young age group of 15-35 years. Here the young agers were producing between the quantities of 5-6 products per day. Since the middle agers (36-55 years) and old agers (56-75 years) were doing the palmyrah product production for a long time in daily basis they were getting body pains and boredom. So, that the production rate was getting down.

2. Type of work

There was a significant association ($p < 0.05$) observed between the variable type of work and quantity of production per day. Among the total producers involved in palmyrah product industry, around 90 percentages of the producers were full time workers in this industry. They were producing of 3-4 products per day. The part time workers are doing the production only after finishing their full time jobs.

3. Total family income

There was a high significant association ($p < 0.01$) observed between the variable total family income and quantity of production per day. Among the total producers involved in palmyrah product industry, nearly three quarter

percentages of the responders were received monthly family income level of Rs. 5000 to Rs. 10000. Another quarter percentages of the responders were received monthly family income level of Rs. 10000 to Rs. 15000.

4. Expenditure made for the production

Among the total producers involved in palmyrah product industry, 81.8 percentages of respondents were spent Rs. 250 to Rs. 850 for the palmyrah production. Other respondents' expenditure level was high. Because, they were using colours and other decorations to improve their product quality. Thus, the expenditure of palmyrah production significantly ($p < 0.01$) shown the association with quantity of production per day.

TABLE VII. CHI-SQUARE ANALYSIS BETWEEN QUANTITY OF PRODUCTION PER DAY AND SELECTED SOCIO-ECONOMIC CHARACTERISTICS

Variables	X^2	df	p value	Decision
Age	11.027	4	$p < 0.05$	Significant
Type of work	11.046	2	$p < 0.05$	Significant
Total family Income	12.171	4	$p < 0.05$	High Significant
Expenditure	49.290	4	$p < 0.05$	High Significant

C. Constraints faced by the producers

There were various types of constraints confronting the palmyrah leaf industry in the study area. Difficulties to get the palmyrah leaf on some period, less number of leaves during rainy periods, leaf price is very high in some period (rainy season), selling price is very low (Big basket – Rs. 130.00, Tray - Rs. 70.00, Box – Rs. 100.00), different price of the products to different salesman, electricity problems, very less margin price for mat (Rs. 55.00), no supports from PDB, Samurdhi bank society and other banks are not providing any loans for people above 55 years of age, sales persons are not coming regularly in rainy periods, fungus attack on the products in rainy period and Lack of market information were the main constraints faced by the respondents.

IV. CONCLUSIONS

From the study it can be concluded that majority of respondents were married. More than half of the leaf product producers belonged to low income group of Rs. 5000 to Rs. 10000. The majority of respondent worked as full time in palmyrah leaf industry. The majority of respondents had lesser than 12 years of experience. All the respondents were doing the production process with the help of their family members. The majority of respondents were producing only trays. Because it has high demand. The majority of respondents were selling their products through salesperson in other districts. The expenditures made by majority of respondents were Rs. 850 to Rs. 1450 per month. The majority of respondents were getting the income from the sale of palmyrah products between Rs. 3300 to Rs. 5400 per month. Majority of respondents were under poverty stage. Their income, employment, living standard and socio-economic status were low. Because, the palmyrah industry is not yet fully established in Eravur Town DS division. Chi-square analysis was done to find out the association between the quantity of production per day and selected socio-

economic characteristics of palmyrah based product producers. The results indicated that there was significant association between the production and socio economic characteristics of the producers. Producers were not having sufficient space and electricity for the production process in rainy period. To avoid this situation, the PDB can help them by giving loans with low interest rate. It will help them to develop their overall production and it will help them to increase the nighttime productivity. The buying price is varying from sales person to sales person. Therefore, the PDB can arrange to buy all the palmyrah products from the producers with a fixed price at least for a short period until the producers fully establish their industry.

REFERENCES

- [1] Arulmageswaran, S., Chandrasiri, I. M. N. and Culas, J. V. (2007). A study on palmyrah (*Borasus flabellifer*) utilization pattern and socio- economic status of dependent livelihood in Mannar district of Sri Lanka, Economics, Resource Management, Social Aspects, Symposium 2006.
- [2] Chandrasiri, J. K. M. D. (1997). Socio Economic Aspects of the Palmyrah Industry and Its Beneficiaries. Research Report. Hector Kobbekaduwa Agrarian Research and Training Institute 114, Wijerama Mawatha Colombo 07, Sri Lanka.
- [3] Dissanayaka, L. (2013). Palmyrah tree will reduce poverty in northern Sri Lanka. Available at <http://www.sundaytimes.lk/131110/business-times/palmyrah-tree-will-reduce-poverty-in-northern-sri-lanka-68088.html>, accessed on May, 19, 2016.
- [4] Jamaldeen, N. (2014). Cosmetics from Palmyrah. Sunday Observer. Available at <http://www.sundayobserver.lk/2014/12/07/fea08.asp>, accessed on June, 01, 2016.
- [5] PDB. (1998). Report of the progress, achievements and position of the palmyrah development board for the period from September 1994 to June 1998.
- [6] Rupasena, L. C. and Chandrasiri, A. (1995). Marketing of palmyrah based products. Research Report. Hector Kobbekaduwa Agrarian Research and Training Institute 114, Wijerama Mawatha Colombo, 7, Sri Lanka, Available at <http://www.dl.nsf.ac.lk/ohs/harti/21880.pdf> accessed on June, 10, 2016.
- [7] UNDP. (2014). Uplifting the lives of women, while reviving the forgotten palmyrah industry. Available at, <http://www.lk.undp.org/content/srilanka/en/home/ourwork/crisispreventionandrecovery/successstories/uplifting-the-lives-of-women--while-reviving-the-forgotten-palmy.html>, accessed on June, 10, 2016.
- [8] Velauthamurty, K., Mary, S., Sashikesh, G., and Srivijeindran, S. (2015). Enhance the quality of palmyrah (*Borasus flabellifer*), Scholars Research Library Journal of Natural Products of Plant Resource, 5(2):37-42.

A Descriptive Study on the Left Hand Fingering Techniques of Carnatic Violin Playing

I.D. Kondasinghe

University of Visual and Performing Arts, Department of North Indian Music

isurudayantha@yahoo.com

Abstract— Indian classical music is a major music system in the world. It has evolved since many centuries. There are two music traditions in Indian classical music named, Hindustani music and Carnatic music. Carnatic music is the oldest music tradition in Indian classical music. With the various musical instruments used in Carnatic music, the Violin is highly demanded. This study is on the left hand fingering techniques of Carnatic Violin playing. As a bowing instrument Violin has achieved the glory in the expression of every note in Carnatic music. A play cannot generate the required rasa and bhava properly without possessing the correct fingering techniques. There are few types of techniques as plain fingering, jandai, meend and gamak. This study will descriptively look in to these techniques and emphasize the importance of studying them systematically along with practices which will lead to acquire expertise. And finally it will discuss the deportment of fingers by using these techniques. The methodology of this research will include primary data sources and secondary data sources. A descriptive study is done. Through continuous practice of these techniques using exercises, beginners can obtain the ability of playing major compositions, geetha, swara jaathi, varnam, keerthanam and krithi.

Keywords: Music tradition, The Violin, Fingering techniques

I. INTRODUCTION

The Violin, a milestone in the evolution of bowing instruments was originated in Italy in 18th century. Then the Violin is being spread all over the world including colonies of Great Britain since last 500 years. As a result of that, the Violin has immigrated to India in 1757. After the arrival of the Violin to India, it was first spread in the Carnatic music tradition.

The Violin playing of Carnatic music is based on Gayaki style. The reason for using the Violin as the accompany instrument (SwaraVadya) is, it can present every technique and bhava that are expressed by vocal. Because of the finger board without frets, the ability to maintain the note continuously by using the bow with the unbroken movements and the similarity of the tone color between the Violin and the human voice, the Violin has become a popular musical instrument and an essential part in Carnatic music system.

Therefore the violinist should be a person who has the capacity to capture each and every bhava which is expressed

in vocal. As well the violinist should be an expert in left hand fingering techniques. He should practice left hand techniques gradually. There are four types of left hand fingering techniques in Carnatic Violin playing.

1. Plain Fingering
2. Jandai
3. Meend
4. Gamak

These techniques are expressed through its practical usage. Through continuous practices of exercises (sarali varisai) regarding these techniques, a person can obtain the ability of playing all the applied compositions within the Carnatic music system and do new compositions by improvisation.

II. PROBLEM

What are the left hand fingering techniques of Carnatic Violin playing?

III. OBJECTIVE

Identifying the left hand fingering techniques of Carnatic Violin playing.

IV. METHODOLOGY

The methodology of this research will include primary data sources and secondary data sources. Personal interviews as primary data sources and secondary data sources such as books, magazines and websites are utilized. A descriptive study is done elaborating the four main left hand fingering techniques in detail.

V. FINDINGS

The left hand fingering techniques of Carnatic Violin playing is mainly consisted of four parts. They can be identified as below.

1. Plain Fingering
2. Jandai
3. Meend
4. Gamak

Explaining these above one by one;

Plain Fingering means the clear and direct usage of related (proper) fingers at the proper positions of the notes. By using proper fingers and playing clear, direct notes (exercises); violinist can obtain the expertise in plain fingering.

Jandai is playing the same note repeatedly. Example: (RR, GG, MM)

When playing as “RR”; finger should be positioned on the key board and then it should be moved down quickly towards the “S” note and then again on to the “R” note.

Other jandai plays also should be played using the proper fingers for the particular notes.

It's clear that through practicing this process of using proper fingers for jandai exercises, a violinist can obtain expertise in jandai playing.

Meend is sliding from one note to another note. This slide can be identified in two ways as, upward meend and downward meend.

Upward Meend- R  D
Downward Meend- P  S

Hence, it's clear that a student can obtain expertise in meend playing through meend practices using the proper fingers.

Gamak is an advanced stage of Meend playing.

Example: if we want to show the note; “M” of “R G M P” accordance of the bhava of the related Raga, using gamak, it is visible that it comes touching Pancham. According to that, notes will be played as R G PM P. This “PM” is played in druth laya than the other notes.

VI. CONCLUSION

By using these four left hand techniques, violinists can obtain the ability of playing all the applied bhava in Carnatic music system.

REFERENCES

- [1] The discussion with Mr. S. Thibakaran in the University of Visual and Performing Arts in 23rd November 2013.
- [2] The discussion with Srimathi Dr. N. Rajam in Banaras Hindu University in 30th January 2015.
- [3] Jayaraman, L. (1984), *The Violin was born In India*, P 16-20
- [4] Sambamoorthy, P.(1959), *The Great Musicians*, P 157-159
- [5] Sathyaranayanan, The modern Violin is not of Indian origin, *SRUTI*, Vol 2, P 20-22
- [6] Gopalakrishnan, M.S., Rag Hamsadhwani, HTCS3121
- [7] https://en.m.wikipedia.org/wiki/History_of_the_violin
- [8] <http://en.m.wikipedia.org/wiki/violin>

Emotional Maturity of Prisoners: A Study of Jaffna and Boghambara Prisoner Communities

S.Thamilarasy*¹ R.Abirami^{#2}

**Department of Forest Conservation, Divisional Forest Office, Vavuniya*

Department of Philosophy, University of Jaffna, Sri Lanka

¹thamil2869@gmail.com

²svabirami@yahoo.com

Abstract— Emotions play central role in the human life. Every individual is expected to have higher emotional maturity to lead a successful and balanced life. Most of the antisocial activities and crimes are associated with emotional immaturity. Studies show that most of the antisocial activists and criminals have lack of emotional control and stability. So the investigator carried out the study “Emotional maturity of prisoners: A study of Jaffna and Boghambara prisoner communities”. The objective was the study was to find out the level of emotional maturity among prisoners. The investigator used random sampling technique to select the sample of 104 prisoners from Jaffna and Boghambara prisons, Sri Lanka. The tool used in this study was Emotional Maturity Scale (EMS) developed by Yashvir Singh and Mahesh Bhargava. It was concluded that the level of emotional maturity of the prisoners was moderately unstable.

Keywords— emotional maturity, criminals, prisoners, emotions, antisocial acts.

I. INTRODUCTION

The emotions play a major role to shape up the human behavior. If people don't know how to deal their emotions properly they can't lead a happy and smooth life. Emotional instability leads anxiety and stress.

Emotional maturity is one of the aspects related to the personality. A person can be said to have matured emotionally when he is able to think objectively. Emotional matured person does express his emotions both constructively and interactively. Individuals who have reached emotional maturity are characterized by the presence of the ability to control emotions to think realistically, understand themselves and be able to show emotions appropriately.

A concept “mature” emotional behavior at any level is that which reflects the fruit of normal emotional development. Emotional Maturity is a measure of one's capacity to create in a positive mental attitude. Emotional Maturity is the process of impulse control through the agency of self. Morgan (1924) stated the view that an adequate theory of Emotional Maturity must take an account of the full scope of the individual powers and his ability to enjoy the use of his powers.

Emotional maturity is observed through thoughts and behaviour. When a person is faced with difficult situation, his level of emotional maturity is one of the major factors in determining his ability to cope. A large part of being emotionally maturity is having the ability to handle anger, disappointment, guilt, resentment, fear, jealousy, grief, insecurity, and myriad of their feelings appropriate.

According to Walter D. Smithson (1974) “Emotional Maturity is a process in which the personality is continually striving for greater sense of emotional health both intrapsychically and intra-personally”. Emotional Maturity is said to be an essential criterion of good adjustment. To be “emotionally mature” means “to signify the capacity to react emotionally in terms of the requirements that a situation imposes. It refers to the avoidance or elimination of responses that are not suited to these requirements. In brief emotional maturity can be called as the process of impulse control through the agency of “self” or “ego”.

Emotional Maturity actually is, according to Frank, “A process of readjustment, the infant learns under parental supervision what situations after permissible opportunities for emotional reactions and to what extent, so that primitive elemental psychological response that we call ‘emotion’ becomes patterned in accordance with approved from the expression and repression favoured by culture”.

According to Saul, if the emotional development of the individual is relatively complete, his adaptability is high, his regressive tendencies are low, and his vulnerability is minimal.

Kaplan (1940) viewed an emotional matured person has the capacity to withstand delay in satisfaction of needs. He has the ability to tolerate reasonable amount of frustration. He has the belief in long term planning and is capable of delaying and revising his expectations in terms of demands of situations he faces. An emotional matured person has the capacity to make effective adjustments with himself, members of his family, and his peers in the school or college. But the maturity means not merely the capacity for such attitude and functioning but also the ability to enjoy them fully.

Emotionally immature people can be extremely challenged to deal with their emotions. So we can assume the person may react in deviant ways to the social norms.

These lead to anti social activities and anti social behaviours. There may be a relationship between criminal activities and emotional immaturity.

II. NEED AND SIGNIFICANCE OF THE STUDY OBJECTIVE

Since emotional maturity plays major role in every human life and responsible for the faults and crimes committed by the people, it is necessary to study this concept. People who are punished for their misconducts and antisocial acts may have immature emotionality. So the present study intends to measure the level of emotional maturity of the prisoners.

III. OBJECTIVE OF THE STUDY

The researcher has formulated one objective for this study. That is,

To find out the level of emotional maturity among prisoners of Jaffna and Boghambara prisons, Sri Lanka.

IV. REVIEW OF LITERATURE

According to a research published on Alcocholrehab.com, there is a relationship between alcoholic addiction and emotional immaturity. When people feel hard to handle their problems they use alcohol for temporary relief.

According to the research on prisoners done by B.D.Murdoch (1972) there is a relationship between aggressive behavior of prisoners and emotional maturity. Lack of emotional maturity was found on prisoners.

In 'Book of Crime and the mind', it's mentioned that emotional immaturity and social immaturity is related with criminal activities, inferiority, and anxiety and it may lead to anti social behaviour and sexual aggressive behaviour.

The above matter refers the relationship between emotional maturity and criminal activities. In the present situation criminal rate is dramatically increasing in Sri Lanka. According to Sri Lankan crime and safety report (2014) murder, kidnap, sexual persecution and credit card and debit card forgeries are wildly held in Sri Lanka. So there is a major threat to the security and safety to the country. Thus, having considered the above facts, this research was done to find out the level of emotional maturity of prisoners.

V. HYPOTHESIS OF THE STUDY

"The level of emotional maturity of prisoners is low".

VI. METHODOLOGY

A. Sample

At present there are three closed prisons and 20 remand prisons in Sri Lanka. Amongst Jaffna remand prison and Boghambara prison were chosen for data collection. Random sampling method has been used in the present study. By the random sampling 104 sample of prisoners were selected from Jaffna and Boghambara prisons. 55 samples

were selected from Boghambara prison. These samples were long term prison inmates. They were sentenced to a term of imprisonment and were called as convicted prisoners. In Boghambara prison, long term prisoners are under the categories of life sentenced and sentenced to death. From Jaffna prison 49 samples were selected. These 49 prison inmates were punished for committing minor offenses.

B. Tool

The tool used in the study was Emotional Maturity Scale (EMS) developed by Yashvir Singh and Mahesh Bhargava. This Scale consists of 48 items and 5 dimensions. The emotional maturity scale consists of 48 items. The first 10 items examine emotional instability, the second 10 items examine emotional regression, the third 10 items assess social maladjustment the fourth 10 items assess personality disintegration and the last 8 items examine lack of independence. The emotional maturity questionnaire is a self report scale on a 5-point Likert scale.

The information collected from the scale was analysed with statistical methods. Higher scores indicate higher levels of emotional immaturity and vice versa. The range of possible score for the overall emotional maturity is 48 to 240. The reliability coefficients ranged from .42 to .86. The scale was translated into both Sinhala and Tamil languages.

Scoring was done as per the manual. The five factors: Emotional instability represents syndrome of lack of capacity to dispose of problems, irritability, needs constant help for ones day to day work, vulnerability, stubbornness and temper tantrums. Emotional regression represents such syndromes as feelings of inferiority, restlessness, hostility, aggressiveness and self centeredness. Social maladjustment shows person lacks social adaptability. Personality disintegration shows person suffers from inferiorities and hence reacts to environment through aggressiveness, destruction and has distorted sense of reality. Lack of independence shows persons parasitic dependence on others, lack of objective interests in people and think of him as an unreliable person.

C. Procedure

The administration of the respective institutes was informed and verbal consent to conduct the study was taken. Consent was also taken from the respondents after explaining to them the purpose of the research. The measure was given individually to the subjects. Before administering the test a short intake interview was taken where their doubts related to the tests were dealt with. They were assured that their responses would be kept confidential and that it was purely for educational research purpose. Instructions were read aloud by the investigator and simple clarifications of word meanings were given on request without influencing subjects responses. Scoring was done as per given in the manual.

D. Statistical Analysis

Data were subjected to both quantitative and qualitative analysis. The statistical techniques like mean, standard deviation used for the present study.

Quantitative analysis: The test was manually scored by using the scoring procedure provided by the author, the raw score of the groups were subjected to various statistical analyses to arrive at meaningful interpretation to the stated hypothesis.

Qualitative analysis: The responses on the information schedule and questionnaire reports were all examined to study the nature of responses and information revealed. This was done on order to facilitate the interpretation of the quantitative data obtained in the questionnaire.

VII. RESULTS AND DISCUSSION

TABLE I PREVALENCE OF EMOTIONAL MATURITY AMONG PRISONERS

Range	Frequency	Percentage %
0-80	3	2.9
81-88	4	3.8
89-106	19	18.3
107-169	72	69.2
170-240	6	5.8
Total	104	100.0
89-240	19+72+6=97	18.3+69.2+5.8=93.3

As per to the manual, the subjects were categorized as follows –

0-80-Extremely stable

81-88-Moderately stable

89-106 Unstable

107-169-Moderately unstable

170-240-Extremely unstable

Data presented in the Table 1 shows that; majority of the subjects (69.2%) had Moderately unstable emotional maturity, 5.8% had Extremely unstable emotional maturity, 18.3% had unstable emotional maturity. 2.9% of the prisoners had Extremely stable emotional maturity and 3.8% had Moderately stable emotional maturity. This study results revealed that 93.3% of the prisoners had low emotional maturity.

TABLE II SHOWS MINIMUM, MAXIMUM, MEAN, AND STANDARD DEVIATION OF THE SUBJECTS OF EMOTIONAL MATURITY

N	Min	Max	Mean	Std. Deviation
104	67	206	123.461	25.258

As presented in Table 2, the mean score of the subjects was 123.4. According to the manual this mean score indicates the

category of 'Moderately unstable' emotional maturity or low emotional maturity. Thus the hypothesis, the level of emotional maturity of the prisoners is low, was accepted.

VIII. CONCLUSIONS

This present study was conducted to find out the level of emotional maturity of prisoners. In the present study out of 104 prisoners, 97 (93.3%) subjects were noticed to have Low emotional maturity. It can be concluded that as majority of the prisoners had low emotional maturity they have committed crimes and antisocial acts.

Emotions play a vital role in the life of an individual. One is estimated to have higher emotional maturity in order to lead effectual and successful life. Hence the emotional maturity occupies significant part of the individual's life.

IX. RECOMMENDATIONS

Emotional maturity is very important to lead successful human life. So every person in the society should take effort to develop his or her emotional maturity. Parents, teachers NGOs, government and Prison administration should be very clear about the concept of emotional maturity and the link of it with crimes.

Specially, when deal with prisoners, administrators of the prison must know the dealing methods and techniques. As the prisoners have low level of emotional maturity, they need emotional and empathetic support from the society. Inappropriate handling methods may lead them to serious emotional problems and psychological disorders & dysfunctions.

REFERENCES

- [1] Mas Budi Yanto. Emotional maturity: understanding and influencing factors. Available at (<http://successismychoice.blogspot.com>)
(Accessed on June 7, 2015)
- [2] Singh, Y., & Bhargava, M. 1990, Manual for Emotional Maturity Scale. Agra: National Psychological Corporation,
- [3] Frank, "Nature and Human Nature", N.J.RutgersUniversity Press, New Brunswick.
- [4] Walter D.Smithson, "Human Development". McGraw Hill, New York.
- [5] Sehuessler Karl, F , Cressey Donald , R .(1950). Personality characteristic of criminals. American journal of sociology, 55(4), 476-484.
- [6] Murdoch, B, D. (1972). Electroencephalograms, aggression and emotional maturity in psychopathic and non-psychopathic prisoners. PsychologiaAfricana, 14(3), 216-231.
- [7] Ralphs Banay. (1943). Immaturity and crime. *The academic journal of Psychiatry*, 100(2), 170-177.

E.M Forster's A Passage to India as an exemplary of Orientalist writing

M.Arivarasy

Department of Linguistics & English

University of Jaffna

arivarasy13@gmail.com

Abstract—This paper aims to analyse E.M Forster's *A Passage to India* from Edward Said's Orientalist perspective. The term 'Orientalism' became a watermark with Edward Said as an intellectual term. According to Said, Orientalism generates a series of stereotypical dichotomy between the masculine 'West' and the feminine 'East'. Said's project is to show how knowledge of Europe about the non-Europeans was part of the process of maintaining power over them. *A Passage to India* deals with the socially and culturally subordinate groups regarding the definition of subjectivity and the production of knowledge. It produces its representation of the Orient in terms of unchangeable stereotypes and reductive categories. But from Orientalist view, Forster in '*A Passage to India*' shows how colonialism creates a false illusion that the west is 'self' and the East is 'other'. Forster's recognition of Indian nationalism has apparently differentiated him from other writers like Kipling who have also written much about Orientalism. Aziz's angry attitude towards Fielding is a germane exposure of the Indian spirit of nationalism. *A Passage to India* might be described as the text of liberalism's critique of empire. Liberalism can ever be seen as an adequate response to imperialism. Analytical and comparative methods are planned to be used. The qualitative methodology of the research will be carried out through texts, journals, articles and informal interviews. The objective is to pinpoint *A Passage to India* as a resistant reading against the imperial politics from Edward Said's Orientalist perspective. Thus, Edward Said's protest against the subjection through his concept of Orientalism is well-portrayed in the novel. Said confirms Orientalism as a strategy of resistance that makes the colonized natives on the very terrain of imperial discourse.

Keywords: power, subjectivity, resistant, truth

I. INTRODUCTION

The aim of this study is to examine the novel *A Passage to India* by E.M Forster from Edward Said's Orientalist perspective. The term 'Orientalism' has become highly problematic. Orientalism carries forward two traits 1. A newly found scientific self-consciousness based on the linguistic importance of the Orient to Europe and 2. A proclivity to divide, subdivide and re-divide its subject matter without changing its mind about the Orient as being always the same unchanging, uniform and radically peculiar object.

A. HISTORY OF ORIENTALISM

The history of intellectual, political and cultural contact between East and West is convoluted, full of ambiguities, enigmas and contradictions. The idea of Orientalism fluctuates from time to time. Radhakrishnan, the eminent Indian philosopher has written of the West's attraction to 'the glamour of the exotic', and has remarked that 'The East has ever been a romantic puzzle to the west, the home of adventures like those of the Arabian Nights, the abode of magic, the land of hearts' desire (Eastern Religions and Western thought, 251)

In the classical Orientalism Christian authors witnessing the Islam conquests had scant interest in the learning of high culture and frequent magnificence of the Muslims Orient. Since the time of colonialism the East has also been depicted not only as exotic, mysterious and alluring but as malignant, dark, threatening, Robert Bridges in *The Testament of Beauty* says that in the past the West looked to the East for spiritual wisdom and East is now dazzled by the material conquests of the west. The Enlightenment Philosophies had been much attracted to the Chinese civilization, particularly Confucianism which they understood as a rationally-based and humanistic system of social ethics. 'It was fit to give the Chinese a high idea of European science and to show the accordance of this science with the venerable and sacred traditions of Chinese wisdom' (*East and West*, Rene Guenon, 72)

Orientalism became the catalyst for nationalism in the later colonial period. Discovery of ancient manuscripts and texts, monuments and sites gave the nationalists the historical continuity and cultural identity. It is essential for the struggle for nationhood. Most influential of all theorization about Orientalism in recent years has been Edward Said's widely celebrated *Orientalism* in which he argued that the Orient was a 'system of ideological factions' whose purpose was to legitimize western cultural and political superiority, furthermore the western understanding of the East had grown out of a relationship of power, of domination, of varying degrees of cultural hegemony. (Said 1995, pp321-5) Said's argument addressed primarily to European encounter with Islam and with the Middle East, although Said himself extends the case to the Orient in general. From the late 18th to the 20th century, Orientalism remained a more or less neutral descriptive term, with a cluster of both positive and negative connotations.

Most influential of all such theorizations in recent years has been Edward Said's widely celebrated *Orientalism* in which he argued that the Orient was a 'system of ideological fictions' whose purpose was and is to legitimize western cultural and political superiority, furthermore the western understanding of the East has grown out of a relationship of power, of domination, of varying degrees of cultural hegemony. (*Orientalism*, 321-5) Said's argument, it must be said is addressed primarily to European encounter with Islam and with the Middle East, although Said himself extends the case to the Orient in general.

B. EDWARD SAID'S ORIENTALISM

Orientalism has been, after all a political vision of reality between the European/the West/ us and the Orient/ the East/ them. Orientalism, conception of western strength and Eastern weakness has been intrinsic to the discourse. The significant elements in defining the relation between the Occident and the Orient were the vastly increased systematic knowledge about of Orient in Europe. The writer must organize the Orient, locate himself in relation to it and finally to represent it or speak on its behalf. The object and fact of Orientalism is a fluid entity. Orientalism has valued Europe more highly in almost every aspect proposed for comparison. The discourse of postcolonial is therefore foregrounded on a struggle for power- that power focused in the control of metropolitan language. Power is invested in the language because it provides the terms in which the truth itself is constituted. Said pronounces that the negative emergence of Orientalist structures could be reduced if the East starts to speak itself. Said highlights that 'East cannot represent themselves, they must be spoken for' (Said 1995, p.21)

Said puts forward several definitions of orientalism in the introducing to 'Orientalism'

- 'Orientalism, a way of coming to terms with the Orient that is based on the Orient's special place in European western experience.' (p.1)
- '.....Particularly valuable as a sign of European Atlantic power over the Orient that is as a veridic discourse about the orient' (p.3)
- 'A style of thought based upon an ontological and epistemological distinction made 'between the 'orient' and the 'occident'' (p.2)
- 'A westerns style for dominating, restructuring and having authority over the orient.' (p.8)
- 'A distribution of geopolitical awareness into aesthetic, scholarly economic, sociological, historical and philological text.'(p.12)
- Orientalism as a dynamic exchange between individual authors and the large political concerns shaped by the three great empires. British, French, America in whose intellectual and imaginative territory the writing was produced. (p.15)
- Orientalism was ultimately a political vision of reality whose structure promoted the difference between the familiar (Europe, the West, 'us') and the strange (the Orient, the East, 'them') (p.14)

- As Said claims, the westerners has been able to 'penetrate', 'wrestle with' and 'give shape and meaning' to the mysteries of the Orient. Orientalism, conception of the western strength and Eastern weakness has been intrinsic to the discourse. The most intellectual question evoked in Orientalism by Said.
- Can one divide human reality, as indeed human reality seems to be generally 'divided, into clearly different cultures, histories, traditions, societies, even races and survive the consequences humanity

What distinguishes Orientalism from other stereotyping and 'othering' discourses is the European position of strength or even domination in relation to the Orient. The 'weak Orient' was contrasted with 'the powerful Europe' although the relationship was often disguised in admiring the 'greatness of the ancient civilizations of the Orient'. Orientalism has valued Europe more highly in almost every aspect proposed for comparison, whether it be politics, culture or religion.

The rational, virtuous and mature European has been able to see the irrational, depraved and childlike Oriental. As a result, the Oriental has become something one can judge, study, discipline and illustrate and hence contain and represent. (Said 1995, p.40)

In Said's view, colonialists equated the colour of their skin with a 'superior ontological status' and the power to rule the rest of the world. Being a white Man was self-confirming. 'One became a White Man because one was a White Man. It was a destiny that left little time for seeking casual explanations from history.' In addition to being regulated by norms of behavior suitable for distinguished white male gentleman, being a white Man meant specific judgements and evaluations. Only an Occidental could speak of Orientals and only the white Man could identify and designate the non-whites. Typologies distanced the non-whites from the white and traditions and education kept the oriental/Coloured in his separate place for the Occidental white to study him. (Said 1995, pp.226-228) Naturally, racial theory, rising imperialism and the incomplete and inadequately assimilated sciences reinforced each other. Ontological and empirical truths combined with the study of origins, development, character and destiny gave these destinations validity.

II. AN ANALYSIS OF A PASSAGE TO INDIA

Edward Morgan Forster was an English novelist was an English novelist, short story writer, essayist and librettist. He is known for his ironic and well-plotted novels examining class difference and hypocrisy in early 20th century British society. Forster's humanistic impulse towards understanding and sympathy may be apathy summed up in the epigraph to his 1910 novel *Howards End* 'Only Connect' (Forster 1910, p.6)

A. Colonized Land

In 'A Passage to India', Forster's India is hostile to foreigners and attacks its colonizers ferociously. The manner in which all Indian characters portrayed echoes an undercurrent of unauthenticity, simulating in this regard where the 'other' features were understood through the old narratives. The colonizers claim that they have the mission of 'bringing light' to the colonized as ignominious darkness. (Memmi 1979, p.74-76) The mission legitimizes the colonization and distances of other races. Edward Said notes the depiction of colonized races as being 'naturally subservient, advances, developed and morally mature Europe.' (Eagleton at 1990, p.72) Forster explores the relationship between colonizer and the colonized. *I have had twenty five years; experience of this country, and during their twenty five years. I have never known anything but disaster result when English people and Indians attempt to be intimate socially. Intercourse, yes. Courtesy, by alternative, Intimacy never, never. The whole weight of my authority is against it.* (Forster, p.120)

B. Imperial dialogues /imperial ideologies

The abandonment of identity construction is prominent in *Orientalism*. Said critiques the categories of Orient and Occident as a style of thought based upon a series of fixed, essentialized ontological and epistemological distinctions.

One of the key aspects of the novel which follow a colonial paradigm are Forster's subtle but firm dismissal of India's complex cultural and religious ideologies. India exists in the ideology of Mrs. Moore and Adela as a trope, a conceived space and not an actuality. Here, Forster shows a pattern for making a mockery towards white people out of the cultural and social nuances of the other to highlight his belief of India as a 'muddle'. One of the key aspects key aspects of the novel which follow a colonial paradigm are Forster's subtle but firm dismissal of India's complex cultural and religious ideologies. India exists in the ideology of Mrs. Moore and Adela as a trope, a conceived space and not an actuality.

C. Schizophrenic imitativeness

The colonizers are portrayed with elevated features of education, tolerance, philosophy and manliness in contrast to the ignorance, muddle and informality of the natures. To Forster an educated Indian like Aziz is talkative, impractical and incapable of understanding practical matters.

Frantz Fanon said his 'Black skin White Mask' (1967) that the desire of the slave to own the colonizer's world results in schizophrenic imitativeness (79). Colonization certainly leads to a cultural encounter, and the colonized subjects develop interest in that encounter.

D. Officialdom

Cesaire writes of colonialism as a society reduced to officialdom and the officialdom is the ultimate barrier to human contact for 'where there is officialdom every human relationship suffers (Cesaire 200) In his seminal work

Orientalism Said argues that the Orientalist approach amounts to a set of essentialist characteristics applied to the 'Orient' from a perspective which universalizes Western or European values. During the hysterical meeting after the arrest of Aziz, a subaltern shares his ideas, *The natives all right if you let him alone Lesley! Lesley! You remember the one I had a knock with on your maidan last month. Well, he was right. Any native who plays polo is all right. What you've got to stamp on is these educated classes, and mind I do know what I'm talking about this time (A Passage to India p.173)*

The failure to assimilate and Aziz's ultimate rejection of the desire to assimilate at all, has a complex role in the web of colonial structure and oppression.

E. Colonial Other

'They prove that colonization, I repeat, dehumanizes even the most civilized man, the colonial activity, colonial enterprise, colonial conquest which is based on contempt for the native and justified by that contempt, inevitably tends to change him who undertakes it, that the colonizer who in order to ease his conscience, the colonized is hardly a human being, he tends rapidly toward becoming an object' (Memmi p.41)

Fielding like Forster felt the barrier between colonizer and the colonized. He states that 'the sense of racial tension of compatibility, never left me.' (p.315) His love for the Indians is well-established and so his love for the country. Fielding and Forster denounces colonization and this explains the contradiction in their attitude towards colonization.

F. Voice of freedom

In the same vein, Fielding's helpless question 'why can't we be friends now?' is answered by multitudes of voice. Towards the end of 'A Passage to India' Aziz's angry attitude towards Fielding is a germane exposure of the Indian spirit of nationalism. His angry reactions to Fielding's mockery remark 'who do you want instead of the English?' appears to be an outburst of nationalism. As Forster puts it, 'Down with English anyhow. That's certain clear out, you fellows, double quick I say.' Dr. Aziz anticipates with remarkable social and most post-colonial nationalisms of the Islamic world. Said's upward mobility is a necessary means to gain counter authority to 'speak truth to power'. Forster gives the colonized a voice to defend their rights and to express their attitudes and feelings regardless the colonizer's practices. These two novels proposes internal resistance by a secular interrogation of identitarian thoughts.

To summarize, Anglo-Indians must control all meanings, written, spoken and symbolic. *A Passage to India* intervenes at a time when this control is being questioned. Colonial discourse in all its forms should confirm Anglo India's sense of difference and superiority by drawing an appropriate response from the colonized as a recognizable opposition. *Abinger Harvest* and *Hill of Devi* and *A Passage to India* offer the liberal individualism, an alternative engagement with imperialism. This is summed

up in *A Passage to India* in which Forster repeatedly invokes 'the Oriental' as individual against the European nations. He sees in the East an ideal manifestation of his beloved individuality against the soulless, clanking efficiency of the European state. All this is reflected in Aziz's own tenacious individualism that composes idealistic verse and 'express what is deepest in the heart.' One can deduce from the tone of the essay *The Mind of the Indian Native State*. (Abinger p.368-79) Forster values princely fiefdoms as rural models presided over by distinguishable and sometimes odd personalities to set against centralized rule, either British or Indian. They are not strictly speaking British India (the empire) nor Nationalist India (the anti-empire) but a third kind of space Forster seeks, above grubby politics' He comments in this essay *So long as his subjects are uneducated, a Prince is in a strong position from every point of view. They revere him with the old Indian loyalty and a glimpse of his half-divine figure brings poetry into their lives. And he understands them even when he is indifferent or unjust, because like them he is, rooted in the soil* (The Mind of the Indian nation State Abinger p.378)

The contradictions of Forster's liberalism are most clearly disclosed in the novel. The desire to transgress, to transcend cultural barriers expressed in Forster's work is always thwarted by the conditions and history of the tongue which expresses it. The battle between native and white man had to be visibly joined. The view is essentially a product of Forster's romantic idealism. He would kill all nationalism, including English and Indian with individual kindness of he could *kindness, more kindness and even after that more kindness* says Aziz, *I assure you it is the only hope.* (Forster p.128)

III. CONCLUSION

Said accepts the necessity to understand real history through texts. *A Passage to India* participated in the imperial politics that 'classifies and reinforces the feelings and attitudes of colonizers. Said calls for critics to take responsibility for 'articulating the voices dominated, displaced or silenced by the textuality of texts. They deal with the sociably and culturally subordinate groups regarding the production of knowledge. It constructs a pure native identity to oppose a monolithic identity. The liberation at the end demonstrates to reconceive a new history which is liberalism in relation to colonialism inclusive of the supposedly silent mass of colonized natives. Said confirms Orientalism as a strategy of resistance that makes the colonized natives speak on the very terrain of imperial language and discourse. Thus, Edward Said's protest against the subjection through his concept of Orientalism is well-portrayed in the novel. Said confirms Orientalism as a strategy of resistance that makes the colonized natives on the very terrain of imperial discourse. Thus, it can be concluded that the novel *A Passage to India* by E.M Forster is an exemplary of Orientalist writing.

IV. METHODOLOGY

This study involves the qualitative method of the research as it requires gathering relevant data through texts, journals, articles. The object is to pinpoint that both these novels are resistant readings against the imperial politics from Edward Said's Orientalist perspective. Thus I attempt to analyse *A Passage to India* on the basis of Orientalist perspective.

REFERENCES

- [1] Abraham W.E. 1962 *The Mind of Africa*. London: Weidenfeld and Nicolson.
- [2] Achebe, Chinua. 1988 "An Image of Africa: Racism in Conrad's *Heart of Darkness*." *Joseph Conrad Heart of Darkness*. Norton Critical Edition: New York and London. Ed. Robert Kinbrough.
- [3] Adam, Hochschild. 1999 *King Leopold's Ghost: A story of Greed, Terror and Heroism in Colonial Africa*. New York: Mariner Books.
- [4] Alatas, Hussein. 1977 *The Myth of the lazy Native*. London: Frank Cass.
- [5] Almond, Philip. C. 1989 *The British Discovery of Buddhism*. Cambridge University Press.
- [6] Ambrosini, Richard. 1991 *Conrad's Fiction as Critical Discourse*. Cambridge University Press.
- [7] Ashcroft, Griffiths and Tiffin. 1989 *The Empire Writes Back- Theory and practice in post-colonial literatures*. London: Routledge Taylor & Francis Group.
- [8] Bahr, Lauren S. Johnson, Benard. 1991 Ed *Collier's Encyclopaedia*. Vol 1. Oxford: Maxwell Macmillan International Publishing Group.
- [9] Batchelor, Stephen. 1994 *The Awakening of the West: The Encounter of Buddhism culture*. Berkeley, Calif: Parallax Press.
- [10] Bear J.B. 1962 *The Achievement of E.M Forster*. London: Chatto and Windus Ltd.
- [11] Childs, Peter (ed.) 1999 *Post-colonial theory and English Literature*. Edinburgh: Edinburgh University Press.
- [12] Forster, E.M. 2005 *A Passage to India*. London: Edward Arnold.
- [13] Memmi, A. *The Colonizer and the Colonized*. Boston: Beacon Press. 1967.
- [14] Radhakrishnan S. 1962 *Eastern Religions and Western Thought*. India: Oxford University Paperbacks.
- [15] Said, Edward. 1995 *Orientalism* Western Conceptions of the Orient. London Routledge&Kegan Paul Ltd.

THE SCHOLARLY PURSUITS OF COMPILING DICTIONARIES IN JAFFNA –A STUDY ON THE 19TH CENTURY EFFORTS

S.S.Gayathree

Translation Studies

University of Jaffna

gayachan57@gmail.com

Abstract— Sustainable regional development requires emerging knowledge in Science, Technology, Arts and other fields. Translation, which deals with languages, plays a vital role with the march of time. In order to be familiar with the latest development and to cope with the dissemination of knowledge, translation contributes a lot. Among all types of translation tools, dictionary is the most essential, prominent and very much supportive tool for translators. Valuable information and vital facts in dictionaries serve as a treasure trove for translators. The 19th century had been a period of vigorous translation activities in the Tamil world. With the advent of Westerners the present form of dictionaries was introduced in the Tamil milieu. Western scholars with the assistance of the native scholars involved themselves in the noble task of compiling authoritative dictionaries as the potential tool for translation. It is always appropriate and appreciable during the process of translation to seek the help of a dictionary which has been compiled in the society in which the language is nourished and cherished for long. Translation may be enriched and embellished by employing the proper tool from the same milieu. This research aims at analysing the competency of the Dictionaries, compiled in Jaffna in the 19th century for Translation and this is based on Descriptive and Comparative Methodologies. Especially the dictionaries compiled in Jaffna are taken into consideration in this study. The period of this research is limited to the 19th century. This research may facilitate the translators by introducing the dictionaries, compiled in Jaffna.

Keywords: Translation tools, Tamil milieu, Authoritative Dictionaries

I. INTRODUCTION

Appropriate use of the dictionaries may enrich the performance of translation. The concept of dictionary in Tamil milieu could be traced back to the *Uriyiyal* of *Tolkaappiyam*. Before the compilation of the present form of the dictionaries in Tamil milieu people had to depend on *Nikandu* for reference.

The present form of dictionaries was introduced in the Tamil milieu with the advent of Westerners. Western scholars with the collaboration and cooperation of the native scholars involved themselves in the noble task of compiling authoritative dictionaries as the potential tool for translation. It is always appropriate and appreciable during the process of translation to seek the help of a dictionary which has been

compiled in the society in which the language is nourished and cherished for long. In this respect this paper deals with such works.

This study is limited to word-level from the Linguistic perspective. Especially the dictionaries compiled in Jaffna are taken into consideration. The period of the compilation of dictionaries in Jaffna in this research is limited to the 19th century. Among the dictionaries compiled in Jaffna in the 19th century the following classification is perused in this research:

- Mono-lingual Dictionary
Tamil-Tamil
- Bi-lingual Dictionaries
Tamil-English and English –Tamil

The aim of this study is to bring-out the efforts of the scholars in compilation of the dictionaries in Jaffna. The objectives of this research are to facilitate the translators by introducing the dictionaries, compiled in Jaffna, to give due honour, respect and a place to the dictionaries compiled in Jaffna and to analyse the competency of the same.

This research is based on Descriptive and Comparative Methodologies. The data are derived from the available dictionaries, compiled in Jaffna. An analysis is made to find out the adequacy and competency of the dictionaries. These are compared with the recent dictionaries from Tamil Nadu in a small scale. Finally, the findings are recorded logically.

II. DICTIONARY AS A TOOL IN TRANSLATION

Among all tools of translation tools, dictionaries play a vital role in translation. Valuable information and vital facts in dictionaries serve as a treasure trove. The performance of translation is enhanced by the right and appropriate use of dictionaries.

Dictionary is a reference book or list of words in an alphabetical order together with a guide to their meanings, definitions, information such as etymology, the use and usage of a word with examples and contexts, pronunciation, spelling and equivalents in other languages or in simple words. Plurals of nouns and forms of verbs are available. Relevant idioms and phrases, too, are included. Sentences and uses of the words in relevant contexts are added. The grammatical aspects including the morphemes should be dealt with utmost care with appropriacy.¹

An **active or production-oriented bi-lingual dictionary** is compiled with the intention of helping the user to express the given ideas in the target language. This means, the translator or the user has already known the meaning or what is denoted by the word, but finds it difficult to search for a proper equivalent as per the context. This type of dictionary is helpful in this circumstance.²

A **passive or reception-oriented bi-lingual dictionary** helps to comprehend a given lexical item in the target language. The translator or the user is unaware of the meaning or what is denoted by the word. To have an exact comprehension of the word, this type of dictionary may lend a hand.³

The performance of translation is enhanced by exact comprehension and appropriate employment of equivalents. In order to have the translation with textual accuracy and precision a translator uses dictionary as the effective tool for reference. While doing so the reference should be adequate enough to encounter the barriers regarding words and equivalents in translation.

III. DATA COLLECTION

Lexicon in Tamil context has been in vogue for centuries. It could be traced back to **Tolkāppiya** era.⁴ **Nikāntukal** alone were in vogue amidst Tamils till the advent of Europeans and were widely written and referred. Since the Lexicography has been considerably developed in the occident, these Western scholars were able to identify the deficiency in **Nikāntukal** as soon as they started learning Tamil.⁵

With the advent of the Westerners, the Tamils too were introduced to a proper alphabetical arrangement, in dictionaries. Veerama Munivar compiled **caturAkarāti** in 1732 in four volumes. Then the dictionary **Mānipāy Akarāti / Yāzhppāṇa Akarāti** appeared in 1842. Chandrasekara Panditar, the compiler of the dictionary named the dictionary as ‘**peyarakarāti**’ because it is an expansion of the first part **peyarakarāti** of **caturAkarāti**. As the dictionary was printed in **Mānipāy**, it gets the name.⁶

A committee was appointed under the leadership of Rev Joseph Knight in 1833 to compile a Dictionary in Tamil. Levi Spaulding, Samuel Hutchings, Miron Winslow and Peter Percival, the Missionaries functioned as the members of the committee. The Native Scholars Gabriel Tissera, A.Chandrasekarapandithar, Carol Visvanathapillai, William Nevins Sithamparapillai and Irupalai Cenathiraya Mutaliyar also cooperated in the first attempt of compiling Dictionary in Tamil in Ceylon. Unfortunately, Rev Joseph Knight, the chairman of the committee passed away in 1838. Levi Spaulding succeeded him by proceeding further and the Dictionary was completed and published in 1842 in Jaffna.

This Dictionary later has come to be known as **Yāzhppāṇa Akarāti or Mānipāy Akarāti** (Jaffna Dictionary or **Mānipāy** Dictionary). The 58 500 words in this Dictionary are the four fold number of words of **caturAkarāti**. Kalaththoore Sami Vethakiri Mudhaliyar and Kaanchipuram Ramasami Naaudu improved this Tamil – Tamil Dictionary by appending some more terms and published as ‘**peyarakarāti**’ in two editions before 1893.

The word **Akarāti** is first employed in **Mānipāy Akarāti**. The term **Akarāti** was given in the **Manipay Dictionary** for the first time.

Joseph Knight and Levi Spaulding engaged themselves in the republication of the **Mānipāy Akarāti** or **Yāzhppāṇa Akarāti**. In the second edition of **Yāzhppāṇa Akarāti or Mānipāy Akarāti** 36 737 words in English are being defined.

Each lexical item in the second edition by Joseph Knight and Levi Spaulding has explanation in Tamil and English. This Dictionary has been very much supportive for the non-natives in their effort to learn Tamil. The salient feature of this Dictionary is the explanation given in Tamil and English for each word.

Earlier attempts made in language revival in Jaffna in the 19th and 20th centuries embrace many fields. Yet they can be broadly classified into three main branches:

- i. Works Conforming to Conventional Literary Forms
- ii. Works on Research Studies
- iii. Works on Modern Forms of Literature

Compilation of Dictionary falls under the ‘Works on Research Studies’. Tamil scholars of Ceylon were the pioneers in the field of lexicography in Tamil. The first Tamil dictionary compiled by Tamil scholars titled **Mānipāy Akarāti / Yāzhppāṇa Akarāti** was published in Jaffna in 1842. As a joint effort of many scholars the dictionary was brought out with about 58,500 words.⁷

Having felt the need and importance of dictionaries the native scholars of Tamil engaged themselves as individuals or in groups in the noble task of compiling dictionaries. Wyman Kathiravelpillai, Chunnakam Kumaraswami Pulavar and A. Mootootamby Pillay were such scholars.⁸

Winslow's Tamil–English dictionary was published in 1862 by the American Mission Press, Diocesan Press (now CLS Press). It contains the unpublished work source of Rev. Joseph Night and Rev. Samuel Hutchings. This Dictionary is based on the works of Johann Rottler, which itself got inspiration from Johann Fabricius's Work in the mid 18th century.⁹

IV. ANALYSIS

In **Yāzhppāṇa Akarāti or Mānipāy Akarāti**, dialect words are given and certain entries are explained with more details. Some categorizations are observed in it. Winslow's Dictionary seems to be a storehouse of words for those who want to learn Tamil or for the exact comprehension. Equivalents for the technical terms in Tamil Literary Tradition, Astrology, Astronomy, Puranas, Botany and Zoology are also available in Winslow's Dictionary. The names of gods are clearly elucidated. These words and their elucidations may be helpful for a translator to enrich the performance in a wide spectrum. Even some special terms in aesthetics are available in Winslow's Tamil – English Dictionary. Specific religious terms are given with various elucidations in Winslow's Tamil – English Dictionary. Even some alien words which are adapted into Tamil too could be referred from Winslow's Tamil – English Dictionary.

In order to encounter the cultural barrier in the process of Translation, these entries are supportive.

Words that are not generally entered in other Dictionaries could be found in Percival's English – Tamil Dictionary. Many equivalents are given in Percival's English – Tamil Dictionary. The translator can select the appropriate equivalent as per the context. These equivalents may be helpful to meet the contextual barrier in Translation.

Each entry is elucidated well in **Na Kathiravelpillai Akarāti**. Many rare words from various fields are employed. The words from Myths and Puranas too are available in it. As the Manual Dictionary by Joseph Knight and Levi Spaulding is the re-edition of **Yāzhppāṇa Akarāti or Mānipāy Akarāti**, it carries more entries. A knowledge of Sanskrit words which are lavishly and liberally mixed and mingled in Tamil is indispensable in the process of Translation. In **Yāzhppāṇa Akarāti or Mānipāy Akarāti**, only the pure Tamil entries were being used in the first edition. With the march of time entries from Sanskrit are also included in the editions followed to enhance the quality of the Dictionary and to facilitate the users. N.Kathiravelpillai used *Grandha* letters in Dictionary for the sounds not available in Tamil.

Alien words are amply employed in **Winslow's Tamil – English Dictionary**.

E.g பவித்துரி - Sacrificial grass, தருப்பை (A Sanskrit word)

They are denoted by the abbreviations. The first few letters of the languages are used to refer to those words. Sanskrit terms are denoted by star sign in order to distinguish them from the Tamil terms in it. Sanskrit terms are used and notes are added for some important terms for reference.

It is appreciable that some Tamilised Sanskrit terms too could be available in certain entries in Percival's Tamil – English Dictionary. It is indeed appreciable to adapt some alien words into a language in order to enrich the language. Those words should be included in the dictionaries too. Then the words are adequate enough for the users especially for the translators.

In **Yāzhppāṇa Akarāti or Mānipāy Akarāti** such coinages could be observed. **Na Kathiravelpillai Akarāti** consists of many rare coinages.

The significant aspect of Winslow's Tamil to English Dictionary is that the entries are well elucidated in English and the proper equivalents are being employed. It brings out even the subtle differences with great accuracy for the entries. Alternative elucidations are provided in Percival's Tamil – English Dictionary. Certain words have commendable equivalents in Percival's Dictionary. Certain colloquial entries are precisely given with explanation and equivalent in Winslow's Tamil – English Dictionary. The Translation could be done with clarity by employing these equivalents as per the context. In Percival's Dictionary certain equivalents are not in vogue as the language evolves.

E.g Abhor - வெறு, அருவரு, அரோசி

In English – Tamil Dictionary of Peter Percival, generally the elucidations follow the equivalents and the words are being elucidated well.

In Winslow's Tamil – English Dictionary ample elaborations are given to some entries. This helps in Translation to distinguish the sharp differences. It is to be noted that certain entries can be used for the production-oriented purpose as well as reception-oriented purpose in Translation. In Winslow's English to Tamil Dictionary even some rare entries are included with the equivalents.

E.g Quixotism - மனோகற்பிதம்

These entries and their respective equivalents help to have appropriateness in Translation. Due attention is to be paid for every word whether obsolete or in vogue in Translation. To have equivalent for those rare words this Dictionary can be a valuable resource. In Percival's English – Tamil Dictionary the equivalents are formed as per the main entry. If the main entry is an adjective, the equivalent too is an adjective. Most of the equivalents for the entries are appropriate, acceptable and in vogue. This may be beneficial for the purpose of Translation.

For certain entries some rare words generally found in literature are given as equivalents. An enriched Translation may be possible with these equivalents. At times translators may find it difficult to comprehend the equivalents as rare words are included as equivalents.

E.g cormorant - நீர்க்காகம், காரண்டம், பேருணன்

Sometimes the translator has to refer another Dictionary to assert the validity of the word. In Winslow's Dictionary the equivalents are formed with clarity. A translator can choose the proper equivalent as per the context from Winslow's Dictionary. Certain equivalents in Percival's Tamil – English Dictionary seem to have been compiled for the use of aliens especially for those who have English as their first language.

E.g வைபோகி - A voluptuary

Some equivalents are not accessible by simple means. In Winslow's Dictionary some entries are simply explained with clarity. It is very helpful to comprehend the meaning of the term easily in **Yāzhppāṇa Akarāti or Mānipāy Akarāti** as per the context. In order to have a better understanding of the terms of the original this kind of simple explanation may help a translator.

E.g The term ஒடு is defined as

ஆமை முதலியவற்றின் ஒடு, இரப்போர் கலம், உடைந்த மண்பாண்டம், ஒடென்னேவல், கொட்டைகளின் உறை, முன்றனுருபு and வீடு வேயும் ஒடு

In the process of Translation from Tamil to English the translator can infer the proper meaning of these kinds of words by referring this **Yāzhppāṇa Akarāti or Mānipāy Akarāti**. In the English – Tamil Dictionary of Peter Percival the distinguished meanings are not always clearly provided. Certain equivalents are simply provided in the Manual Dictionary

Assessing the competency of the Dictionary is helpful for a translator to encounter the linguistic barrier in Translation.

Pronunciations for the Tamil words are transliterated with English phonemic symbols in Winslow's English to Tamil Dictionary. The accents too are indicated for the main entry words in Winslow's English - Tamil Dictionary and Percival's English - Tamil Dictionary. The parts of speech are indicated in Winslow's 'A Comprehensive Tamil to English Dictionary'. In Percival's English - Tamil Dictionary the parts of speech are denoted as per the abbreviations explained in that Dictionary. In the English to Tamil Dictionary of Peter Percival, the main entry words selected are rich and high. Proper accent notations are given wherever necessary. In Winslow's English - Dictionary the verbs are explained on the basis of second person imperative i.e முன்னிலை ஏவல். Some cross references can be found in Percival's English - Tamil Dictionary and Winslow's English - Tamil Dictionary. Certain entries are being cross referred in Winslow's Tamil - English Dictionary. In Percival's Tamil - English Dictionary, a list of Anglo - Tamil alphabet is provided to ease the use of the Dictionary especially for the transliteration use.

Etymology of the words could be found in Winslow's Tamil - English Dictionary. The loan words from other languages are denoted by the abbreviations. Some interchangeable letters are employed in Winslow's Tamil - English Dictionary. It is found in Peter Percival's English - Tamil Dictionary that often the Tamil words used to elucidate the English entries are antique Tamil words. In **Yāzhppāṇa Akarāti or Mānipāy Akarāti** priority is given to the words which are in general use among people. Elucidation of the terms of Mathematics, Astronomy and Science are taken from the Tamil Literature of antiquity in **Na Kathiravelpillai Akarāti**.

New words are coined in place of the unavailable words in Tamil in the Manual Dictionary of Knight and Spaulding. Grandha letters are used in Winslow's Dictionary and **Na Kathiravelpillai Akarāti** for the sounds not available in Tamil (ஏ, ஓ).

In this respect the 'Effectiveness of the Dictionaries' is assessed from three perspectives with citations from the Dictionaries. The adequacy of vocabulary is measured, efficacy of the equivalents is assessed and the competency of the Dictionaries is analysed. These are the measures taken to assess the adequacy and competency of the Dictionaries for Translation.

V. FINDINGS

The mono lingual dictionaries **Yāzhppāṇa Akarāti or Mānipāy Akarāti** and N.Kathiravelpillai's **Akarāti** are identified as reception-oriented dictionaries. In some cases they serve for the production-oriented purpose in Translation to have a better equivalent and are helpful to comprehend the obsolete Tamil words.

The Manual Dictionary of Joseph Knight and Levi Spaulding is also a production-oriented and reception-oriented dictionary to some extent.

Winslow's English - Tamil dictionary can be a loadstar especially to foreigners in their study of Tamil language and to whom Tamil is vernacular in acquiring a sound knowledge of the English tongue. It is a true companion for the Translation from Tamil or to Tamil.

Winslow's Tamil to English dictionary was found as production-oriented dictionary as well as reception-oriented dictionary.

English to Tamil and Tamil to English Dictionaries of Peter Percival are very much helpful for comprehension whereas equivalent terms are concerned inadequacy is felt. They can be said as reception-oriented dictionaries where the meaning can be comprehended.

There are dictionaries published by the Indian scholars in 1679 A.D a Tamil - Portuguese Dictionary was published by the Christian Missionaries. A Western methodology was introduced in the production of dictionaries. One of these was compiled by Rev Fr Belchi. Then along with the dictionaries published in Jaffna Madhurai Tamil Sangam published Tamil Lexicon in 1910 based on C.W Kadivaravelpillai and Na. Kathiravelpillai. In today's standard the University of Chennai published a Tamil Lexicon. There are six volumes followed up with the supplement in 1930s. 1,24 405 words are found in these dictionaries. The assistance from the international scholars was received including the Sri Lankan Tamil scholars in compiling these dictionaries.

Scholars included the words found in the ancient Tamil words and the words in current usage. Regional dialects and how they are used were also mentioned. There are many meanings with literary citations. The words are denoted with grammatical constituents.

There are new dictionaries like Dictionary of Contemporary Tamil (1992 & 2008)¹⁰. It is actually the scholars who modified further the dictionaries with various experience. Dictionary of Contemporary Tamil has included scholars from Sri Lanka too. But there are criticisms with regard to Sri Lankan Tamil words. Although the revised editions consists of Sri Lankan Tamil words (1700 words in number)¹¹. Susendrarajah. S. (2011) makes a criticism on the manner the Sri Lankan Tamils words are included. He criticizes the wrong records of the Sri Lankan dialects and points out there are regional varieties spoken by the Sri Lankan Tamils.

VI. CONCLUSION

Thus, the scholarly pursuits of compiling dictionaries in the Tamilian world, especially in the society in which the language is nourished and cherished for long, have been facilitating the translators to encounter the three barriers in the process of translation. These Dictionaries as a prominent tool of translation serve the society to have a better translation through which sustainable regional development could be achieved with emerging knowledge.

But some suggestions are felt. As a language evolves with the march of time, further revisions, refinements and improvements of these dictionaries have become a need of the time to meet the demand, trend and tenor of the language.

As mentioned in the final part of the study, the effort of compiling a modified dictionary like ‘*Kriya*’ is really appreciable. These kinds of efforts ought to be promoted in order to cope with the emerging knowledge as sustainable regional development requires emerging knowledge in Science, Technology, Arts and other fields. Translation, which deals with languages, plays a vital role in this.

The dictionaries compiled in Jaffna in the 19th century may be modified as production-oriented as well as reception-oriented dictionaries by adding current usages and coined-up words with the respective equivalents in order to facilitate the translators so as to cope with the latest development and to cope with the dissemination of knowledge, translation contributes a lot.

REFERENCES

- [1] Maathaiyan, P., **Akarātiyiyal**, Tamizhp palkalakkazhakam, Tañcāvūr, 1997, p 77
- [2] <http://translationjournal.net/journal/63theory.htm>
- [3] <http://translationjournal.net/journal/63theory.htm>
- [4] Jeyathevan, V., **Tamizh Akarātiyiyal vaḷarcci varalāṛu**, aintiṇaip patippakam, Chennai, 1985, pp 3 – 27
- [5] Jebanesan, S., **Ilaṅkai Tamizh vaḷarcciyum Amerikkan Mishaṭṭum**, Kumaran puttaka illam, Colombo, 2007, pp 54 – 55
- [6] <http://csijaffnadiocese.com/uploads/NewsletterJuly2009.pdf>
- [7] Jebanesan, S., **Ilaṅkai Tamizh vaḷarcciyum Amerikkan Mishaṭṭum**, Kumaran puttaka illam, Colombo, 2007, pp 58 – 59
- [8] Sivalingaraja, S., **īzhattu Tamizh Ilakkiya celneri**, kumaraṭṭu puttaka illam, Colombo, 2009, p – 128
- [9] https://en.wikipedia.org/wiki/Tamil_Lexicon_dictionary
- [10] Annamalai, E., etal, Dictionary of Contemporary Tamil, Nagaraj & Company Pvt Ltd, Chennai, 2008
- [11] Suseendaraja, S., *Tamizhiyal sar cintanai tulikal*, Cemamadu Patippakam, Colombo, 2011

Impact of tasks on the performance of students' grammar usage

Mohan Samaranayake*

*English Language Teaching Unit, Wayamba University of Sri Lanka, Kuliyapitiya, Sri Lanka

mksmsamaranayake@yahoo.com

Abstract— Interlanguage errors have long been a field of interest for a number of studies over the years. Errors in article usage, a kind of interlanguage errors are a persistent problem that teachers of English as a second/foreign language very often encounter. It is widely observed in the Sri Lankan context too that learners have difficulty with the article system of English as Sri Lankans consider error-free English as the hallmark of English proficiency. Many teachers agree that errors in article usage is basically a problem caused by the absolute complexity of English article system as learners experience difficulty in expressing definiteness or indefiniteness of the noun using appropriate articles. If these errors in article usage can be identified and categorized, teachers would invariably be able to approach teaching of articles more effectively. Although many researchers approached the problem from different perspectives, the present study was based on an error analysis. This was an attempt to identify the types of errors in article usage committed by first year undergraduates at the Wayamba University of Sri Lanka. The study was carried out to determine whether tasks (a cloze test and a free writing task) affected their performance in using articles. The necessary data were obtained by analysing the students' errors in zero, single and multiple modifier noun configurations. The descriptive method was used and statistical analysis was followed to identify the variance of errors. P values of two-way ANOVA tests on the percentages of correct attempts were considered to determine the effect of tasks on the learners' performance. The analysis of the results indicated that the tasks had no bearing on the performance of the subjects' using articles.

Keywords: interlanguage, errors, grammar

I. INTRODUCTION

This paper is an attempt to identify the errors committed in the use of articles by learners of English as a second language (ESL/L2) at the Wayamba University of Sri Lanka and to determine with some precision the kinds of errors these students make in article usage and to see whether the tasks they engage in have any impact on their performance.

Since the relevant literature indicates that many researchers have approached articles from different perspectives such as error analysis, acquisition of the second language, semantics

and pragmatics (Agnihotri, Khanna, & Mukherjee, 1994; Robertson, 2000; Trenkic, 2007; Zdorenko & Paradis, 2008; Snape & Kupisch, 2010), the present study too was based on an error analysis, which seemed to be the most extensively followed practice among the researchers who carried out studies on articles.

II. METHODOLOGY AND EXPERIMENTAL DESIGN

The corpus of the language sample was studied for errors in article usage by identification, categorization and explanation, which was suggested by Corder (1973) and later modified by Brown (1994), Ellis (1997) and Gass and Selinker (2001). This was a widely-held and frequently utilized method in carrying out an error analysis. Data were collected by means of three tests (a pre-test, a post test and a delayed post-test). Each test comprised two tasks; a cloze task and a free writing task. The cloze task was based on reading and writing skills and was used for the purpose of testing the key uses of articles while the free writing task was based on writing skills for the purpose of identifying whether types of errors committed in the cloze task could be observed in their written production too. Two different tasks were chosen as the relevant literature indicates that students' performance is affected by the task they are engaged in (Agnihotri et al., 1994; Robertson, 2000; Trenkic, 2007; Zdorenko and Paradis, 2008; Snape and Kupisch, 2010). Since students were not informed that article usage would be tested in their free writing task, it was assumed that they produced articles involuntarily. However, in the cloze task (forced choice elicitation task) students had to produce articles consciously.

A description of an imaginary local person given in about 197 words was used as the cloze test. It was adapted and modified from a task given by Hewings (2002) in his Advanced English Grammar textbook. The advantage of this task was that it provided a high degree of control over the input. The same cloze task was used in all three tests (the pre-test, the post-test and the delayed post-test). In this particular cloze task participants had to supply 27 missing articles (ten blanks for missing 'the', eight blanks for missing 'a' and another nine blanks for missing 'an').

Although the same cloze task was used in all three tests, the participants were given a different topic for the free writing task in each test. The topics were 'the most unforgettable day', 'the most unforgettable person' and 'the most unforgettable teacher' in the three tests respectively.

Since the main purpose of the research was to find out whether 'tasks' had any impact on the performance of the subjects' use of articles, subjects' performance was compared among the three tests carried out. This was to find out whether the subjects performed better in the free writing task than in the cloze task. Article usage in 'article + noun', 'article + single modifier + noun' and 'article + multiple modifiers + noun' configurations was considered in gathering data from both tasks. Table 1 shows the examples for these configurations.

Table 1: Noun configurations used in the present study

Article Type	Configuration	Example
the	1. the + noun	<i>the manager</i>
	2. the + single modifier + noun	<i>the Colombo branch</i>
	3. the + multiple modifiers + noun	<i>the most skilful player</i>
a	1. a + noun	<i>a member</i>
	2. a + single modifier + noun	<i>a professional cricketer</i>
	3. a + multiple modifiers + noun	<i>a leading political party</i>
an	1. an + noun	<i>an umbrella</i>
	2. an + single modifier + noun	<i>an honest person</i>
	3. an + multiple modifiers + noun	<i>an ambitious branch manager</i>

After the pre-test a two-hour lesson on articles was given to the participants by a lecturer in ELT. Then after a week's time the post-test was administered and the delayed post test was conducted ten weeks after the pre-test. Subjects were given 40 minutes to complete the cloze task as well as the free writing task. The cloze task was printed on one side of an A4 paper and the instructions for the free writing task were printed on the other side (*Appendix i sets out the cloze task*). Although it was planned to administer the tests to 60 subjects, only 48 were present for the pre-test, 44 for the lesson on articles, 38 for the post-test and 39 for the delayed post-test.

A. Sample

The sample consisted of first year undergraduates of the Faculty of Applied Sciences of the Wayamba University of Sri Lanka. This particular faculty is one of the four faculties of the university and students who take combined mathematics for the General Certificate of Education - Advanced Level (G.C.E. A/L) are selected for its study programmes.

B. Collection of Data

The test was administered in the classroom where the participants usually had their English classes. No special seating arrangement was made and the printed test paper was distributed among them. They were given 40 minutes to complete both tasks. These 40 minutes were taken at the

beginning of their usual two-hour class. Two tasks of the test were printed separately on each side and they were expected to fill in the blanks with 'a', 'an' or 'the' for the cloze task and write the given description in the space provided for the writing task.

C. Analysis of Data

The procedure followed by Agnihotri et al. (1994) in their study for data analysis was adopted in the present study too. They presented data based on percentages and the method they used to calculate the percentage of correct attempts was adopted in the present study since it was a simple, straightforward method which helped comprehend data easily. The procedure was to calculate the total number of attempts that could be made for each potential place in each noun configuration of the cloze task. The percentage of correct responses was calculated against the total numbers of attempts. For example, there were six potential places in the cloze passage where the definite article was required to be inserted in 'the + noun' configuration. Since the total number of subjects being 48 at the pre-test, then the total number of attempts would be calculated as 288 (48 x 6 = 288). Out of these, 'the' was correctly inserted only in 113 attempts. Thus 39.24% (113/288 X 100) responses were correct.

In the free writing task, all possible noun configurations were marked separately and the total number of attempts representing one configuration was calculated by considering all the essays produced by the participants. When essays were analysed for the errors in article usage, individual scripts were considered and the total number of noun phrases requiring articles was identified. After that the number of correct inclusions of articles in these noun phrases was also identified. Both article omission errors as well as article misuse errors were taken into account during the analysis. Likewise, all the scripts were evaluated and the percentage of correct responses was calculated for each article configuration. For example, there were 167 potential places in all the 48 essays where the definite article is required to be used in 'the + noun' configuration in the pre-test. Therefore, the total number of attempts was 167. Out of them only in 78 attempts 'the' was correctly inserted. Thus 46.71% (78/167 X 100) responses were correct. Likewise, calculations for all the noun configurations were carried out. When analysing the errors of article usage in the free writing task, the length of the essays produced was not taken into consideration. The number of errors in each noun configuration was noted and percentages of the correct use were calculated. The same procedure was repeated in all three tests.

D. Explanation of Data

ANOVA (Analysis of Variance) test was performed on the basis of the percentages of correct article usage by using the Minitab Statistical Software (Version 14) to see whether there was any variance between the tasks performed.

The RCBD was used as the purpose was to find the effects of the variables on the results obtained. The three tests deployed (the pre-test, the post-test and the delayed post-test) were taken as treatments of the design and the noun configurations ('article + noun', 'article + single modifier + noun' and 'article + multiple modifiers + noun') and the tasks deployed (the free writing task and the cloze task) were considered as blocks of the design.

Null hypothesis (H_0) in this context is the assumption that there is no impact of the tasks on the performance of the subjects in using articles. If the P value is more than 0.05 ($P > 0.05$) null hypothesis will be accepted (which means that there is no impact of the tasks on the performance of the subjects' article usage) but if the P value is less than 0.05 ($P < 0.05$) null hypothesis will be rejected (which means that there is an impact of the tasks on the performance of the subjects' article usage).

III. ANALYSIS AND INTERPRETATION OF DATA

All possible configurations were considered for the analysis as the relevant literature indicates that an article can precede a noun with or without modifiers. The 'article + zero modifier + noun' configuration was considered when no modifier was used to modify the noun (e.g. *the manager*).

The 'article + single modifier + noun' configuration was considered when only one modifier was used to modify the noun (e.g. *the Colombo branch*). The 'article + multiple modifiers + noun' configuration was considered when two or more modifiers were used to modify the noun (e.g. *the most skilful player*, *the best supporting actor award*). Therefore, articles used in the tasks (the cloze task and the free writing task) were coded according to the noun configurations as correct use of 'the', 'a', and 'an' in 'article + noun', 'article + single modifier + noun' and 'article + multiple modifiers + noun' configurations. Both tasks were marked on the basis of the correct or incorrect article used in the noun configurations given in *Table 1*.

Subjects' deviations from using the correct article in obligatory contexts were categorized in terms of incorrect answers and their variance was established depending on the noun configuration in which the article was placed. Omission of articles too had been considered incorrect in the analysis as it was imperative to use one of the articles in obligatory contexts. Since answers were checked for accuracy, two categories were established as correct or incorrect articles used at potential places. If an incorrect or no article was used when an article was needed it was considered under the category 'incorrect use of article'.

Table 2: Percentage of correct responses of each configuration of cloze and free writing tasks

Configuration	Pre test		Post test		Delayed post test	
	Cloze task	Free writing task	Cloze task	Free writing task	Cloze task	Free writing task
the + noun	39.24	46.71	38.6	40.77	41.45	38.24
the + single modifier + noun	37.5	39.47	36.84	44.00	38.46	42.35
the + multiple modifier + noun	29.17	30.77	31.58	32.73	32.48	31.82
a + noun	37.5	40.78	38.6	41.11	40.17	38.37
a + single modifier + noun	32.81	38.57	38.16	37.93	37.82	39.73
a + multiple modifier + noun	20.83	33.33	23.68	35.14	28.21	36.36
an + noun	54.86	60.00	56.14	66.67	54.7	55.56
an + single modifier + noun	36.46	54.55	43.42	50.00	41.67	58.33
an + multiple modifier + noun	34.38	-	43.42	-	41.03	100.00

A percentagewise comparison of each configuration against both tasks is given in the *Table 2*. It is clear from this table that the subjects' control over the articles in the free writing task is slightly better than their control over the articles in the cloze task and the configuration of 'an + noun' happens to be the most accurate in both task types.

A. Performance of the Definite Article ('the') in Cloze Task vs. Free Writing Task

The difference in the percentage of the correct use of 'the' between the cloze task and the free writing task was not consistent, although there was hardly any difference in 'the + multiple modifiers + noun' configuration in all three tests. A two-way ANOVA was performed on the basis of the above percentages to see whether there was any variance between the tasks performed. Since the P values for the tasks were 0.239 ($P > 0.05$), 0.728 ($P > 0.05$), and 0.093 ($P > 0.05$) for the pre-test, the post-test and the delayed post-test respectively, it can be concluded that the tasks performed

did not have any impact on the performance of the subjects' use of the definite article correctly.

B. Performance of the Indefinite Article ('a') in Cloze Task vs. Free Writing Task

According to the figures shown in the *Table 2*, the difference in the percentage of the subjects' performance in the correct use of the indefinite article 'a', between the cloze task and the free writing task grows wider from 'a + noun' to 'a + multiple modifiers + noun'. The difference in the percentages of the correct article used in 'a + multiple modifiers + noun' configuration is more significant than the other configurations between the cloze task and the free writing task in all the tests deployed. But when the ANOVA was done it was revealed that subjects' use of the indefinite article 'a' did not drastically diverge across the two tasks carried out as P values for the tasks were 0.286 ($P > 0.05$), 0.597 ($P > 0.05$), and 0.775 ($P > 0.05$) for the pre-test, the post test and the delayed post-test respectively. Therefore,

since the result obtained for the uses of the indefinite article 'a' is similar to the one obtained for the uses of the definite article, it can be concluded that two tasks deployed have not affected the subjects' performance in any of the tests carried out.

C. Performance of the Indefinite Article ('an') in Cloze Task vs. Free Writing Task

Percentages depicted in *Table 2* indicate that subjects perform better in inserting 'an' than 'a' in both tasks. They confirm that there is no consistent difference in the percentages between the cloze task and the free writing task in all tests conducted. Further, the difference observed in 'an + multiple modifiers + noun' cannot be taken into account in general as there is no evidence found for this particular configuration among the scripts analysed for the free writing task in the pre-test and the post test. Furthermore, the percentage for this noun configuration has become 100% in the delayed post-test as the two instances found happened to be correct.

When the ANOVA was conducted, all three tests delivered the same results. According to the results of the ANOVA conducted for the noun configurations of 'an', it was interesting to note that the subjects' use of the indefinite article 'an' did not appreciably fluctuate across the two tasks performed as P values for the tasks were 0.339 ($P > 0.05$), 0.493 ($P > 0.05$), and 0.535 ($P > 0.05$) for the pre-test, the post-test and the delayed post-test respectively. Although percentages of each configuration show that on most occasions subjects perform better in the free writing task than in the cloze task, the ANOVA done on the percentages of 'an' shows that the subjects' performance is not affected by the tasks they are engaged in. Since this outcome too confirms the results obtained for the definite article as well as the indefinite article 'a', it seems that the tasks performed did not have any noteworthy impact on the subjects' use of articles.

IV. DISCUSSION AND CONCLUSION

This study too confirms that the article system of English can pose problems for ESL learners as the data show a lot of variability in these students' interlanguage. The analysis of the results proved that the performance of the subjects' article usage was not affected by tasks.

This was indeed contrary to expectation, as it was expected that the learners would perform better in the free writing task than in the cloze task. So the assumption was that they might perform better in the free writing task than in the cloze task as lower error rates are expected in production tasks owing to the fact that learners have the freedom to avoid uses which are uncertain or look for alternatives where they are prone to commit more errors in objective tasks like cloze tests. The result of the present study seems to indicate that the type of task the learners are engaged in does not impinge on their performance in using articles. This is contrary to the findings of Agnihotri et al. (1994), Butler (2002), Robertson (2000), Snape and Kupisch (2010), Trenkic (2007), and

Zdorenko and Paradis (2008) who have found that accuracy rate differs according to the tasks performed. This may be due to the fact that the present study focused on three different noun configurations (zero modifier, single modifier and multiple modifier noun configurations) for its analysis whereas most of the previous studies were confined either to zero modifier or single modifier noun configurations. On the other hand, if a speaking task had been used in the present study to gather data, the result would have been different. However, the result of the present study does not seem to suggest that tasks have an impact on the subjects' performance in using articles.

A. Limitations of the Research

It is imperative to consider some of the limitations of the study carried out. The main concern with regard to the cloze task was that it was not possible to include all basic uses of articles as the scope of the uses that the definite and indefinite articles encompass is vast. In addition, the article uses tested in the cloze task are not a true representation of the items discussed in the lesson taught to them. Moreover, the researcher did not have any control over the output of the free writing task as it was a production task. The data yielded just one or two examples of some noun configurations while for others, there was no evidence. Thus when the subjects' performance in these two tasks was compared they might not have fully represented the subjects' ability to manipulate the English article system.

B. Future Directions

Although 'missing articles' in obligatory contexts was a frequent occurrence along with incorrect use of articles, in the present study it was also considered under the category of incorrect use of articles, not as a separate phenomenon. However, it is important to identify whether omission of articles is deliberate or unintentional as it is difficult to determine whether the learner has omitted the articles or replaced it with the zero article. One future area of research would be to look into the learners' omission of articles and to identify whether they are intentional or unintentional.

C. Conclusions

The main findings of the present study suggest, as far as Sri Lankan ESL learners are concerned, that they do have problems with using articles. Moreover, these usage difficulties affect their performance in the target language.

This study also indicates that testing of grammatical items such as articles should not be limited to one type of task. Tasks should incorporate contexts in which students are most likely to encounter articles. These findings also confirm the potential difficulties that could arise due to the complex nature of the noun phrase. It is because the extended use of the definite and indefinite articles in English language has led the learner to be confused as the learners' system of article is incomplete.

Therefore, incomplete application of rules has been the primary cause of article errors. This can also be one of the factors contributing to poor performance in article usage. In addition, these errors indicate how far the learners have progressed in their interlanguage continuum, and what remains for him to master, as Gass and Selinker (2001) stated.

In conclusion this research has identified that the tasks learners engaged in do not seem to affect their performance in article usage. However, these findings indicate that ESL research on articles should be replenished by identifying whether learners' omission of articles is intentional or unintentional.

REFERENCES

- [1] Agnihotri, RK, Khanna AL, and Mukherjee, A (1994) The use of articles in Indian English: Errors and pedagogical implications, In R.K. Agnihotri and A.L. Khanna (Eds.), *Second Language Acquisition*. New Delhi: SAGE Publications.
- [2] Brown, DB (1994) *Principles of language learning and teaching* (3rd ed.), New Jersey: Prentice Hall Regents.
- [3] Butler, Y (2002) Second language learners' theories on the use of English articles, *Studies in Second Language Acquisition*, 24, 451-480
- [4] Corder, SP (1973) *Introduction to applied linguistics*, London: Penguin Books.
- [5] Ellis, R (1997) *SLA research and language teaching*, Oxford: Oxford University Press.
- [6] Gass, S and Selinker, L (2001) *Second Language Acquisition: An Introductory Course* (2nd ed.), Hillsdale, N.J.: Lawrence Erlbaum.
- [7] Hewings, M (2002) *Advanced English grammar*, New Delhi: CUP India
- [8] Robertson, D (2000) Variability in the use of the English article system by Chinese learners of English, *Second Language Research*, 16(2), 135-172.
- [9] Snape, N and Kupisch, T (2010) Ultimate attainment of second language articles: A case study of an end state second language Turkish-English speaker, *Second Language Research*, 26(4), 527 – 548.
- [10] Trenkic, D (2007) Variability in second language article production beyond the representational deficit vs processing constraints debate, *Second Language Research*, 23(3), 289-327.
- [11] Zdorenko, T and Paradis, J (2008), The acquisition of articles in child second language English: Fluctuation, transfer or both? *Second Language Research*, 24 (2), 227-250.

Appendix I – Cloze Task

Task 1. Write the missing articles (a, an or the) in the blanks.

Nimal Perera; A profile

Nimal Perera recently became chief minister in a local government institution. Mr. Perera is honest person and has had varied career. He was professional cricketer in 1980s. He used to be all-rounder and some people considered him to be most skillful player of his generation. After series of injuries, he became manager of Colombo branch of ABC bank. Most of staff considered him to be ambitious branch manager. Nevertheless he was very popular among his colleagues as easy – going character. Later he became actor for brief period of time. He won best supporting actor award for his only film in which he acted as marriage broker who always carried umbrella. Some years later, he was offered executive position in one of biggest supermarket chains in country. After that he became active member of leading political party. The party asked him to contest for the local government election as he was attractive down-to-earth politician. Now he also holds ministerial portfolio there and wants to be member of parliament one day.

Stylistic analysis as an alternative in teaching English-literature at G.C.E O/L

V.J.Naveenraj

*Department of Languages and Communication Studies,
Trincomalee Campus, Koneshapuri, Trincomalee, Srilanka.*

vnavenraj@yahoo.co.uk

Abstract—This research investigates the effects of stylistic approach as an alternative to the current teacher-centered teaching approaches in teaching English literature at GCE O/L. It has been observed that the percentage of students offering English literature at GCE O/L is deteriorating year by year throughout the schools in Trincomalee district. The main aim of this dissertation is to demonstrate how to analyse the literary text stylistically and to prove how useful it is in teaching English language skills in the classroom. Therefore, this research paper is two folded. One is the stylistic analysis on the select poems and a novel taken from the GCE O/L syllabus and the other is the experiment of stylistic approach in the classroom to find out its effectiveness. The study adopted pre-test, post- test, and the experimental teaching design. The participants in the study are of eleventh standard students (G.C.E. O/L) – (General Certificate in Education) in the district of Trincomalee - Srilanka. Three types of schools were chosen for the experiment. They are: urban, semi-urban and the rural schools. 20 students in each school were the target groups for the experiment. Two hypotheses were tested. Data were analyzed using the performance of the students in the tests after the teaching sessions. The questions were categorized under the following linguistic strata: lexical, syntactic, phonological and pragmatic elements. Findings revealed that there had been significant effects on students' achievement in poetry through stylistic approach. The other extraneous variables such as gender of the students, social class, and educational level of the parents and the motivational factors of the students had their minor effects. Their impact is marginal compared to the independent and dependent variables. The application of the stylistic approach is the independent variable and the improvement in learning language skills is the dependent variable in my research. The theoretical base such as linguistic stylistics, literary stylistics, and the speech act theory lie as a strong foundation upon which the classroom teachings in stylistic approach and the subsequent testing were undertaken in my research.

Keywords—stylistic-analysis, linguistic-analysis, literary text, poetic language, interpretation

I. INTRODUCTION

The percentage of students offering English literature at GCE O/L in the Eastern Province is 1.2% only. The failure rate in English language as a subject at GCE O/L in schools in the Eastern Province of Srilanka is 67%. It is a bitter truth and an important issue to take notice to reverse the current trend of

bull-tail development in the district of Trincomalee. The failure of English teaching not only in Trincomalee but also in many districts in Sri Lanka has posed several questions for us to think about. The issue has become serious in the recent past. It is also an issue that is giving students, teachers and school authorities a very big challenge to seek solution in spite of several attempts by the government to increase the pass rate throughout the country. The low performance in both these subjects (English Literature and English Language) has pushed the students into deep trouble where they miss the opportunity to get the admission to many lucrative courses such as Journalism, Law, Mass Communication, architecture, Drama and Theatre and a host of other subjects in our tertiary institutions. At least a credit pass in English Language at GCE O/L along with the adequate Z score is a requirement for any candidate to be eligible for admission to any of the aforementioned courses. The main concern is therefore how to reverse the undesirable trend of unsatisfactory performance in literature-in-English with particular emphasis on poetry. While the parents aspire to get their children with adequate English language skills, the practical situation in many government schools is not in the shape as many parents expect.

Many criticisms pointed out that the students generally did not perform well in the three genres especially in poetry where the performance was worst. Critics put the blame on the incompetent teachers who messed up teaching literature at the school level. Today, it is a general opinion that most of the English teachers are poor in performance and the failure of English teaching is due to their lack of seriousness, poor knowledge of literary texts, sub-standard teaching by incompetent teachers and their the bad approaches of teaching.

All these are in confirmation that the poor performance was because of poor teaching approaches currently adopted in Sri Lankan schools and they minimize students' active participation and thus fail to gain the educational and motivational benefits from experiential learning and from the integration of the students' reaction into the teaching and learning situations.

The following teaching approaches are commonly adopted by the teachers in Trincomalee district in teaching literature. They are: impressionistic model, cultural model or literary-core approach, interpretation of characters approach and appreciative approach. More often the explanation is based on

the teacher's knowledge, not based on the text. This is where the problem begins. Text is ignored and the teacher's own opinion becomes the one and only answer to the questions. The students are in disadvantage in literary based approaches as it is teachers-oriented and does not give room for extended language work. Interpretation of characters approach is seen as a springboard or a tool to counsel students and teach morals. In appreciative approach the beauty of the text is not seen. This approach leads to frustration and lack of interest. In these approaches, teaching literature tend to be superficial. Literary texts are taught as finished products, to be unilaterally decoded, analyzed and explained by the school teachers. To improve the performance of students in poetic literature, there is a need to improve the quality of teaching by employing teaching approaches that will facilitate better achievement. The aim of this study is to show that the teaching of literature rightly practiced, can be lively, stimulating, challenging and a participatory activity and this can be achieved through stylistic approach.

The proposed Stylistic approach deals with investigating how the resources of a language code can be put to use in the production of the actual messages. This approach considers literature primarily as discourse, a communicative discourse. This method also provides a way of integrating two subjects, English language and Literature-in-English. It is a systemic teaching of literature and it helps in deepening the process of understanding. Stylistics is a study of language in literature and that it is a part of linguistics. When one analyzes the linguistic pattern of a text, he gets the answers to questions such as how literary effects are encoded in language. The target of this approach is to decode meaning and structural features of literary texts by identifying linguistic pattern in the texts. It is claimed that Stylistic is the only linguistic discipline which allows the analysis of a literary texts and their literary meaning by way of linguistic techniques. This approach deals with the teaching of literature and poetry in particular emphasizes the writer's choice of words and their functions, the structure and the deviation from the norms, the use of foregrounding and parallelism, and other figure of speech, the lexical cohesion and coherence in the texts and the grammatical patterns, and how all these bring out the message or meaning in the texts.

Stylistic approach leads to thematic approach

The other important issue is that it deals with the thematic approach which makes us to find out the central theme of any work of art which may be psychological, ethical, didactic or sociological. It deals with the organization of text around a theme. It encourages learners' active involvement, emotionally and intellectually in learning. In this approach, the major themes which anchor everything are identified. Other minor themes also identified and how these themes, characters and the stanza, in the case of a poem, relate to the major themes is identified. The themes may be more than one but they are all

connected and how these themes are presented is the concern of thematic approach. Settings, characters and situation can be the other elements of the themes. These contribute to give its values. The author comes up with an idea, it obsesses him and he is compelled to express it. When we listen to somebody we always try to understand what the speaker tries to say and what the content is. The speech acts play an important role in this conversation. It is not the words but the action behind the words is very important. The search for theme ends in finding a concrete form and the embellishment around it, so that it will have both internal and external values. This approach helps students to search for values. The teacher can guide what the students should do or not do based on their reading. The main purpose of stylistically analysing the text is to deal with decoding of meanings and structural features of literary text especially poetry. The thematic approach deals with stimulating the learners to think about or around an idea a text is conveying. This makes the study interesting and active on the part of students.

Students struggle over the deviant nature of the poetic language

This research arises from both my experience as a teacher of English for the last 20 years at tertiary level and my attempt to liquidize the problems faced by the students especially the students at GCE O/L in dealing with the literary language especially the poetic language which causes much trouble to the students as it is deviant from the ordinary language. The teaching of English Literature in stylistic approach was undertaken by me at school level mainly to develop the language skills as literature is rich in vocabulary and sentence structures. Today, in most of the classrooms literature is used to appreciate its content matter. Many teachers fail to incorporate language skills along with it, thus giving little importance to the vast varieties of language- use in literature.

In this research paper, basic stylistic analysis is done to sensitize them to the literary use of language for certain effects. After the introduction of stylistic approach in the selected schools, the students found language learning interesting and they began to extend their use of language beyond the examination context to express their feelings and thoughts. Major emphasis and initial focus were put on the language and the use of style in Literature. I have found that the usage is the key in improving the language. This study has provided a theoretical basis and methodology which enabled me to evaluate my past teaching experience in new perspective. It also enabled me to systematically analyse and organize my current practice in the classroom. The result I received through the questionnaire is an encouragement for me to further develop stylistics in every aspect and the need to incorporate speech acts theory has struck my mind that it would be ideal if it is mingled with stylistics so that the literary evaluation would be complete and worthy to get the readers' admiration.

I have mentioned this point under the caption Suggestions and Recommendations in the latter part of this dissertation.

Saussurean concept of the “sign”

It addresses two kinds of questions, theoretical and pedagogical. The theoretical questions include: What is the style of literary language? How can we characterize it? Is it separated from that of the ordinary use of language in our daily communication? How is discourse in the literary use of language different from that in ordinary communication? To answer these questions, I start by examining language as a system of signification. The Saussurean concept of the sign is a point of entry. Although Saussure classifies literature as a Second order system, it is a legacy of his contribution that the medium becomes the focal point of the study of art and language the primary concern of the study. The Russian Formalists sharpened this focus on the medium by on the reflexive use of language in literature. So the poetic function is characterized by the dominant focus on the theme. But the literary use of language is also a kind of discourse which partakes of other functions such as the pragmatic and the interpersonal ones. This dissertation attempts to bring the Formalist approaches and discourse analysis together in the stylistic of the use of language.

The second kind of question is of pedagogical nature: What are the problems of English teaching. How should language and Literature be taught to the second language learner? How are these two subjects related? Why is the language standard falling although the time and effort spent on it is greater than that of other subjects? Why is the number of students studying literature dropping? What place might the stylistic approach to literary language have in both language and Literature-teaching? This thesis attempts to illustrate and recommend the integration of the teaching of language and literature through the stylistic approach to both the literary and non-literary texts.

The crux of the problem

Why do we introduce literary texts in the classroom? It is because the language of literature is rich in vocabulary and also rich in variety. Learning the language skills is more important than being satisfied with understanding the content-matter of the literary text.

The teaching of literature can be seen as a means of introducing learners to such a serious view of our world, of initiating them in the process of defining themselves through contact with others' experience.

Stylistic approach is student-centered

To begin with, the major concentration is on understanding the literary composition and its effects on the element of 'literariness' which is responsible in making the language powerful and literary. It is understandable that the study of interaction of the stylistic patterning of language and the

stylistic functions it creates will be of interesting exercise to the students in the class room.

To show where stylistics stands among literary studies, and to set the scene for the whole thesis, the impressionistic teaching which is currently followed by many teachers in the schools where the teacher gives the ready-made answers to the students is set against the stylistic approach which is more appropriate in developing language ability while appreciating the literary merits of the texts especially for non-native students/readers. The set pattern in analyzing the literary text forms the basis for the stylistic analysis and it leads to the interpretation of the text as the ultimate objective of analysis. **The set pattern begins with the lexical analysis leading to the syntactic analysis through phonological pattern analysis. Thus, the linguistic elements are heavily applied as the major resource for the stylistic analysis.**

To substantiate it in practical terms, and at the same time to demonstrate it to the readers and students how stylistic analysis can be performed, a model of literary stylistic analysis is attempted with select poetry taken from the syllabus given for the GCE O/L students in Srilanka. It is based on the consideration of the stylistically significant features of the structure of the layout (including clause and sentence structure, paragraphing and cohesion) and of lexis. It is the stylistic effects and functions produced by these features rather than the description of them which is more important. Mere description of language and style is not very important in my point of view; instead, the primary task is to provide a descriptive account of our intuitions concerning the effects and functions produced on us by the text. This supplies a secure basis for interpretation of texts and for teaching interpretation.

Demonstration of stylistic analysis

Four select poems by various poets are analysed separately to demonstrate how this model works and it is done to show readers and students the ways of applying and performing it. A stylistic study of the poems can be of help to the understanding of some aspects of their style. On the other hand, these texts are different in their application of their language organisation and mode of narrative discourse. The deviant, the conventional and the archaic use of language is highlighted in my analysis. This is argued to be useful to the pedagogy of teaching stylistics.

Literary stylistics is described as the most convenient approach for non-native students of English literary composition. This approach is student-oriented and, therefore, initially more advantageous than an 'impressionistic approach', a 'historical/social and biographical approach', or 'culture-specific approaches'.

Sensitizing the students to the nuances of language

More attention is provided to the aims and intentions of teaching literary stylistics to the students who offer the subject

English literature in the school. The final and most important argument is placed on the student-centered classroom-pedagogical procedures. These include forms of linguistically systematic 'rewriting' which are used as a means to two ends: One is to sensitise the students to language; and the other is to demonstrate stylistic features and functions.

II. BACKGROUND OF THE STUDY

When we look at school teachers' qualifications it is obvious that many teachers who teach English language skills are weak in their own language ability as well as in their teaching methodology especially in the rural schools in the Trincomalee district. More than 90% of English teachers are not graduates. They are either trained or non-trained teachers. The G.C.E O/L result in the Eastern Province is the evidence for the above said statement. As a result of this, there is a poor language development among the school children. This problem can't be solved in a short period of time. Initially, teachers must know how to teach language skills through literature. Hence, the stylistic approach is demonstrated in this thesis as a means of solving the problem of the students if properly applied at the classroom level. Secondly, this approach may help students to apply on their own even without the help of the teachers to find the meaning of the literary texts thus making them independent in analyzing the texts in the correct way. There may be several reasons why English teaching is a failure in this country. But, this research is not about any of those reasons. Instead it comes out with a solution to solve it.

STATEMENT OF THE PROBLEM:

Most of the students do not want to offer the subject English literature at GCE O/L in fear of failing the subject. Instead, they offer other optional subjects such as music, art, or commerce available as per the GCE O/L curriculum given by the government.

Majority of students who offer English literature pass the subject but when compared to the total number of students appear for G.C.E-O/L the amount is very slim in each year. It is only 1.2% in Trincomalee district. The case is same in the other two districts-(Batticaloa and Amparai) in the Eastern Province.

Most of the students who offer English literature are denied A or B grade. Many end up in C grade, S grade or fail.

Most of the teachers are not equipped with appropriate teaching methods to handle English literature to develop the language skills among the students.

English language teaching is a failure nationally as per the statistics and it has created a major worry among the planners at the ministerial level.

Out of 5213 students from 152 schools in Trincomalee district only 69 students offered English literature in GCE

O/L. This is only 1.32% in the year 2012. Many students do not want to offer this subject owing to the fact that they will fail in the examination. It tells the dire situation that the whole country is facing today.

Most of the rural schools do not have English teachers to teach English literature.

Result analysis- English literature for year 2010, 2011 and 2012

District	2010			2011			2012		
	Total No. Sat	Sat for English Literature	No. Passed	Total No. Sat	Sat for English Literature	No. Passed	Total No. Sat	Sat for English Literature	No. Passed
Trincomalee	5414	56	50	5288	57	49	5213	69	58
Batticaloa	6267	23	16	6635	27	23	6616	23	19
Ampara	9038	96	62	8880	116	91	8762	128	63
Total	20719	175	128	20803	200	163	20591	220	140

(Report collected from the dept. of Education Trincomalee)

Result analysis of English Language GCE- O/L:

District: Trincomalee -2014

No. of Schools	157
No. Sat	4931
No. of Passes	1756
No. of Fails	3175
Percentage of Pass	35.61
Percentage of Fails	64.39

District: Batticaloa -2014

Total no of Schools	146
No. Sat	6437
No. of Passes	2275
No. of fails	4162
Percentage of Pass	35.34
Percentage of Fail	64.66

District: Ampara-2014

No.of Schools	120
No.of Passes	1077
No.of Fails	2650
Percentage of Passes	28.90
Percentage of Fails	71.10
No. Sat	3727

District: Kalmunai -2014

No. of Schools	87
No. Sat	4976
No. of Passes	2272
No. of Fails	2704
Percentage of pass	45.66
Percentage of fail	54.34

Percentage of Pass- District wise analysis

Year	Trincomalee	Batticaloa	Kalmunai	Ampara
2012	36.15	38.27	46.88	34.17
2013	39.67	40.03	53.03	29.74
2014	35.61	35.34	45.66	28.9

Percentage of Fails- District wise analysis

Year	Trincomalee	Batticaloa	Kalmunai	Ampara
2012	63.84	61.73	53.12	65.83
2013	60.33	59.97	46.97	70.26
2014	64.39	64.66	54.34	71.1

The failure percentage for the Eastern province is 64%. This tells the pathetic situation of English language teaching and learning in the Eastern province.

The total number of students offering English literature as one of the nine subjects against the total number of students sitting for GCE O/L shows the gravity of the problem the whole country of Srilanka faces especially in the Eastern Province and the situation is worse in some other provinces in the country.

RESEARCH QUESTIONS:

1. Can the stylistic approach be advantageous over the traditional impressionistic teaching approach at the classroom level?
2. Are the current methods of teaching faulty?

HYPOTHESES:

1. Traditional method of teaching is not adequate in developing the language skills.
2. Stylistic approach can be more efficient in developing language skills.

OBJECTIVES OF THE STUDY:

1. To show how language skills can be incorporated through stylistic approach.
2. To focus more on the language varieties and styles while teaching and studying literature.
3. To make the students independent in analyzing the literary texts especially the poetic language through the stylistic approach.

SIGNIFICANCE OF THE STUDY

My main aim is to propose a suitable teaching approach in dealing with literature. I believe that the findings

from this study would lead to effective strategies for the teaching of poetry in schools in SriLanka. It is expected that the result would lead to improved teaching and learning in poetry with the use of stylistic approach leading to the thematic understandings. I strongly believe that the study would lead to the improvement of students' achievement and make poetry a pleasant pursuit. This proposed new teaching approach could be of use to curriculum designers and textbook-writers teachers especially the untrained teachers and the students.

III. METHODOLOGY AND ORGANIZATION OF THE STUDY

This research is two folded. One is the showcase of stylistic analysis on select poems and a novel. The second one is the experiment of stylistic approach in the class room to check its effectiveness. Pretest, post-test, experimental teaching design and the administration of questionnaires were used in this study. Three schools have been identified for the study. 25 Students at eleventh standard from each school were targeted for this research.

Questionnaire: Two types of questionnaire were administered. One is to record the improvement in the performance. (Type I) It was administered twice, initially and finally. (Pre-Test and Post-Test)

The other is to get the general information on the variables that may affect learning English literature. (Type II)

Questionnaire was prepared with 15 questions for each poem taught. The same questionnaire that was given on pre-test was given again in the post-test with a new poem in target to see the difference or improvement.

Type I questionnaire consists 15 questions on 5 linguistic levels.

Question Area	Number of Questions
Lexical	4
Syntactic	4
Literary Devices	3
Phonological	3
Pragmatic	1

I have used only three instruments to quantify the progress of the students.

Pre-test to find out their current position and the Post-test to find out their growth. The other Questionnaire is to find out the influence of the extraneous factors which may

come into the scene of this research and may have its say I wanted to find out the parental involvement, motivational factors and other important factors which I thought to be important for this research. In order to find the reliability of the test, the result was subjected to a test- retest statistical analysis to find out the difference. The procedure of this experiment was in two phase; Pre-test period and the Post-test period. In between the teaching sessions in proposed stylistic approach. and was divided into twelve weeks. Initially the purpose of this research was discussed with the selected school teachers and they were given the exposure of stylistic approach by me before I used them in actual teaching in their schools. Thereafter, the pretests were administered to the students. The next eight weeks were used for the treatment programmes in which the experimental groups were exposed to stylistic to the teaching of poetry. The last week was used for post- test administration.

Process in the stylistic approach to literary studies

As a first step, select poems and a novel are analysed stylistically giving priority to the language styles and variations thus showing a model to develop the language skills through literary texts.

As a second step, the stylistic model is experimented with the experimental group of students in all three schools at the eleventh standard.

Initially pre-test is administered to the selected students from the experimental group in order to find out their current ability in answering to the questions related to their syllabus.

Then the teaching in stylistic approach is conducted to the experimental group for a period of one month comprising 20 hours of teaching.

Then the post test is administered with the same type of questions but the poem is unseen before to find out the improvement in their writing. This method is to find the gap or deviation in the new type of teaching introduced. The main idea is to find the difference between the traditional impressionistic teaching and the new method.

The difference between the both teaching approaches is recorded through the pre-test and the post-test conducted among the experimental groups in all three schools. Further, the feedback of the students is gathered in the form of questionnaire.

IV. METHOD OF DATA ANALYSIS

The Post-Test data collected from the study was studied in comparison to the Pre-Test results. The result has been described qualitatively and quantitatively. Descriptive statistics used include computation of frequency and percentage. The achievement of students in each of the

variables is also taken into account. The comparative analysis became the base for the conclusion whether the stylistic approach is advantageous or disadvantageous. The effects of the other extraneous variables were also taken into consideration while implementing the teaching in the stylistic approach.

Data analysis is done based on the performance of the students collected in the form of questionnaire which was prepared to test the major linguistic levels such as lexical, syntactic, phonological and pragmatic levels along with the literary devices and literary language.

V. RESULTS

The analysis of data confirmed that the stylistic approach in teaching literature is effective in developing the language skills of the students especially among grade eleven students. (GCE O/L students). Further, the feedback of the students proved that they not only improved their language skills but also they got out of fear of poetic language which has been a threat for them for a long period of study.

The other important finding is that the majority of students who showed much enthusiasm in studying literature is female students. Though the gender difference in studying literature is not the target of my research, it is important to note that the gender has played a significant role in this study.

SCOPE AND LIMITATION OF THE STUDY:

This research work is limited only to the literary genres of poetry and novel. Dramatic language is not experimented. Experiment was tested only in the poetic language with school students at grade 11.

REFERENCES

- [1] Short Michael (1983): "Stylistics and teaching of literature", C.J. Brumfit: language based approaches, Oxford:Pergamon press,67-84
- [2] Syal, Pushpinder (1984): "A stylistic Analysis of Soyink's Idanre and mahapatra's relationship in the context of non- native literature in English."
- [3] Toolam, M. (1990): The Stylistics of Fiction, new York: Routledge.
- [4] Widdowson,H. (1975); " Stylistics and the Teaching of Literature, London
- [5] Widdowson, H. (1978): Teaching language as Communication,Oxford: Oxford University Press.
- [6] NozarNiazi and Rama Guatam (2010) "How to study literature": Raj Press New Delhi.

The Morphological Study of the Constraints of Affixation in English Word: A Tool-Based Approach

M.Somathasan

Advanced Technological Institute, Trincomalee, Sri Lanka

msomathasan@yahoo.com

Abstract— This paper tries to show the strengths and weaknesses in the knowledge of affixation and its constraints in English complex word formation found in the second year students of Higher National Diploma in English at Advanced Technological Institute at Trincomalee. For the students, *Introduction to Morphology* is one of the units in the subject, *Language Structure, Usage, and Linguistics*. Morphology is the study of words and word formation - Rochelle Leiber (2009). Affixation is one of the areas in word formation. For example, the affixes *un-* (prefix) and *-ness* (suffix) in the complex word *unhappiness* are mostly familiar to the students as they usually use them in the classroom. But, it is not sure that most of the students are aware of the correct arrangement of these affixes to the root part *happy*. Further, the parts, *un-*, *happy*, and *-ness*, morphologically known as *morphemes*, are not simply strung together like beads on a string. Instead, there are some constraints of affixation in the process of this complex word formation. The starting-point for the formation of this word is *happy*; the morpheme *un-* is then added to form *unhappy*, which in turn is the basis for the formation of *unhappiness*. Therefore, the study of constraints, i.e. the study of rules, by which morphemes can combine to form complex words, is called *morphotactics*. Based on it, I have developed a simple student-friendly language learning and testing tool named as *Morphotactic Ruler* for helping the said students be familiar with the nature of affixes and their constraints in the complex word formation in English.

Keywords: morphology, complex word, morphemes, affixation, constraints, morphotactics

I. INTRODUCTION

Chesterfield states that words are the dress of thoughts; and Norman Lewis says, "Words are the exciting and mysterious tokens of our thoughts". One step above, Shakespeare says (in *Hamlet*), "Suit the action to the word, the word to the action". Thus, a rich knowledge of words and their structure can help a student in strengthening his linguistic base. The study of words and their structure comes under morphology which means *morphe* (Greek – *form* or *shape*) and *ology* (*science of knowledge*). Thus, morphology is the science of word forms; and Francis Katamba (1993) says that morphology is the study of the internal structure of words. Morphology's chief interest is especially in complex words

which have a very fine articulating structure. In order to analyze or decompose a complex word, first, a student has to identify the morphemes in the word, (i.e. the smallest meaningful units or the building blocks of the word), and the patterns or constraints that determine how these morphemes should be arranged or stuck together to form the word. For instance, the complex word *beautifully* consists of the morphemes such as *beauty*, *-ful*, and *-ly*. These morphemes are undoubtedly combined like *beauty + ful + ly*. But, when they are combined like *beauty + ly + ful*, the word convicts the ungrammaticality which is marked by an asterisk like **beautylyful*. Why is the form *beautylyful* incorrect? And then what accounts for it? The answer for both questions can be found in the study of *morphotactics*, i.e. the rules which help to glue the morphemes together found in the word. For the deep study of morphotactics, the terms *word formation*, *morphemes*, *complex word*, and *affixation* (i.e. *prefixation* and *suffixation*), should be thoroughly learnt.

Word formation:

English is a highly productive language, and processes of word formation frequently result in the addition of new items to the English lexicon. New lexical items are endlessly borrowed, blended, compounded, and derived into the English language. The general term for this process is *word formation*. Laurie Bauer (1983) states that the study of English word formation is the central interest of linguistics. As the term 'word-formation' suggests, it is dealt with the formation of new words. It can be seen that the words *employee*, *inventor*, *unkind*, *lighthouse*, *table spoon*, and *lorry driver* are obviously composed by putting together the smaller elements to form larger words with more complex meanings; and we can say that we are dealing with morphologically *complex words*. For example, the word *employee* can be analyzed as being composed of the verb *employ* and the ending part *-ee*, and further the adjective *unkind* can be analyzed as being derived from the adjective *kind* by prefixing the meaningful element *un-* at the beginning of the adjective *kind*. Thus, the complex words can be analyzed or decomposed into their smallest meaningful units which are called *morphemes*.

Morpheme:

Morphemes are the smallest individually meaningful elements in the utterances of a language - Charles Hockett (1958). Further, David Crystal (1976) defines a morpheme as "the smallest bit of language which has a meaning". For instance, the elements *in-*, *de-*, *cipher*, *-able*, and *-ity* are the

morphemes of the word *indecipherability*. Some morphemes can occur only if attached to some other morpheme(s) to have a clear meaning. Such morphemes are called *bound morphemes* in contrast to *free morphemes*, which occur on their own with meaning. Some examples of bound morphemes are *un-*, *dis-*, *im-*, *anti-*, *en-*, *em-*, *-ment*, *-ing*, *-ed*, *-ness*, *-ful*, and *-less* in the words *unkind*, *dislocate*, *impolite*, *antidemocratic*, *enable*, *empower*, *improvement*, *playing*, *recited*, *happiness*, *careful*, and *useless* respectively. Some bound morphemes, for example *im-* (in *impossible*), must always be attached before the central meaningful element of the word, (in this case *possible*), the so called *root* or *base*, whereas the other bound morphemes, such as *-ity* (in *unity*), *-less* (in *careless*), *-ness* (in *happiness*) must follow the root or bases. Using Latin-influenced terminology, *im-* is called a *prefix*; *-ity*, *-less*, and *-ness* are *suffixes*, with *affix* (sometimes called the *marked form* – Adams, 1973) being the cover term for all bound morphemes that attach to root or bases (sometimes called the *unmarked base form* – Adams, 1973).

Complex word:

A complex word in English is the outcome of the morphological processes which are *concatenative* and *non-concatenative*. While concatenative process is considered, it consists of *compounding*, *incorporation*, and *affixation*. As far as the process of affixation is concerned, a complex word reflects the constant or stable internal structure. Within the word, morphemes are not randomly arranged, but instead they have a strict and systematic linear sequence. For example, the internal structure of a complex word looks like (*prefix + root*) or (*root + suffix*) or (*prefix + root + suffix*). The affixation, here, refers to *prefixation* and *suffixation*. For instance, in the word *reactivation* (*re-act-iv-at-ion*), *re-* is a prefix; and *-iv-*, *-at-*, and *-ion* are suffixes. Whether it is a prefix or suffix, it is called an *affix*, a common name for the parts that are not really words by themselves, but get glued onto words in some way. Further, affixes are linguistically, especially morphologically termed as bound morphemes.

Affixation:

The term *affix* has its origin in Latin: *affixus*, past participle of the verb *affigere*, *ad-* ‘to’ + *figere* ‘to fix’. George Yule (2010) defines affixes as “a large number of small ‘bits’ of the English language which are not usually given separate listings in dictionaries”. The term *affixation* can be defined as a morphological word-formation process of attaching an affix to the root or base of a word. For example, the morpheme such as *-er* added to the end of the root *teach* is an affix (also known as *suffix*); and the morpheme *pre-* added to the beginning of the root *fix* is also an affix (a.k.a. *prefix*). Affixation is a very common and productive morphological process in agglutinating languages like English. Here, words can have several prefixes and suffixes, but they are characteristically distinct and readily parsed into their parts – like *develop-ment-s* in English. Affixes are classified based on two criteria. The first criterion is the position in which the affix occurs relative to the location or position of the root or base of the word, while the second is the function an affix performs when it is attached to the root or base of the word.

Classification of affixes based on position:

As far as the positions of the English affixes in a complex word are concerned, they are mostly of two types: *prefixes* and *suffixes*.

Prefix:

A *prefix* is a bound morpheme that is added to the beginning of a word in order to form a new word with a different sense or meaning. For example, while looking at the word *prefix* itself, it can be seen that it is made up of two morphemes: *pre-* and *fix*. Here, *pre-* is the prefix (bound morpheme) and *fix* is the root or base (free morpheme) in the word *prefix*. And further, ‘pre’, means *before*, and ‘fix’ means *attached*. A prefix as a bound morpheme has its own meaning, and when it is added to the beginning of the root or base, it changes the meaning of that word. What is more, prefixes are very useful, because when it is identified and semanticized only, the students can learn the meaning of the new word and improve their vocabulary or mental lexicon. It is also to be noted that prefixes are represented by the morphemes *followed* by a hyphen (-) as *un-* in *unhealthy*, *a-* in *atypical*, and *sub-* in *subway*.

Suffix:

In languages that use affixes, there is a general preference for suffixes over prefixes. A *suffix* is a bound morpheme which is attached to the end of a root or base or even stem. For example, the word *globalizations* depicts four suffixes: *-al*, *-ize*, *-ation*, and *-s*. First, the suffix *-al* is affixed to the root *globe*, resulting *global*. Then, the second suffix *-ize* is attached to the base *global* and the word is *globalize*. Thirdly, the suffix *-ation* is glued to the base *globalize* and causes the word *globalization*. Finally the suffix *-s* is suffixed to the stem *globalization* and the final word is *globalizations*. It is to be noted that suffixes are represented by the morphemes *preceded* by a hyphen (-) as *-al* in *natural*, *-ful* in *beautiful*, and *-er* in *player*.

Classification of affixes based on function:

Based on the function the affixes perform when attached to a word, they are divided into two categories: *Derivational function* and *Inflectional function*. Affixes indicating derivational function are known as *derivational affixes*, and affixes representing inflectional function, *inflectional affixes*.

Inflectional affixes:

An inflectional affix is a type of bound morpheme which performs a grammatical function without changing the grammatical category or the central meaning of the word to which it is attached. For instance, the inflectional morphemes are represented in the underlined parts of the words *boys*, *accepted*, *sleeps*, *taller*, etc. Inflectional affixes are not used to create new words and all the inflectional affixes in English are suffixes; and they are only eight in number. Look at the following:

1. Regular plural - (e)s as in *books*, *boxes*
2. Comparative - *er* as in *poorer*, *cleverer*
3. Superlative - *est* as in *prettiest*, *happiest*
4. Possessive - ' as in *Priya's house*
5. 3rd person singular - (e)s as in *reads*, *teaches*
simple present tense

6. Present participle - *ing* as in *studying, doing*
7. Regular past tense - (*e*)*d* as in *watched, helped*
8. Past participle - *en* as in *taken, eaten*

Derivational affixes:

Derivational affixes are bound morphemes which produce new words from existing words, usually by either changing the meaning and/or the part of speech, i.e. the syntactic or lexical category, or both, of the words they are attached to (Godby et al., 1982). In English language, derivational morphemes can be either prefixes or suffixes. For example:

un + *kind* (adj) = *unkind* (adj)
by + *product* (n) = *by-product* (n)
re + *search* (v) = *research* (v)
re + *forest* (n) = *reforest* (v)
king (n) + *dom* = *kingdom* (n)
man (n) + *hood* = *manhood* (n)
clever (adj) + *ness* = *cleverness* (n)
beauty (n) + *fy* = *beautify* (v)

The prefixes *un-* in *unkind*, *by-* in *by-product*, and *re-* in *research* derive new words; and they maintain the same word class; and these prefixes are called *class maintaining derivational prefixes*. In contrast, the prefix *re-* in *reforest* gives new meaning, but changes its grammatical category. Thus, prefixes like *re-* in *reforest* are called *class changing derivational prefixes*. Like these, the suffixes *-dom* in *kingdom*, and *-hood* in *manhood* are *class maintaining derivational suffixes*; and *-ness* in *cleverness* and *-fy* in *beautify* are known as *class changing derivational suffixes*, but both create new lexical items.

Morphotactics:

Hierarchical structure is an essential property of human language. Words (and sentences) have component parts, which relate to each other in specific, rule-governed ways. Morphotactics is concerned with ordering of morphemes in a word (Chomsky & Halle, 1968). English language reflects the morpheme-based morphological system. As far as the syntax of morphemes in a complex word is concerned, there is a set of principles for combining or arranging morphemes into words. As explained above, morphemes are the building blocks of words and they are, further, defined as the minimal linguistic units with a lexical or grammatical meaning. The word *equalizer* has three morphemes like *equal*, *-ize*, and *-er*. The formation of this word is not a mere matter of concatenating these three morphemes. Instead, it is a two-steps operation. First, the bound morpheme *-ize* is added to the simple adjective root *equal*, resulting in the verb *equalize*. Subsequently, as the second step the bound morpheme *-er* is added to this verb and the result is *equalizer*. It is clear that the combination of *equal* + *er* + *ize* (= **equalerize*) is ill-formed and does not convey any sense. Therefore, it is ungrammatical and is marked by *. Thus, the morphological structure of a complex word is a layered one. In short, morphology might be seen as morpheme syntax, as the set of principles that tells the students how to combine free and bound morphemes into well-formed words with meaning.

Stratum or affix ordering:

Knowledge of word structure includes the knowledge of affixation or affix sequence. The root/ base and affixes must be arranged in a sequence allowed by the word formation

rules. The order of words in a sentence shows the *external mobility*, but the order of morphemes in a word depicts the *internal stability*, i.e. the order is usually fixed. Affixes are added at different *classes* or *levels* or *layers* or *strata*, i.e. according to stratum theory of morphology, different classes of affixes are added to bases in such a way that all the affixes from one class or stratum have to be added before affixes from the next class or stratum can be added. This is referred to as *level ordering* since each stratum or level is ordered with respect to all others. Each level has associated with a set of morphological rules that do the word-building. English affixes can be grouped in two broad classes on the basis of their phonological behaviour: *neutral* (secondary) and *non-neutral* (primary). The neutral/ non-neutral distinction corresponds to the classic distinction of weak boundary ('#') between neutral suffix and base vs. strong boundary ('+') between non-neutral suffix and base in Sound Patterns of English.

Neutral affix (secondary affix):

There is no phonological effect, i.e. stress pattern on the base to which it is attached (Chomsky & Halle, 1968). Neutral or secondary affixes are attached at level 2. Level 2 suffixes are #*ness*, #*less*, #*ly*, #*ful*, #*wise*, etc. For instance:

kind [kaɪnd] #*ness* [nəs] - kindness [kaɪndnəs]
 help [help] #*less* [ləs] - helpless [helpləs]
 direct [dɪrekt] #*ly* [lɪ] - directly [dɪrektlɪ]
 hand [hænd] #*ful* [fʊl] - handful [hændfʊl]

Non-neutral affix (primary affix):

There is an effect on segmental or suprasegmental structure of the base. Non-neutral or primary affixes are attached at level 1. Thus, the affixes denoting Level 1 are +*ic*, +*ee*, +*ity*, +*ory*, +*acy*, etc. For example:

photograph [fəʊtəgra:f] +*ic* [ɪk] - photographic [fəʊtəgræfɪk]
 unite [ju:nəɪt] +*ity* [ɪtɪ] - unity [ju:nɪtɪ]
 strategy [strætɪdʒɪ] +*ic* [ɪk] - strategic [strətɪ:dʒɪk]

The levels of the affixes in a word are embedded and they can be represented in the following way.

[root]
 [level 1 affix – root – level 1 affix]
 [level 2 affix – level 1 affix – root – level 1 affix – level 2 affix]

According to the level-ordering concept, English prefixes and suffixes belong to the following levels or classes or strata (Spencer, 1991):

Level 1 prefixes: *re+*, *con+*, *de+*, *sub+*, *pre+*, *in+*, *en+*, *be+*, etc.

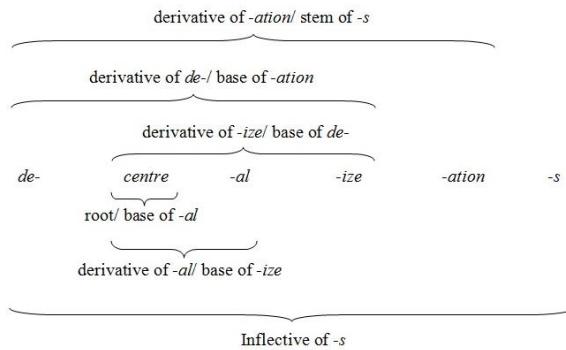
Level 1 suffixes: *+ion*, *+ity*, *+y*, *+al*, *+ic*, *+ate*, *+ous*, *+ive*, *+able*, *+ize*, etc.

Level 2 prefixes: *re#*, *sub#*, *un#*, *non#*, *de#*, *semi#*, *anti#*, etc.

Level 2 suffixes: #*ness*, #*less*, #*hood*, #*ful*, #*ly*, #*y*, #*like*, #*ist*, #*able*, #*ize*, etc.

Typically (there are some exceptions) stratum 1 affixes, i.e. primary affixes (non-neutral affixes) tend to be of foreign origin (Greek or Latinate) whereas stratum 2 affixes, i.e. secondary affixes (neutral affixes) are mostly Germanic (affixes tend to combine with bases from the same source.)

Level 1 or strong (+) boundary affixes (which are all derivational affixes) are always closer to the root; and level 2 affixes, i.e. neutral affixes are on the outside. It was also pointed out by Bloomfield (1935) who referred to the inflection as the outer layer of the morphology of word forms, and derivation as the inner layer, i.e. the derivational affixes in English are *morphemes of the inner layer*, as it is possible to have another suffix after a derivational affix, but the inflectional affixes in English are *morphemes of the outer layer*, because it is not possible to have another suffix after an inflectional affix. Thus, it can be said that stratum 1 or level 1 affixes do not occur outside stratum 2 or level 2 affixes in the morphologically complex word. It is clearly represented through the following diagram of the word, *decentralizations*.



II. METHODOLOGY

To test the students' knowledge in affixation based on the level or stratum ordering of affixes in English complex word formation process, I have developed a tool, *Morphotactic Ruler*, by using the computer language, Visual Basic 6. In this tool, sixteen complex words with different number of morphemes have been included. When a word is selected, its morphemes are horizontally and randomly spread. First, the student has to identify the root morpheme; otherwise he cannot continue the testing. Then, he can click the rest of the morphemes in order to get the word correctly. Suppose, when he adds an affix in wrong order, it is mentioned in Red colour and he is alerted to delete the particular added affix by using the *Back* button in the tool, otherwise he cannot proceed his testing, further. After that, he can think of the correct affix to be added to the root or already formed base. When the affixes are orderly clicked, the word is shown in Green colour. Moreover, if a student is unable to organize the morphemes of the word, he can check the answer by clicking the *Answer* button. It is the mechanism of this tool. For example, while the rules of stratum ordering or affixation are applied to the formation of the complex word *unkindness* [ʌŋkəɪndnəs], first the root morpheme *kind* [kaɪnd] (adjective) is clicked, then the level 2 prefix *un* [ʌn] is added to the root to form the adjective *unkind* [ʌŋkəɪnd]. Finally, the level 2 suffix *#ness* [nəs] is

attached to the base, *unkind*, to get the noun *unkindness* [ʌŋkəɪndnəs].

III. RESULTS

For this study, 45 students in the second year of the course of HND in English at ATI, Trincomalee were selected. Each student was given three chances to arrange the morphemes in order to get a meaningful word. 11 students were successful to get the correct stratum ordering of the words at first attempt; 23 students used their second chance to get the correct organization of morphemes in the words. 7 students used their third attempt correctly; and 4 students showed their inability to find out the appropriate words, but they were successful in the fourth attempt. The following Figures (1, 2, and 3) show a student's attempts to get the word, *unkindness*.

Sample visuals of the developed tool:



Figure 1



Figure 2

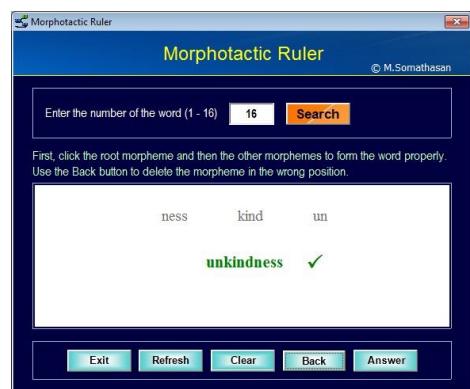


Figure 3

IV. DISCUSSION

Though the results were like this; the tool was, in fact, appreciated by all the students; and they indicated that the tool guided them to find out the word correctly.

V. CONCLUSION

The knowledge of affixation, i.e. the knowledge of internal arrangement of morphemes in the complex word formation, is quite essential for the students who take the subject, *Introduction to Morphology*, in their course of study. Based on this concept, 45 second year students who follow the Higher National Diploma in English at Advanced Technological Institute (ATI) at Trincomalee were taken to this study. The study was to test the selected students' knowledge in affixation or stratum ordering in English complex word formation. For this purpose, I developed a simple student-friendly testing tool named as *Morphotactic Ruler*. It was developed by considering the status of right morpheme arrangement and the wrong morpheme arrangement. The right morpheme arrangement was indicated by Green colour while the wrong morpheme arrangement, by Red. When the student met a wrong morpheme arrangement, the tool did not allow him or her to continue the word formation until he deleted the last attached affix by using the *Back* button in the tool. The students were given 3 chances to show their ability in affixation. Out of 45 students, 11 students were successful in their first attempt; 23 were in second attempt; 7 in third attempt, and 4 students struggled, but were successful in fourth attempt. Although the results showed this status, the students felt that the tool was very helpful for them to know the stratum ordering of affixes in English complex word formation, and especially they said that it fully guided them in their attempts. Further, they stated that the tool was powerful to increase their word power, as well.

REFERENCES

- [1] Adams, V. (2001). Complex Words in English. Harlow: Longman
- [2] Bauer, L. (1983). English Word Formation. Cambridge: Cambridge University Press
- [3] Bloomfield, L. (1935). Language. London: George Allen& Unwin Ltd.
- [4] Chomsky, N. and Halle, M. (1968). The Sound Pattern of English. New York: Harper & Row Publishers
- [5] Crystal, D. (1976). Linguistics. England: Penguin Books Ltd.
- [6] Edward, F. (2012). Language: Its Structure and Use. 6th ed. Cengage Learning
- [7] Giegerich, Heinz J. (1999). Lexical strata in English: morphological causes, phonological effects. Cambridge: Cambridge University Press
- [8] Haspelmath, M. (1996). Wordclass-Changing Inflection and Morphological Theory. YoM
- [9] Hockett, C. (1958). A Course in Modern Linguistics. New York: Macmillan Company
- [10] Katamba, F. (1993). Morphology. Palgrave Macmillan
- [11] Lieber, R. (2009). Introducing Morphology. Cambridge: Cambridge University Press
- [12] Meyer, C.F. (2009). Introducing English Linguistics. Cambridge: Cambridge University Press
- [13] Pinker, S. (1999). Words and Rules. New York: Basic Books
- [14] Plag, Ingo. (1996, 1999). Morphological Productivity: Structural Constraints in English Derivation. Berlin and New York: Mouton de Gruyter
- [15] Radford, A. et.al. (1999). Linguistics: An introduction. Cambridge Cambridge University Press
- [16] Selkirk, E. (1982). The Syntax of Words. Cambridge: The MIT Press
- [17] Somathasan, M. and Saranya, R. (2014). Developing an English Morphotactic Ruler: A Testing Tool based on the Constraints of Affixation in Complex Word Formation. Indian Streams Research Journal (ISRJ).
- [18] Spencer, A. (1991). Morphological Theory: An Introduction to Word Structure in Generative Grammar. Cambridge: Cambridge University Press
- [19] Yule, G. (2010). The Study of Language. 4th edn., Cambridge: Cambridge University Press

The Employment of Symbols by Toni Morrison in Beloved

K. P. Sugandika Sandamali

Department of Languages and Communication
Trincomalee Campus, Eastern University, Sri Lanka
2013sugandika@gmail.com

Abstract— The effectiveness of the writing depends on the ability of the writer to employ the language in the creations. As a writer in black community, Toni Morrison tries her best to share her experience with others while she attempts to re-build her nation. In this study it is going to be discussed the usage of symbols in her novel *Beloved* to give different interpretations. This study deals with mainly sixteen (16) symbols that are illustrated under places, objects and things, activities and colors. And also the basic attention is focused on different interpretations that they stand for. This work aims at showing the interest of Morrison for symbols and her intention to represent different interpretations behind the usage of symbols in *Beloved*.

Keywords—Black Community, Experiences, Symbolism.

I. INTRODUCTION

It is impossible for all the people to have the same experiences in the same time. Therefore to share their experiences with those who don't know about it, writing and publishing is more significant. Naturally, writers are the persons who try their best to share their experiences with others through writing and publishing. Though it is easy to deal with popular and pleasant themes in writings, some authors make a great attempt to tackle something hidden and unpleasant matters in the society. Among these authors, Toni Morrison is a one who reputed especially for the themes including violence, oppression and sacrifice in many of her writings.

Symbolization is the main literary device that the author has used in *Beloved* to convey different themes effectively than other figure of speeches, because it is possible to connect different perspectives with the same symbol. Through that the author can convey her own symbolical representations without expending any extra labor with her prime purpose of depicting specific symbols in the novel. It is common for people to have their own ideologies according to the level of their education and the experiences that they have achieved throughout their lives. In the novel, using symbol as the main device, the author makes an open space for all type of readers to go forward with their different interpretations.

The researcher has selected two objectives as “to find out available symbols in the text and to interpret found symbols” to give a clear picture for the paper. And also the mastery

and the ability of handling language are evident when we see the symbolization of *Beloved*, because the author uses the symbols in different shapes. In this light, this research study is very specific, because it deals with the symbolism in Toni Morrison's *Beloved* and different interpretations for the symbols. And also these symbols together enrich the creation with its literary value in the frame of writing. This study has focused on four (4) types of symbols including, places, actions, objects and colors. Some symbols of the novel beautifully keep the history of Blacks within the lines of the story.

II. DATA ANALYSIS AND DISCUSSION

Places as Symbols

124 (Name of protagonist's house in Bluestone Road)

In *Beloved*, the employment of the name 124 for the identification of Sethe's house is identical, because it is very appropriate to give the information about the real situation of the house. According to the arithmetical order, the number three (3) should be there between two (2) and four (4). However through the usage of 124 as the name of the house, the author tries to depict some more details regarding that particular place. Especially this name stands as a symbol to indicate a kind of absence inside the house.

The description of the author at the opening chapter of the novel tells about the implied meaning of 124.

Ohio River

The Ohio River which belongs to United States has formed by the confluence of the Allegheny and Monongahela rivers at Point State Park in Pittsburgh, Pennsylvania. The name of the river suggests the meaning of “Good River”. According to the socio cultural background of the country, the author of the novel has used the Ohio River to symbolize the freedom of slaves.

In many places, the author employs the name of the river to symbolize the freedom of slaves in *Beloved*.

While the river Ohio symbolizes the freedom, it conveys the notion of satisfaction in Sethe's mind that makes her happy while she feels secure. In addition to this, Morrison, compares the water of this river with pure drinking water which gifts the relief for the people when they are thirsty. When Sethe asks for some water, the old man gives her water from a jar. However, in the text the author uses the

term “Ohio” instead of water, because she wants to convey the relief of Sethe’s mind when she cross the river.

Bluestone Road (Name of the road that the house of the protagonist has placed)

Bluestone Road in Cincinnati stands as the setting for the present story in Beloved while the Sweet Home plays the role of the setting for the story that comes with the technique flashback. In present story, Bluestone Road symbolizes the freedom of slaves and the degree of their strength of their community.

The color “blue” is considered as the symbol of calmness, because it seems very comfortable for the eyes of the viewers. So, this easiness and the consolation depict by blue, build another stable notion about the lives of people combining with “stone” in the novel. Simply, Bluestone Road symbolizes the comfortable way of living of former slaves without any trouble and the degree of community solidarity with them.

Sweet Home in Kentucky (A Plantation Home)

Sweet Home is a kind of plantation farm that employs slaves in cultivation and James Garner is the owner of the farm. Extremely, the name of the Sweet Home is ironic, because the routine is completely different with what the meaning of the suggested name. According to its’ name, the happenings should be pleasant. The Sweet Home should be a sweet place for all the people, especially those who live there. However it is somewhat different from the other plantation houses in Kentucky, because Mr. Garner encourages his workers (slaves) to think as men.

However the situation of the Sweet Home was completely different after the arrival of Schoolteacher (the name comes in this way in the text) to keep the things in order. His way of leading and running the farm added the suffering for the lives of slaves. Those who concerned as men within Sweet Home become animals under the ruling of Schoolteacher. In one situation Schoolteacher takes Sethe as an animal to give a lesson for his pupils.

From that point, the severe suffering of the Sweet Home men is started. Here the author uses this name of the plantation house to symbolize the unbearable suffering of the Slaves.

Actions as symbols

Cry of Denver in Chapter one

Crying and sobbing are only two ways that express the sorrow of human beings. When people are crying, it gives the signal for others that they are not in a good mood. In chapter one, the author tells us about a situation that connects with the cry of Denver for one reason. And also the author takes this opportunity to give some clues about the community solidarity with Sethe’s family.

She is crying because they are alone in that area without any connection with the people around them. This makes them isolate among others. Normally human beings are social animals, because always they search for others company. It is very difficult to live without the help of the community. Anyhow Sethe’s family hasn’t any connection with others

around her. This symbolizes the lack of communication, relationship, and the isolation of the people of 124 in Bluestone Road. This lack of communication leaves her family in to vulnerability. If she had the close connection with others, there might not be this kind of unfortunate happening when Schoolteacher arrives to bring Sethe back with her children.

Denver’s crying directly connects with her burning desires to get the affection of the community and to have close friends apart from the ghost they have in their house. And also this tells her eagerness to have the company with others instead of isolation and loneliness.

Stealing milk of Sethe by Schoolteacher’s people

Stealing is always comes forward to depict the cruel and vicious nature of the people. If the stealing comes with a material or an object, there is a less space for the breaking down of the mind set up. However when it connects with stealing baby’s milk in the breasts of the mother, unconsciously it makes readers heart sad. In one situation, Sethe becomes a victim of such kind of situation when she tries to escape from the Sweet Home.

Simply this action symbolizes the unkind, brutal and cruel mind set up of the slave masters, because they tortured her when she was pregnant with a child. On the other hand this explicates the power of slave owners can put upon slaves in that social system.

Trip of Sixo to see the woman

Naturally people have an interest towards their opposite sexes. People are like to mingle with others especially women with men and men with women. When it is difficult to get the association of whom they want, they try their best to grasp it without thinking about the barriers they have to face. In *Beloved* the extreme desire of Sixo to associate a woman symbolizes through his thirty mile trip. And also this may be reflected his necessity to have his own dearest relationship.

Anyhow the trip of Sixo to see the woman can be interpreted in several directions. In one aspect this is related with the longing for love and affection. And also indirectly this may be the desire of Sixo for having connections with the outer world since their boundaries are too limited to the walls of Sweet Home.

Buying the freedom of Baby Suggs by her son

Freedom stands for the ability and the right of the people to do what they want without other’s interruptions. Normally all human beings are born with this freedom of their own. However some people have to sacrifice their lives and the wish under others ruling. In such kind of situations, they have to fight for their natural rights also. Here in *Beloved* slaves are not in a position to fight with their masters instead of that they sacrifice their lives to buy the freedom.

In the novel, the author highlights the dedication of Halle for his mother to buy her freedom. In one point, this symbolizes the responsibility of a son for his mother, since it is the duty of a son to keep his mother comfortably. On the other hand this reflects the humanity of the people. If

someone is suffering severely, people should help them to get free from that.

Attending for the Carnival

The carnival is a public festival that involves music and dancing for the happiness of the people. Attending a carnival typically represents the joyful feelings and the mind set up of the participants. From the beginning of the novel many of its characters are not in a position to be thrilled. The major characters Sethe, Paul D, Baby suggs, and Denver suffer throughout their lives. After the joining of Paul D with Sethe's family, it shows some shadows of happiness.

Here carnival is the symbol of happiness. So the attempt of Paul D to attend the carnival symbolizes his effort to be happy with his close people. This shows the shadows of the happiness that lay far away for their lives. In one aspect this suggests the natural longing of the people for the pleasure. And also it symbolizes the attempt of the innocent people to begin new lives forgetting what they had sad in the past.

Caring of Denver for Beloved

The people of 124 have very limited relationship with Cincinnati community. This makes them isolate within that area. Though Denver finds for the friends as a young girl, the atmosphere of her house and the happenings deprived them from the community. When Denver is longing for any relationship, the sudden arrival of Beloved makes her delight and gives new hopes. And also the name Beloved persuades Sethe and Denver to accept her as a member of their own family, since it is the name of her dead daughter. For Denver, Beloved becomes her own sister. The influence of all these reasons careers the great care of Denver towards Beloved.

Pulling children to sea by Sethe's mother.

Children are the wealth of parents and they sacrifice their lives for them. However this condition is different for slave parents. Though they have their heart felling love for their children, they don't allow them to spend their lives with parents, because it makes unpleasant experiences for them. As the children of slave parents, these children also have to suffer as their parents suffered throughout their lives. Therefore slave parents don't allow them to live. So pulling the children to the see by Sethe symbolizes the love of the mother for the children.

Killing the baby girl by Sethe

At the beginning of the story, Sethe had four children. In later part, there are only three (3) children in the novel. The third one, the girl has missed when the story is in its progress.

This killing of her own child symbolizes the protection of the slave parents for their children. Sethe's mother also pulls some of her children to the sea to avoid their being future slaves. Here also killing is the only way that she had to save her children from sufferings. So she did it. Though killing is a bad and cruel thing, the author uses it here to convey the

feeling of love that the protagonist has for her children. In another way it is better to interpret this as the maternal love.

Comparing Sethe with animals

Everyone knows animals are totally different and unrespect in the society when it compares with human beings. And also no one is responsible to pollute humanness of others. When people have their identity parallel with animals there is no it's own identity for human beings. This type of intentional destruction of human identity can be seen in *Beloved*.

On the other hand, this symbolizes the destruction of identity of human beings. Though they born as human beings, they haven't any privilege to live as humans, their masters lead their lives according to their wish. In one aspect, human beings also belong to the category of animals. However the unique characteristics of people differentiate them from animals. Simply this tells about the helplessness of slaves and the heard headed mind set up of slave masters.

Things and objects as symbols.

The tree of Sethe's back

The protagonist of the novel, Sethe has a mark in a shape of a tree on her back. In Literature, trees symbolize the calmness and the tranquility of the mind, since always trees are connected with the nature to make people comfortable. Though trees stand to make the peace in the mind of the people, the tree in Seth's back makes her upset and suffers at every moment.

Here Sethe describes the way that she got her tree on her back. So this description shows that it is not a thing that comforts people. It is a tree of punishment. Mainly, this tree of Sethe's back symbolizes the violence in the novel. This tells readers how the suffering of the slaves in front was their masters. According to the shape of the tree, the degree of the suffering can be imagined.

Red velvet

In literature, velvet symbolizes the wealth and the comfort. In the novel, when Sethe runs away from Sweet Home, she meets a white girl known as Amy Denver who goes to Boston for some velvet. The prime purpose of her journey is to get some velvet for her which is in different colors. Buying velvet is not an easy task for Amy, but she tries her best to achieve her hope in the life. She has discovered all the information about velvet and the places she can buy them. So this symbolizes her burning desire for the comfort in her life and the willingness in her mind for a bright future. Her courage in the novel to find out velvet, symbolizes the longing of her mind for a beautiful life in future.

Red Heart

Red heart is a term that Paul D whispers when he was so close to the inside part of Beloved, because she compels him to touch her inside part and to call her name. In many of the

close relationships which are related with love and feelings, it symbolizes the lust and emotions especially connected with sex. In Paul D's relationship with Beloved, he murmurs the term "red heart" repeatedly. So this red heart symbolizes the feelings and emotions of Paul D in the text.

III. CONCLUSION

As a story of a specific community of the world *Beloved* has achieved a significant importance among the readers. This has taken the attraction of the readers, because of its' language, plot, characterization, setting, style and the writing techniques. Among these techniques, the usages of literary devices are much highlighted. Simply it is very easy to understand that the author has overloaded the novel with number of symbols.

The ability of the author can be seen very clearly by the way the novelist employs the symbols in the novel. Sometimes the author may use this much of symbols in the novel depending of many reasons. The author may be wanted to familiarize different interpretations for the same thing in the novel for the readers with different viewpoints. And also through the employment of symbols the author can express some things indirectly to the readers who can see the inside of the interpretation. It is very important to say that when we use symbols it can avoid the problems that can come to the author after publishing the creation. So as an experienced author Morrison may use the symbols in her *Beloved*.

The mastery of the author can be seen the way that she has used the symbols in the text. Some people think that only the objects can be the symbols. However in *Beloved*, the author has used actions, colors, places and objects as the symbols.

As a conclusion to the research study it is important to say that the author has overloaded the novel with symbols to give the message of the novel very sound manner.

REFERENCES

- [1] Abraham, Kinfe, *Politics of Black Nationalism: From Harlem to Soweto*, Trenton: Africa World Press, 1991.
- [2] Barksdale, Richard and Kenneth Kinnaman, *Black Writers of America: A Comprehensive Anthology*, Englewood Cliffs, NJ: Prentice Hall, 1972.
- [3] Magill, Frank N., ed., *Masterpieces of African American Literature*, New York: Salem press, inc., 1992.
- [4] Petocz, A. (1999). *Freud, Psychoanalysis, and Symbolism*. UK: Cambridge University Press.
- [5] Whitehead, A. N. (1927). *Symbolism: Its Meaning and Effect*. London: Cambridge University Press.
- [6] https://btk.ppke.hu/uploads/articles/135505/file/introduction/satellite/sym_symbol.html

Impact of Perceived Quality of Work Life on Job Performance of Teachers in the Eastern Province of Sri Lanka

S.L.Ajmal Khan^{*1}, V.Kanagasingam^{*2}

¹*University of Jaffna and South Eastern University of Sri Lanka,*

ajmalkhans1@yahoo.com

²*Faculty of Management and Commerce, Eastern University of Sri Lanka,*

kana692002@yahoo.com

Abstract— Quality of work life is one of the most important factors for human motivating and improving of job performance. The objective of the study was to determine the effects of quality of work life on job performance of teachers teaching in government schools in the Eastern Province in Sri Lanka, as well as factors that contribute toward their level of job performance. 562 teachers serving in government schools in 14 zones in the Eastern province of Sri Lanka participated in this study. The questionnaire administered had 26 questions of Quality of Work life testing 8 variables and 45 questions of Job Performance testing 7 variables. Data analysis was done using SPSS 16.0. The Pearson correlation coefficient and multiple regression tests were used for data analysis and to determine relationship between variables in the model (Quality of work life, and Job Performance). There was a significant and positive correlation between job performance of the teachers and their quality of work life ($P=0.003$). The results of the study showed that quality of work life significantly influence on job performance; managerial dimensions of quality of work life make a better predictor for job performance among teachers in government schools. Implications of this study suggest to school administrators, teachers, and other stakeholders of the educational institutions. Future study is also suggested to be carried out to private schools, industry, manufacturing, hospital and other educational centers. Meanwhile other dimensions of the quality of work life such as psychological dimension could be added to improve the model.

Keywords—Quality of work life (QWL), Job Performance (JP) and Teachers

I. INTRODUCTION

Development of a nation is primarily dependent on the education system available in the country. Education is nowhere without teachers' playing a pivotal role in ensuring achievement in an educational institution. Teachers' job performance plays a crucial role in students' learning process and their performances in curricular and co-curricular activities. It is known to be related to teacher's effectiveness (Medly and Shannon, 1994). Teachers play a basic and dynamic role in the educational system. It is said that good performance of students depends upon effective

teaching of their teachers. As professionals, teachers need to be appropriate role models and exhibit to their students a commitment to scholarly values and to life-long learning (Medly and Shannon, 1994). One factor that might influence teacher's job performance is Quality of Work Life. It includes the organizational climate. The dimensions of organizational climate were measured based on principal's leadership behavior and teacher's behavior. Principals can encourage effective performance of their teachers by identifying their needs and try to meet them (Adeyemi, 2010). This encouragement is very much dependent on various aspects of the principal's leadership behavior. Teacher's behavior too plays a major role in the teacher's job performance.

Therefore, the teachers' performance is highly crucial in the education sector. The education is the most important thing to produce a total man with the knowledge, attitudes and skills required not only for the present world but also for that of the future. In the case of delivery of quality education, the teachers are the most crucial & valuable resource. In recent decades, the picture has changed. There has been sharp decline in the standard and quality of education at all levels. Navaratna (1999) indicated that the reading habit and the use of libraries in the learning process have almost disappeared from our education culture. (Ginige (1997) emphasized that, deteriorating educational standards and rapidly growing private tuition, together with the widening gap between the schools, authorities should rethink education in terms of customer- focused new approaches to fulfill the needs of a changing society. So, he further noted that, the educational authorities today are compelled to look for new strategies that can improve the quality of school system and to improve the performances of teachers serving in the teaching field of different sectors.

This research testifies to the existence of either direct or indirect impact of the quality of work life and on job performance. A study by Huang, Lawler and Lei (2007) reveals that quality of work life has a significant impact on organizational commitment and intention to quit, both of which are interrelated with job performance. Consistently, a

study by Lee, Singhapakdi and Sirgy (2007) revealed that quality of work life generally has a positive influence on job performance-related outcomes, such as job satisfaction, organizational commitment and camaraderie. Furthermore, Probst (2003) found a positive connection between quality of work life and improved job performance through job security, whilst Cuyper and Witte (2010) opine that quality of work life mediates the relationship between job involvement and job performance. Based on the empirical findings discussed, a positive interplay between quality of work life and job performance in the present study can be envisaged.

As other factors which have impacts on teachers performance mentioned above, Quality of Work Life also influences the teacher's job performance. Teachers are arguably the most important group of professionals for our nation's future. Without teacher, the education system will be crippled. The increased importance in teacher's job performance has made it extremely important to identify the factors that influence teacher's job performance. In recent years, effects of perceived Quality of Work Life on teacher's performance have become topic of concerns for researchers and education officers. Although numerous studies have been conducted on teacher's job performance, past research has been constrained by the shortage of studies on the influence of Quality of Work Life on teacher's job performance. Number of reports has shown that teacher's job performance is deteriorating around the world in general, and also Malaysia in particular. This seems to be affecting the teaching and learning process as well other instructional activities at school. As a result, students are the most affected individuals. Hence, it is crucial to determine the factor that has influence on teacher's job performance.

Teachers are the main employees or responsible and accountable personnel who are fully engaged in the teaching and learning activities of the schools. The teachers are pillars and important assets to the school education system. They are answerable to all kinds of issues, problems and irregularities with regard to teaching and learning of students at schools. Teachers are partly responsible for students' drop-outs and mainly responsible for the production of examination results, making students in excelling in extracurricular activities and he is the sole custodian of a set of students assigned to him/her. It has been observed that lack of opportunities for career development, lack of flexibility and freedom, lower compensation, discrimination in rewards and benefits, conflicts between teachers, parents, education officers and students and lack of facilities are some of the issues that the teachers of schools face today. All these factors are related to Quality of Work Life (QWL) as QWL deals with both the intrinsic and extrinsic aspects of jobs. QWL encompasses mode of wages and payment, working condition, working time, health hazard issues, financial and

non-financial benefits and management behavior towards employees (Islam & Siengthai, 2009).

Due to the importance of the education sector, it is necessary to evaluate the QWL and the job performance of the teachers working in the government schools because they feel that the QWL is not adequate and they may leave the job or reluctantly work or will go for other jobs which provide better QWL. It has been further envisaged that the executive members play key role in manipulating their services by providing better administration and building the nation. Thus the primary concern of the study is to examine the interrelation between QWL and Job performance of teachers serving in the government schools in the Eastern Province of Sri Lanka.

II. Problem Statement

Quality of work life in an organization is essential for the smooth running and success of its employees. QWL helps the employees feel secure and think that they are being thought of and cared for by the organization in which they work (Sadique 2003). They view that QWL with mixed feelings as characterized by unchallenging jobs, shortage of personnel, lack of feedback, lack of recognition for work done, lack of staff development activities, lack of resources and poor communication where there is no two way communication but, the teachers of government schools are playing a vital role in performing teaching and allied tasks together with implementing extracurricular activities effectively in the school educational system.

According to the Ministry of Education in Sri Lanka, the teachers are recruited to school system through highly competitive examination and proper recruitment procedures. The promotion of teachers from one grade/class to another higher grade/class is done through proper system based on their academic and professional qualification, experience and their performance of the career. Therefore these teachers must be respected at work. Their duty must not cause them any physical discomfort or mental anguish. They must feel something enjoyable or at least not unpleasant. They must feel the salary they are paid is sufficient for the work they are discharging. They must feel valued, rewarded, motivated, appreciated and empowered as though they are doing something important for their organizations.

Education sector in Sri Lanka is going to be very challengeable in future because schools have to compete with one another to provide better education and the private schools become a challenge to these government schools in terms of curriculum and extracurricular activities, the standard of education, discipline of students and other aspects of education. (P.K.Pakkeer Jaufer (2009). So, the QWL and the job performance of teachers of government schools must be given top priority before drafting educational reforms because they are the direct implementers of the systems or reforms. Therefore, this study investigates the factors affecting the quality of work life and job performance of government school teachers in

Sri Lanka and also tries to find out the relationship between quality of work life and their job performance. The research questions were what factors affect the quality of work life of teachers, what factors affect the job performance and how the Quality of work life impact on the job performance of teachers serving in government schools in the Eastern Province of Sri Lanka.

III. Objective of the study

The study is undertaken with the following objectives.

To analyze the factors directly affecting the quality of work life of teachers who serve in government schools in the eastern province of Sri Lanka

To analyze factors directly affecting job performance of teachers who teach in government schools in eastern province of Sri Lanka

To analyze the relationship between quality of work life and job performance of teachers who serve in government schools in eastern province of Sri Lanka

Significance of the study

Policy makers of the education sector who plan for the promotion of education in the country will find the result of this study valuable and good suggestions for their future planning. It can be used to improve their employees' participation, motivation and involvement in the effective running of their schools and producing excellent academic and non-academic performances. Schools strive hard to keep up to the competition among schools and expect advantages to develop their schools further and to become leaders in the divisions, zones or districts or provinces. Educational authorities have obligations to promote the standard of education by promoting the quality of work life of teachers of schools because they might be tempted to search for other organization of higher profession that may present better quality of work life.

Therefore, the findings of this study will enable the authorities concerned to identify the areas which need much attention with regard to quality of work life of teachers and their job performance and expect total commitment from them and recommend for policy changes in terms of human resource development to authorities. One important reason why the organizations take interest in improving quality of work life of their employee is because they see it as a means of obtaining greater employee motivation and commitment to the organization objective.

The need for the study was felt important and noteworthy because of the following reasons. There have been a very few studies on the quality of work life and job performance of teachers in the education sector (Primary and Secondary). Though some of the past studies tried to explain job

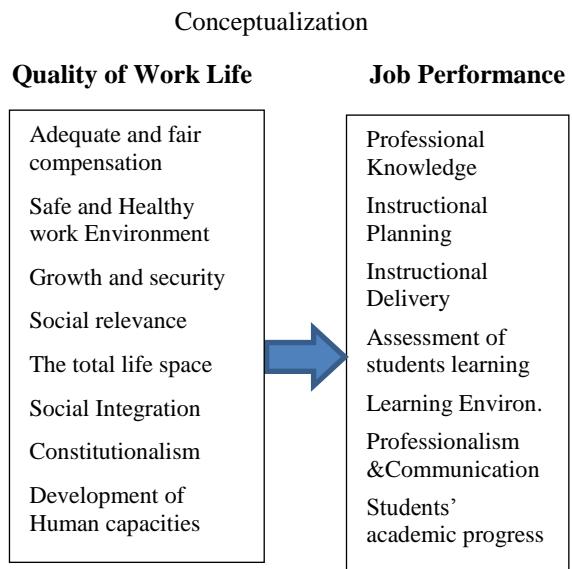


Figure: QWL and Job Performance Source: Adopted from Walton (1980) and Dr. James Stronge (2014) **Key concepts: QWL**

Satisfaction and motivation in terms working condition and incentives in place, the quality of work life and their job performance have been neglected. An attempt is however made in this study to provide an integrated explanation of quality of work life and job performance.

Adequate and fair compensation

It refers to sufficient salary for all full time work and enough payment to cover current life requirement considering social criteria.

It also refers to fair and adequate pay, fair and proper payment for good performance, innovative reward system, the circumstances and procedures relating to promotion policies, seniority and merit in promotion and development (Walton, 1980)

A safe and healthy work environment

Safe environment may go beyond description of the physical environment, hours of work, safety, health hazards, travel requirements and other features of the job (Gordon, 1996).

Growth and security (Career development)

It refers to having good conditions to increase personnel empowerments and skills (Bernardin & Rassal, 1998).

Social relevance

It refers to employees' perception of social responsibilities of the firm. The employee and employer relationship domain concerns labour relations law and compliance and procedures designed to maintain good working relationship between employees and employers. Here relationship is denoted in the communications. These domains are

concerned with sharing information among employees, management and out-side constituents including customer (Bermadin & Russell 1998).

The total life space

It refers to the existence of equilibrium between work life and other section of employees' life. This concept of a balanced role encompasses work, schedules, career demands and travel requirements that do not continually take up leisure and family time and advancement and promotion that do not require repeated geographical moves (Walton, 1980).

Social integration

It refers to the sense of belonging to the organization. It includes factors such as the effect of motivation on success, addressing to personal problems and paying attention to team work, According to Walton (1980).

Constitutionalism

It refers to the situation for employees to express their opinion without being afraid of top managers. (Walton, 1980).

Developing human capacities

Walton (1980) asserts that experiencing a high QWL is dependent upon the extent to which jobs allow the employee to use and develop his or her skills and competencies. In light of the above mentioned jobs, it should contain a number of features that would allow employees the opportunity to use and develop their human capacities and eventually experience QWL. These features include autonomy, skills variety, task significance, feedback, meaningfulness and wholeness.

Key Concepts: JP

Professional knowledge

It refers that the teacher demonstrates an understanding of the curriculum, subject contents, and the development needs of the students by providing relevant learning experiences, effectively addresses appropriate curriculum standards, integrates key content elements and facilitates students' use of higher level thinking skill (Dr. James Stronge 2014).

Instructional planning

Dr. James Stronge (2014) emphasizes that the teacher plans standard of learning, career and technical education standard, the school division's curriculum, effective strategies, resources and data to meet the differentiated learning needs of all students.

Instructional delivery

Dr. James Stronge (2014) stresses that the teacher should engage students in learning by using a variety of effective

instructional strategies in order to meet individual learning needs of all students.

Assessment of or for student learning

It refers to the teacher systematically gathering analyzing, and using a variety of formative and summative data to measure students' academic progress, guide instructional content and delivery method and provide timely feedback to both students and parents throughout the school year, James Stronge 2014).

Learning environment

It refers that the teacher uses resources routines, and procedures to provide a respectful, positive, safe, student-centered environment that is conducive to learning. (James Stronge 2014).

Professionalism and communication

It refers that the teacher maintains a commitment to professional ethics, communicates effectively, and takes responsibility for and participates in professional growth that results in enhanced student learning, collaborates and communicates effectively within the school community to promote well-being and success of all students, (Dr. James Stronge 2014)

Students' academic achievement

The work of the teacher results in acceptable, measurable, and appropriate student academic progress, sets specific, measurable, and appropriate achievement goals for student learning progress based on baseline data, documents the progress of each student throughout the year, (Dr. James Stronge)

Hypotheses

The following hypotheses were developed and to be tested in this study

Null Hypotheses (H₀)

There is no significant relationship between QWL and Job Performance

Alternative Hypothesis (H₁)

There is a significant relationship between QWL and Job performance

Null Hypotheses (H₀)

There is no significant relationship between QWL and its factors/variables

Alternative Hypothesis (H₁)

There is a significant relationship between QWL and its factors/variables

Null Hypotheses (H₀)

There is no significant relationship between JP and its factors/variables

Alternative Hypothesis (H₁)

There is a significant relationship between JP and its factors/variables

IV. Study Design

In this research, relationship between quality of work life and Job performance and impact of QWL on the job performance of teachers serving in government schools in the Eastern Province of Sri Lanka was studied. The model developed and carried out by Dr. James Stronge (1980) and Walton (1980) was not carried out to assess the impact of QWL on the Job Performance of Teachers in Sri Lanka. So the researcher used this model in this research. The study made use of questionnaire as the research instrument. The questionnaire to assess Quality of Work Life included 26 questions and 45 questions to assess Job performance to suit the research context. Five-Point Likert - type scale ranging from very dissatisfied (value of 1) to very satisfied (value of 5) was used to measure the Quality of Work Life (QWL) and Job Performance (JP). The questionnaire of this paper involves 71 questions in total. The following steps were followed in going about the research design;

- a. A pilot study of questionnaire was conducted to establish the adequacy and reliability of the instrument in wording, context, question sequencing and bias. It is a way of providing ideas and to test the relevance of the instrument to the environment in which the teachers are serving.
- b. The unstructured interviews were conducted with the teachers after the pilot study to ascertain that all the questions in the study are simple and easy to comprehend.
- c. The final stage was the administration of the adapted questionnaire to a sample from selected schools in the eastern province of Sri Lanka.

Sampling

Stratified random sampling technique was used for this study and stratified random sampling was used because of the nature of the population of the study and the behavioral pattern of the profession that they are more on ground than what obtains in the government schools. This study certified Cooper and Schinder (2006), criteria for usage of stratified random method namely: (a) increased sample's statistical efficiency, (b) adequacy of data for analyzing the various sub populations or strata. In addition, the study ensured that stratified sampling was used in this study to ensure that the schools with different categories of teachers are well represented.

The study population from which the sample was drawn for the study consists of 20,961 teachers from 1074 schools from all 16 educational zones in the Eastern Province of Sri Lanka. 562 teachers were taken from these schools as the study sample through stratified sampling method and questionnaire were administered to 600 teachers ranging from SLTS 1, SLTS 2-I, SLTS 2-II and SLTS 3-I serving in government schools in the Eastern Province of Sri Lanka.

The total Number of schools in the Eastern Province is 1074 and the total number of teachers serving in these schools is 20961 (Data Management Branch Ministry of Education, 2013). 5405 teachers in 80 1AB schools, 6012 teachers in 183 1C schools, 6474 teachers in 369 Type 2 schools and 3070 teachers in 442 Type 3 schools. 562 teachers were chosen for this study are 146 teachers from 1AB schools, 163 teachers from 1C schools, 174 teachers from Type 2 schools and 79 teachers from Type 3 schools in 16 educational zones. . The sample size of 562 teachers out of the total population of 20961 was considered for the research.

Data Collection

Out of the total study population of 20961 teachers serving in the government schools in 16 educational zones in the Eastern Province of Sri Lanka, the sample size of 562 teachers were chosen through stratified sampling method and 600 questionnaires were administered to collect the data from the sample size of 562. The adapted questionnaire consists of total of 71 questions based on QWL and JP in addition to the personal information of the teachers of the sample size.

Method of Measurement

In this research, the impact of Quality of Work Life of teachers serving in the Eastern Province of Sri Lanka on their Job Performance was studied. Research method was descriptive-Correlation type and was an applied method in terms of goal. Statistical population of the research was teachers serving in the government schools in the Eastern Province of Sri Lanka whose number was 20961 at the time of this research. 562 teachers of the total population were taken as the sample size of the population for the research. Data were collected during the period of 2015 and 2016 using primary source of data collection. Questionnaire was used as an instrument of data collection. Data are presented in scree plot. Reliability is analyzed by Cronbach's alpha. (Table I, and Table III) Validity is analyzed with the help of experts in the field. Factor analysis, correlation and regression analysis (single and multiple) were also conducted with the aid of statistical package such as SPSS (16.0), MINTAB 14 and excel -2007.

Method of Data Analysis and Evaluation

The collected data were analyzed by making use of descriptive statistics which enabled the researcher to synthesize and summarize the quantitative data. The descriptive statistics described the sample in terms of the response to the question using frequencies, means and the standard deviations. Sampling adequacy was measured by Kaiser-Mey-Olkin measures of sampling adequacy for Quality of Work Life and Job Performance individually to determine the factor analysis. Sampling adequacy for both

factor was greater than 0.5. Therefore, Factor analysis was done for both QWL and Job Performance. Bartlett's Test of Sphericity was conducted to know correlation among variables. Significant value in both factors was 0.000. (Table IV and Table V)

Discussion on the research variables

In this study, researcher proposed to examine the perceived impact of Quality of Work Life on the Job Performance of teachers as a main hypothesis. The H_0 was QWL is not related to Job Performance and H_1 was QWL is related to Job Performance. Results from hypothesis testing indicated that H_0 is rejected because $P\text{-Value} = 0.000$ and also $P < 0.05$. R^2 from the regression model summary between QWL and JP was 68.7% which reveals strength of impact is in the satisfactory level. The Fitted regression equation model shows that one unit increase in QWL will increase in the JP by 0.508 which is a positive beta value for the QWL.

Discussion of results from analyzing hypothesis testing

As determining the impact of QWL on the Job Performance of teachers in government schools in the Eastern Province in Sri Lanka. Results indicate that there is a positive and exponential correlation between two.

As determining hypothesis 1, that factors of QWL such as adequate and fair compensation, Work condition, Development of capacities, Social integration, Constitutionalism, Total life space and Social relevance have positive relation with QWL, results indicate that each factor is significantly related to raise of QWL. Likewise, as for determining hypothesis I that factors of Job Performance such as Professional knowledge, Instructional planning, Instructional delivery, Assessment of students' learning, Learning environment, Professionalism and communication and students' academic progress have also positive relations with job performance. Results indicated that each factor is positively related to raise total job performance. In this study results revealed that seven factors of Job performance have positive relations in the following ascending order. Students' academic achievement, Professionalism and communication, Assessment of students' learning, instructional planning while three other factors as fifth, sixth and seventh which have less effective.

In addition to the above, to determine how the factors of QWL such as adequate and fair compensation, working condition, growth and security, development of human capacities, social integration, constitutionalism, total life space and social relevance impact on job performance. Results indicated that four of the above variables of QWL such as Adequate and fair compensation Development of human capacities, working conditions Social relevance have more positive impact on job performance that means that when the teachers are satisfied with the financial benefits they receive such as salary and allowances their performance will improve. Another factor that has the positive impact on

the job performance of teachers is the development of human capacities. It has the dimensions of decision making freedom, performing several tasks and information access. This will make the teachers perform well. Another factor that has the positive impact on the job performance of teachers is working condition. It has dimensions of working hours, working environment and salubrity level. When these are improved the teachers will perform better than before. Another factor that has positive impact on the job performance of teachers is social relevance. It has dimensions of proud of work, contribution to the society and quality of the product or services. When the teachers are satisfied with the above Dimensions they tend to work better and perform better. These four variable will lead the teachers Perform better in factors of instructional planning, Assessment of students learning, Professionalism and communication and students' academic achievements. This result is consistent with the result from Amirtash Ali Mohammed, Mozaffari Seyd Amir Ahmed and Askari Ahmed Reza's study (2013) under the title of the relationship between quality of work life and faculty members' job performance in Islamic Azad University in district 4, Iran. Average of all components was above mean, further, present study reveals that factors such as adequate and fair compensation, working condition, development of human capacities and social relevance have positively significant impact on the job performance while other four factors have positive relationship without significance. Studies conducted by Shruti Sehgul (2012), Demet Leblebic (2012) have proved that working conditions have significant impact on the gradation of job performance.

V. Conclusion and Recommendation

Main goal of this research was to study the impact of Quality of work life on the Job performance of teachers teaching in the government schools in the eastern province of Sri Lanka. Results of this research are similar to findings of Swart (1985), Marks (1986), Beasley (2005) and Dargahi & Nasle (2007) in which importance and relationship between Quality of Work Life and Job Performance have been emphasized.

This study identified eight factors relevant to Quality of Work Life of teachers teaching in government schools in the eastern province of Sri Lanka. The mostly influencing factors are Adequate and fair compensation, Development of human capacities, Work and Total life space and Social relevance. Total QWL rises when the mostly influencing factors rise. All the beta value for these factors are positive towards total QWL and these factors could be considered by authority concerned as factors to improve QWL of teachers in government schools in Sri Lanka. (Table II) Sig. values of all these factors are below 0.05. It states that the test is significant. There is a relationship between such factors and Total QWL.

Study further found that all seven factors of Job Performance are contributing and total JP rises when mostly influencing factors rise. All the beta values are positive towards total JP and these factors could be considered by the authority concerned as factors to improve job performance of teachers teaching in government schools in the eastern province of Sri Lanka. Sig. values of these factors are below 0.05. It states that test is significant. There is relationship between such factors and total JP.

A test was conducted to find the relationship between the aspects of QWL and Job Performance. The test revealed that Adequate fair and compensation, Development of human capacities, Work and Total life space and Social relevance are significantly related to JP (Table VI) while factors such as Safe and healthy work environment, Growth and safety, Constitutionalism and Social integration do not have significant relationship. Therefore Adequate fair and compensation, Development of human capacities, Work and Total life space and Social relevance are considered as mostly contributing factors than factors such as Safe and healthy work environment, Growth and safety, Constitutionalism and Social integration. However Total QWL rises when significantly and non-significantly important factors of QWL rise. Coefficient table shows that all the beta values for these factors are positive towards total JP and all these factors could be considered by authority concerned as factors to improve Job performance of teachers teaching in government schools in the eastern province of Sri Lanka. Sig. Values of all these factors except four are below 0.05. It states that the test is considerably significant. There is a relationship between factors of QWL and JP (Table VII).

A well-educated society is an output of well-educated teachers. Teachers should contribute more to the society by imparting their knowledge to students, by guiding them to correct path, by teaching them good discipline and guiding them to correct career paths. Teachers are the direct stakeholder of the society in terms of education but the communication with the teachers by the parents is not rewarding. The teachers are not motivated by the students as well as parents. The teachers are well communicated by the parents, well-wishers and principals when something goes wrong not when something good happens. When the school produces good results in public examinations, students are praised not teachers on the other hand when the school produces bad results in the public examinations, the teachers are well communicated and commented or criticized badly. This situation leads to the less performance by teachers. So the officers concerned, the parents and other stakeholders in the society should communicate with teachers and with the teachers' advice and feedbacks their children life would prosper.

A large number of teachers in Sri Lanka is an asset to the country. They are playing very significant role in Sri Lanka

in making the country a Knowledge hub in Asia. So a well-designed QWL initiatives for teachers will yield competitive advantage and as it will increase job performance. This will in return motivate them to perform their duty in superior way leading the schools in Sri Lanka to a better future by yielding expected outcome.

It should be said that the Quality of work life and Job performance of teachers are a continued process not a project or a plan. The goal of the Quality of work life as a process is to promote the job performance and to attain expected results. Therefore, considering the results obtained from this study, attention should be paid to factors affecting and promoting quality of work life to enhance job satisfaction. The efforts should be made to prevent losing of quality of work life and increase job performance.

Implication of the study

This study provides valuable implication for the government schools in Sri Lanka that have growing interest in attracting and retaining quality teaching staff. The study revealed tern province statistically significant relationship between Quality of Work Life and the job performance of teachers teaching in government schools in the eastern province in Sri Lanka. Thus, the school management and educational administration should emphasize on the policy based on the concerned issues of Quality of Work Life improvement. There is no doubt that an improved QWL can lead to higher level of job performance which in turn will reduce the turnover rate or rate of joining the profession of teaching in government schools in Sri Lanka. The finding of this study strongly points to the importance of factors of QWL such as Adequate and fair compensation, Development of human capacities, Work and Total life space and Social relevance as significantly influencing on job performance of teachers in government schools. Most of these factors are intrinsic. Teachers give priorities intrinsic factors like respect, equality, praise, recognition and justice than extrinsic factors like compensation and development of human capacities.

Limitation of the study

The researcher encountered numerous limitations during the study. The most notable one is that most of the teachers did not co-operate to furnish the questionnaires administered to them. The other important one is that the researcher could not visit the most difficult area schools in the province to collect data. The other disgusting experience was that the education officers whom the researcher approached to get further information were reluctant to give true information.

Summary

This research study was done with the prime intension of finding the perceived impact of Quality of work Life on the job performance of teachers teaching in government schools in eastern province of Sri Lanka. The result revealed that

there is a positive and significant impact on the job performance of the said teachers. Educational administrators have to pay more attention in maintaining QWL and job Performance of teachers teaching in government schools in the eastern province of Sri Lanka. This situation will make sure in fulfilling objective of both teachers and the schools they serve in in an acceptable manner. Therefore, this section provides some of the recommendation to improve the job performance through QWL of teachers teaching in government schools in the eastern province of Sri Lanka.

REFERENCE

- [1] Adel Salavati, Keyhan Maghsoudi & Kaveh Hasani (2013), Relationship between Quality of work Life and the Productivity of manpower, *Management and Administrative Science Review*, 2(3), 243-253.
- [2] Nurharai Salamat (2013).The impact of Organizational Climate on teachers' Job performance, *Educational Research* Vol. No.2
- [3] Julie Kowal and Emily Ayscue Hassel, Measuring teacher and leader performance
- [4] Hussain Ali,M.A.M.(2010), Impact of Job Design on Employees performance with special reference to school teachers in Kalmunai Zone.
- [5] Dr,James stronge,(2014), Teacher Performance Evaluation System.
- [6] Sterwart, G.L., & Kenneth G.B.(2011). Human Resource Management: *Linking Strategy to Practice* (Second Edition), Wiley.
- [7] Sri Lanka Educational Information 2013, Retrieved from www.moe.ac.lk Accessed on 24.03.2015
- [8] Walton,R.E. (1975). Criteria for quality of working life . The free press, New York, 1,91-104.Walton, R.E.(1980). Improving the quality of work life. *Harward Business Review*. 19(12), 11-24
- [9] Sadique,Z.(2003). Quality of Work Life among white collar and blue collar employees. *Journal of institute of Bangladesh studies*, 26,169-174
- [10] Pakkeer Jaufer (2009). The School for Better Education. PP(1)
- [11] Mahadi Haggi & Nadar Bohloohi (2013, August 24-25), Study and prioritizing effective human resource productivity by achieve model and topsis method: *the case study of Iran Manufacturing Company. Presented paper in 1st International technology education and environment conference, African society for scientific research.*
- [12] Islam,M.Z.& Seingthai,S. (2009) Quality of work Life and Organizational Performance, *Empirical evidence from Dhaka export processing Zone, Presented paper at ILO Conference, Geneva*
- [13] Dargarhi ,H.,& Nasle Seragi,J.,(2007) An approach model for employees-Improving Quality of Work

Life,*Iranian Journal of Public Health* 36(4), 81-86
Shruti Sehgal (2012) Relationship between work environment and productivity, *International Journal of Engineering Research and Application*

TABLE I :Reliability test for Quality of Work Life

Criteria	Cronbach's Alpha Value
Adequate and Fair Compensation	0.854
Safe and Healthy environment	0.732
Development of human capacities	0.726
Growth and Securities	0.814
Social Integration	0.762
Constitutionalism	0.789
Total Life Space	0.737
Social Relevance	0.802

Source: Survey Results

TABLE II : Component Matrix QWL

	Component		
	1	2	3
Adequate fair Compensation	.533	.529	
Development of Human capacities			.959
Work and Total space of Life	.889		
Social Relevance of the work		.888	

Source: Survey Results

Extraction Method: Principal Component Analysis

TABLE III : Reliability test for Job Performance

Criteria	Cronbach's Alpha Value
Professional knowledge	0.753
Instructional planning	0.831
Instructional delivery	0.692
Assessment of or for students learning	0.754
Learning environment	0.701
Professionalism and Communication	0.876
Students' academic achievement	0.725

Source: Survey Results

TABLE IV : KMO and Bartlett's Test (QWL)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.533
Bartlett's Test of Sphericity	593.090
Df	325
Sig.	.000

TABLE V : KMO and Bartlett's Test (JP)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.507
Bartlett's Test of Sphericity Approx. Chi-Square	1.780E3
Df	990
Sig.	.000

TABLE VI : Component Matrix JP

	Component		
	1	2	3
Instructional Planning	.775		
Assessment of Students' learning	.775		
Professionalism and communication		.973	
Students' academic achievement			.982

Source:Survey Results

Extraction Method: Principal Component Analysis

TABLE VII : Regression Model QWL and JP variables

	Unstandardized Coefficient		T	Sig
	B	Std. Error	Beta	
(Constant)	48.599	3.552		13.681 .000
Adequate	.935	.052	.508	18.121 .000
Develop. Human	1.548	.192	.227	8.081 .000
Work Condition	.835	.062	.371	13.504 .000
Social Relevance	1.059	.096	.304	11.074 .000

Dependent variable : Job Performance

The Impact of Corporate Social Responsibility (CSR) on Organization Citizenship Behavior (OCB) and Employee Turnover Intention (ETI) in Telecommunication Sector Employee-A Study of Northern Province in Sri Lanka

Bairavi N.

Department of Economics and Management, Faculty of Business Studies, Vavuniya Campus of the University of Jaffna

bairavil2@gmail.com

Abstract— The increasing importance of Corporate Social Responsibility (CSR) stresses on organizations to start focusing on CSR activities. To measure employee's behavior two dimensions such as assess the organizational citizenship behavior and turnover intention have been taken into consideration addresses the impact of CSR on employee's behavior in telecommunication sector in Sri Lanka especially in the two districts in the northern province. Since this research is quantitative in nature, a survey has been conducted among 100 employees for the telecommunication sector in Sri Lanka which covers Sri Lanka Telecom, Dialog Axiata, Mobitel, Airtel, Hatch and Etisalat these companies are holding 80-90 % market share of cellular market in Sri Lanka. Employees selected are having minimum academic qualification of graduation in the telecommunication sector. The research hypotheses were tested by using Univariate and Bivariate analysis. The findings suggested that CSR positively impact with OCB and negatively with ETI. CSR activities help the companies to develop positive behavior in employees and reduce negative conduct/activities. Positive behavior improves employee performance which increase profitability and will lead to good reputation of the company as well whereas negative attitude conduct increase firm liabilities.

Keywords-- Corporate Social Responsibility (CSR), Employee Turnover Intention (ETI), Organizational Citizenship Behaviour (OCB), Sri Lanka, Telecommunication Sector.

I. INTRODUCTION

There are huge pressures that company takes the social obligation from all its shareholders and consumers today are starting to make comments in decision making of the corporations. They are concerned about the working place, condition, human rights protection, environmental stability, child labour and many things when to buy a

particular product or Services. (Rahmani and Nilsson, 2007; Jenkins, 2005).

From previous researches it has been realized, that there is a need to study the impact of CSR on telecommunication industry employees' behaviour in many organization. Employees play an important and significant role in firm's CSR actions, so it is very important to study their behaviors toward CSR. Impact of CSR on different elements like employee performance, employee perceptions and employee commitment had been studied in details in previous researches and some studies related to consumer perception about CSR activities were also conducted. So it is recommended to study the impact of CSR on telecommunication industry employee's behaviour in Vavuniya and Jaffna. There are different dimensions of behaviour but in this present research study two dimensions of behaviour will be discussed

1. Employee Turnover Intention (ETI)
2. Organization Citizenship Behaviour (OCB).

A. *Based on the research problem the following research questions are formulated*

RQ₁: To what extent do the CSR activities impact on the behaviour of the employees' in Telecommunication sectors in Vavuniya and Jaffna districts?

RQ₂: Is there any relationship between Corporate Social Responsibility and Employee Turnover Intention?

RQ₃: Does Corporate Social Responsibility associated with Organization Citizenship Behaviour?

B. Objectives of the Study

The main objective of this study is to find out how Corporate Social Responsibility actions have a direct impact on telecommunication industry employee's

Organization Citizenship Behaviour and employee's turnover intention. Following objectives will be fulfilled through this research,

- To understand the concept of Corporate Social Responsibility.
- To study the Corporate Social Responsibility in relation to organizational citizenship behaviour and Employee's Turnover Intention.

C. Significance of the Study

This particular study examines the relationship between CSR of Employee's Behaviour in telecommunication sector in the Jaffna and Vavuniya districts.

The results of the study may be of value to CSR in understanding what causes individual's employee's behaviour and how it can be encouraged and promoted within the organization. From previous some years CSR has given much more attention and many organizations started focusing on CSR activities. Many organizations in Vavuniya & Jaffna are also conducting CSR activities for the welfare of stakeholder, and started investing in CSR programs for achieving high level of Environmental, economic and social benefits.

II. LITERATURE REVIEW

Corporate Social Responsibility meets the needs of large number of stakeholders (Clarkson, 1995). From few last decades in CSRs history, any unique definition of CSR used for all the purposes has not been emerged (Rahman, 2011). Some definitions define CSR as an activity that engages corporations with society and it is a process by which an organization develops its social awareness and corporate culture (Rupp, Ganapathy, Aguleria, and Williams, 2006).

Carroll (1979) defined CSR as "The social responsibility business encompasses the economic, legal, ethical and discretionary expectations that a society has of organizations at a given point in time. "CSR activities aimed to force the corporations to According to Turnipseed (2002), OCB is an ethical behaviour of employee at workplace. Employee who feel that their organization is engaged in activities of corporate social responsibilities and have more concentration for the welfare of the society, then they develop a positive effective behaviour, and act in a positive way, which ensure an effective and positive relation between CSR activities and OCBs. According to Riordan, Gatewood & Bill (1997) there is a negative relationship between employee's perceptions of Turnover is defined as the "individual movement across the membership boundary of an organization" (Price, 2001: P.600) "Individual" means the employees of an organization and the concept of movement is a decision of leaving or staying in the organization. For turnover different researchers used other different labels like quite, exist, attrition, mobility, succession or migration (Morrell, Loan-Clarke, and Wilkinson, 2001).

The intention towards the employee turnover became a major issue for the management of an organization since for a long time *Chen, Lin & Lien, (2010)* and it is still a major problem faced by many organizations. Therefore, more attention has been paid towards turnover behaviour of employees and the major factors responsible for that behaviour (*Richer, Blanchard and Vallerandi, 2002*). Because of higher turnover intention of employee and its great influence on business performance, many firms have taken serious steps towards it and they started investment in company's employees by providing them orientations and training, focus on their development and retention in organization (*Ongori, 2007*). Organizations are now heavily do investment in CSR activities, as engaging in CSR activities make their employee to become loyal with organization, which result in decrease rate of turnover intention (Hansen et al., 2011).

Organizations are heavily invest in Corporate Social (CSR) programs to generate capital and to protect intangible assets that are related to stakeholder such as trustworthiness, reputation etc (*Godfrey, 2005*). Employees are the group of a prominent stakeholder and they received limited research attention in the CSR literature (*Etzion, 2007; Peloza, 2009*). The organization is more attractive for employees if it focuses more on CSR activities (*Greening and Turban, 2000*).

A. Empirical Studies on Corporate Social Responsibility

In line with the vast literature on CSR, many scholars have conducted empirical studies on the relationship between CSR and other variables. A relationship of great interest is that of CSR and profitability, with studies that had produced mixed results. In a study of the past 25 years' worth of research concerning the relationship between corporate social performance and corporate financial performance, *Griffin and Mahon (1997)* found 33 studies supporting a positive relationship, 20 studies supporting a negative relationship and 9 studies supporting a nil relationship

On the other hand, *Alexander and Buchholz (1978)* conducted an important study (consisting of 3 and 5-year assessment periods and adjustment of risks) and concluded empirically that "there seems to be no significant relationship between stock risk levels and degree of social responsibility. However, they used stock prices as an indication of profitability, when stock prices do not necessarily reflect as such. Other researchers used a different approach in determining the social responsibility of organizations; they counted the number of lines devoted to the topic of social responsibility in the annual reports (*Bowman & Haire, 1975*) and gave each organization a low, medium or high social responsibility rating. As an indication of profitability, they used the organizations 5-year return on equity (ROE). Interestingly

enough, organizations with a medium level of social responsibility performed the best, while there was no evidence that organizations with a high social responsibility rating had similar performances.

B. Organization Citizenship Behaviour

Organization Citizenship Behaviour represent individual behaviour that is flexible, not clearly recognized by the formal reward system and it promotes the effective functioning of the organization. Here we studied the impact of CSR on OCB of employees. Favorable treatment, generated by CSR practices, should be in the favor of OCB.

OCB is one of the most widely studied topics in organizational behaviour research (*Podsakoff and MacKenzie, 1997* :). *Organ* and his colleagues (*Bateman, Smith and near1983* :) first coined the term "Organizational Citizenship Behaviour" in 1983 (*Podsakoff et al, 2000*). OCB has been defined as (*Organ and Moorman, 1993*:). contributions to organizational effectiveness that are neither mandated by individual job requirements nor recognized by the formal reward system, illustrates the challenge posed to narrowly defined models of rational self-interest. Because OCB is discretionary, nor an enforceable role requirement.

From the definition and studies of *Organ* some features of OCB can be summarized as follows (*Organ, 1990; Organ and Ryan, 1995; Paine and Organ, 2000; Organ, 1997*):

- Beneficial and informal behaviour or gestures,
- Discretionary; not enforceable requirement of the role or job description,
- Not directly or explicitly recognized by formal reward system; non compensated individual contributions in the workplace that goes role requirement
- Enhances the effective functioning of the organizations in the aggregate.

Bateman and *Organ* enumerated a list of behaviours and gestures such as expression of personal interest in the work of others, suggestions for improvement, care for organizational property, punctuality, willingness to endure occupational cost, and refraining from expressing resentment and complaining about insignificant matter etc. (*Organ, 1990*).

C. Relationships between Corporate Social Responsibility and Organization Citizenship Behaviour

The relationship between CSR and employee related outcomes, such as organizational justice, organization-based self-esteem, in role behaviour, OCBs and turnover. When performing CSR, especially employee focused CSR, organizations are sending signals to their employees that they approve of and care for them. *Lee and Peccei (2007)* found supporting evidence that through such positive feedback, employees develop a greater sense of organization-based self-esteem. In their paper, *Bowling*

and his fellow researchers (2010) conducted a met analysis of the predictors and consequences of organization-based self-esteem, and concluded that organization-based self-esteem has a positive relationship with job performance and OCB behaviour, while an inverse relationship was seen with turnover intentions. Using data from organizations in Israel, (*Carmeli, et al., 2007*) gave evidence that CSR exerted positive influences on identification and job performance.

Sims and Kroeck (1994) examined the influence of ethical fit on employee attitudes and intentions to turnover. They found that when organizations have CSR practices that match the desired ethical work climate of their employees, their employees have greater satisfaction, greater organizational commitment and diminished turnover intentions than individuals who did not share the same ethics with the organization.

However, from the above, we can see that there is a lack of theoretical synthesis on how and why CSR impacts employees' attitudes and behaviour, which can be explained by the lack of empirical evidence available. Seldom do papers go beyond the relationship between CSR and employee's organization commitment and job satisfaction. Therefore, I seek to bridge this gap through the examination of our proposed theoretical framework.

D. Relationships between Corporate Social Responsibility and Employee Turnover Intention

Turnover Occurs Whenever an Employee leaves The Company, whether voluntarily or involuntarily. Voluntary terminations result from resignation due to employment elsewhere, relocation and other professional and personal reasons. An involuntary termination occurs when an employee is fired whether for misconduct, poor performance, or simply at the will of the employer for reasons related to suitability of employee skills, qualifications and work habits.

Employee turnover refers to the number or percentage of workers who leave an organization and are replaced by new employees. Measuring employee turnover can be helpful to employers that want to examine reasons for turnover or estimate the cost-to-hire for budget purposes. Blanket references to turnover can be confusing; therefore, specific definitions and calculations for employee turnover may be useful to human resources practitioners.

Turnover intention is a measurement of either the employees of an organization plan to leave their positions or the organization plans to remove employees from their positions. Here we study the impact of CSR on turnover intention of employees. Favourable treatment, generated by CSR practices, should negatively influence the turnover intention.

III. METHODOLOGY

Research method of questionnaire is used in the present research study keeping in view its nature and requirements. Particular focus of the study is to know and

analyze the impact of corporate social responsibility on employees' behavior in whole department of telecommunication sector of Sri Lanka in Jaffna and Vavuniya. Research is quantitative in nature. Reason behind is that, quantitative research is more reliable, easy to measure and genuine as compared to qualitative research.

Data has been collected from whole department of telecommunication sector of Sri Lanka in Jaffna and Vavuniya from following companies: Sri Lanka Telecom, Dialog Axiata, Mobitel, Airtel, Hutch and Etisalat as they holding 80-90 % market share of cellular network in Sri Lanka and are relatively mature competitors for the last 10-15 years. Data had been collected by convenient sampling technique on the bases of researchers' convenience. Total of 100 questionnaires were distributed in whole departments of telecommunication sector of Sri Lanka in Jaffna and Vavuniya and got back the response of 100 respondents. The sampling frame consists of whole employees all departments with education of graduation. SPSS 16 version was used to analysis the data to test the hypothesis. The suitable tools were used to test the hypothesis and find the reliability. Following techniques are used to validate the findings and to get best solution.

A. Conceptualization

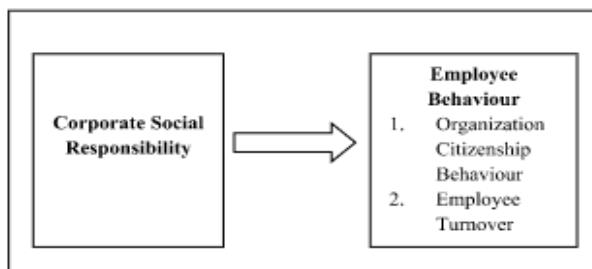


Figure 1. Conceptual Model

Source-European Journal of Business and Management

B. Hypotheses of the Study

The following hypotheses were developed based on the conceptual model:

H₁: There is a significant Impacts of Corporate Social Responsibility on Employees Behaviour in Telecommunication Industry.

H₂: Corporate social responsibility positively influences organizational citizenship behaviour of employees.

H₃: Corporate social responsibility negatively influences the turnover intention

H₄: There is a significant positive relationship between CSR and OCB

H₅: There is a significant negative relationship between CSR and ETI

IV. DATA ANALYSIS

In this research the researcher tries to identify that, to what extent the relationship between CSR and OCB & ETI. There are many statistical analysis techniques are used to assess the objective of the hypotheses, those are formulated in the previous part. These statistical techniques are as follows, correlation analysis, regression analysis, one way ANOVA.

A. Correlation between Corporate Social Responsibility and Organization Citizenship Behaviour & Employee Turnover Intention Behaviour

From the table I it can be observed that there is a positive relationship between Corporate Social Responsibility and Organization Citizenship Behaviour, there is a negative relationship between Corporate Social Responsibility and Employee Turnover Intention Behaviour. There is a positive correlation between Corporate Social Responsibility and Organization Citizenship Behaviour and negative correlation between Corporate Social Responsibility and Employee Turnover Intention Behaviour in telecommunication sector.

TABLE : I CORRELATIONS

	CSR	OCB	ETI
Pearson Correlation	1		
CSR Sig. (2-tailed)			
N	100		
Pearson Correlation	.797**	1	
OCB Sig. (2-tailed)	.000		
N	100	100	
Pearson Correlation	-.418**	-.279**	1
ETI Sig. (2-tailed)	.000	.005	
N	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

The table II it can be observed that the simple regression analysis was carried out to find out the effect of Corporate Social Responsibilities on Organization Citizenship Behaviour. Thus the Corporate Social Responsibility contributes significantly to increase the Organization Citizenship Behaviour in telecommunication sector at 63.5. % and remaining 36.5% can be contributed by the other factors.

TABLE – II MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.797 ^a	.635	.631	.30521

a. Predictors: (Constant), CSR

Table III

Coefficients matrix for impact of Corporate Social Responsibility on Organization Citizenship Behaviour
To assess the impact of Job Satisfaction on Organization Citizenship Behaviour in telecom sector, the following regression equation was formed

TABLE III COEFFICIENTS

Model	Unstandardized Coefficients		T	Sig.
	B	Std. Error		
1 (Constant)	.490	.240	2.041	.044
CSR	.819	.063	.797	13.058 .000

a. Dependent Variable:

OCB

$$OCB = .490 + .819 (CSR)$$

Here we can be observed that when the CSR will increase at the same time OCB also will be increased by 0.819. According to the regression analysis the hypothesis H₄ is accepted and the CSR has an impact positively influences OCB of employees.

The table IV, it can be observed that the simple regression analysis was carried out to find out the effect of Corporate Social Responsibility on Employee Turnover Intention. Thus the Corporate Social Responsibility contributes significantly to increase the Organization Citizenship Behaviour in telecom sector at 17.5. % and remaining 82.5% can be contributed by the other factors

Model summary for impact of Corporate Social Responsibilities on Employee Turnover Intention

TABLE IV MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.418 ^a	.175	.166	.58513

Table: V Coefficients matrix for impact of Corporate Social Responsibilities on Employee Turnover Intention

To assess the impact of Job Satisfaction on Organization Citizenship Behaviour in telecom sector, the following regression equation was formed.

$$OCB = 4.916 + (-.548) (CSR)$$

Here when the CSR increases by a active the ETI will be increased by -.548. According to the regression analysis the hypothesis H₅ is accepted and the Corporate Social Responsibilities (CSR) has an impact negatively influences Employee Turnover Intention.

TABLE V COEFFICIENTS

Model	Unstandardized Coefficients		Beta	T	Sig.
	B	Std. Error			
1 (Constant)	4.916	.461		10.671	.000
CSR	-.548	.120	-.418	-4.554	.000

a. Dependent Variable: ETI

TABLE VI - HYPOTHESES TESTING

No	Hypotheses	Tools	Results
H₁	There is a significant Impacts of Corporate Social Responsibility on Employees Behaviour in Telecom Industry	Regression	Accepted
H₂	Corporate social responsibility positively influences organizational citizenship behaviour of employees.	Regression	Accepted
H₃	Corporate social responsibility negatively influences the turnover intention	Regression	Accepted
H₄	There is a significant positive relationship between CSR & OCB	Correlation	Accepted
H₅	There is a significant negative relationship between CSR & ETI	Correlation	Accepted

V. RESEARCH FINDINGS

This research study examines impact of Corporate Social Responsibility and Organization Citizenship Behaviour & Employee Turnover Intention among employees in the telecommunication sector in Jaffna and Vavuniya districts based on the collected samples of 100 subjects from Sri Lanka Telecom, Dialog Axiata, Mobitel, Airtel, Hutch and Etisalat companies. Questionnaire in English and Tamil languages was developed based on the related literature review. Correlation analysis was done between CSR and dimensions of Organization Citizenship Behaviour and Employee Turnover Intention. And it was found there is a significant degree of correlation between CSR and dimensions of OCB. Then a correlation test was applied to check the degree of correlation between two main variables under study and found 63.5% degree of correlation.

The telecommunication sector of Sri Lanka is performing CSR activities and adopting innovative ways to show that they care for the humanity. When a company has CSR initiatives, employees feel proud and they are more committed to the organization. CSR helps in developing positive behaviours and reducing negative behaviours in employees. This study showed positive relationship between CSR and OCB and negative relationship between

CSR and ETI. Companies should focus on CSR activities in order to develop positive behaviours and reduce negative behaviours in employees because when employees observe that their organization is socially responsible they feel respected and show positive behaviours. When the employees develop positive behaviours and reduce negative behaviours they become more committed to the organization, become more loyal and work to promote the operations of organization. With the help of positive behaviours employee performance will also improve and it will lead to good reputation of the company.

VI. LIMITATIONS AND FUTURE RECOMMENDATIONS

The present research is concerned with the study of CSR and its impact on employee behaviour in whole departments of telecommunication sector of Sri Lanka in two districts of Jaffna and Vavuniya. This study focused on only two dimensions of employees' behaviour. There is a need to study the impact of corporate social responsibility on other dimensions of employee behaviour also. Hence cannot be generalized to all departments of cellular companies of Sri Lanka. Moreover, it was conducted in a short span of time which was available for the research. The sample size can be increased in order to generalize the results. The present research was restricted to two districts only. This study targeted whole of telecommunication sector of Sri Lanka in Jaffna and Vavuniya for only five companies of telecommunication sector of Sri Lanka.

During this study several ideas and potential research areas have been identified. The purpose of this section is to serve as a source of inspiration for further researchers who want to write research papers within this area of work. In this manner the followings are the suggestions for further researches.

- Future researcher should go for large sample, as with large sample it is easy to generalize the results on whole population. This study can be used by managers as a technique to enhance OCB and ETI level among employees, as it does explain the factors which are helpful in enhancing OCB level & ETI.
- The culture of organizational citizenship behaviour can be advanced through giving positive energy for the employees that follow the organizational regulation.

REFERENCES

- [1] Ali, I., Rehman, K., Ali, I. S., Yousaf, J., and Zia, M. (2010). Corporate social responsibility influences, employee Commitment and organizational performance. *African Journal of Business Management*, Vol. 4(12), pp. 2796-2801.
- [2] Bateman, T. S., and Organ, D. W. (1983). Job satisfaction and the good soldier: the relationship between affect and citizenship. *Academy of Management Journal*, Vol. 26, pp. 587-595.
- [3] Bowen, H. R. (1953). Social Responsibility of the Businessman, Harper Row, New York.
- [4] Carroll, A. B. (1999). Corporate social responsibility. *Business Society*, 38(3), 268 – 295.
- [5] Campbell, J. L. (2006). Institutional Analysis and the Paradox of Corporate Social Responsibility. *American Behavioral Scientist*, Vol. 49(7), pp. 925-938.
- [6] Chen, M-F., Lin, C-P., & Lien, G-Y. (2010). Modeling job stress as a mediating role in predicting turnover intention. *The Service Industries Journal*, pp. 1743-9507.
- [7] Clarke, J. & Sweet, M.C. (1999). The use of corporate social disclosure in the management of reputation and legitimacy: a cross sectional analysis of U.K. top 100 companies. *Business Ethics: A European Review*, 5-13
- [8] Committee for Economic Development, (1971).Social Responsibility of Business Corporation. New York.
- [9] Cormier, D & Gordon, I. M. (2001).An examination of social and environmental reporting strategies. *Accounting Auditing and Accountability Journal*, 14(5), 587-616.
- [10] Clarkson, M. (1995).A Stakeholder Framework for Analyzing and Evaluating Corporate Social Responsibility. *The Academy of Management Review*, Vol. 20(1), pp. 92– 118.
- [11] Carroll, A. B. (1979). A three-dimensional conceptual model of corporate social responsibility. *Academy of Management Review*, Vol. 4, pp. 497-505.
- [12] Comfort, D., Hiller, D., & Jones, P. (2007). What's in store? Retail marketing and corporatesocial responsibility. *Marketing Intelligence & Planning*, 25(1), 17-30.
- [13] Ells, R. (1956). Corporate giving a free Society. New York.
- [14] Ernst & Ernst.(1978), Social Responsibility Disclosure. Ernst and Ernst, Cleveland.
- [15] Gray, R., Kouhy, R & Lavers, S. (1995a). Corporate social and environmental reporting: a review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing and Accountability Journal*, 8 (2), 47-77.
- [16] Gray, R. (2000). Current developments and trends in social and environmental accounting, reporting and attestation: a review and comment. *International Journal of Auditing*, 4, 247-68.

- [17] Godfrey, P. C. (2005). The relationship between corporate philanthropy and shareholder wealth: A risk management perspective. *Academy of Management Review*, Vol. 30, pp. 777- 798.
- [18] Hansen, S. D., Dunford, B. B., Boss, A. D., Boss, R. W., and Angermeier, I. (2011). Corporate Social Responsibility and the Benefits of Employee Trust: A Cross-Disciplinary Perspective. *Journal of Business Ethics*, Vol. 102(1), pp. 29-45.
- [19] Kotler, P., & Lee, N. (2005). Corporate Social Responsibility: Doing the Most Good for Your Company and Your Cause. Hoboken, New Jersey. John Wiley & Sons, Inc.
- [20] Ongori, H. (2007). A Review of the Literature on Employee Turnover. *African Journal of Business Management*, pp. 049-054.
- [21] Organ, D. W. (1988). Organizational Citizenship Behavior: The Good Soldier Syndrome. *Lexington Books, Lexington, MA*.
- [22] Price, J. (2001). Reflections on the Determinants of Voluntary Turnover. *International Journal of Manpower*, Vol. 22, pp. 600-624.
- [23] Porter, L.W., Steers, R.M., Mowday, R.T. & Boulian, P.V. (1974). Organizational commitment, job satisfaction, and turnover among psychiatric technicians. *Journal of Applied Psychology*. 59 603-609.
- [24] Rahman, S. (2011). Evaluation of Definitions: Ten Dimensions of Corporate Social Responsibility. *World Review of Business Research*, Vol. 1(1), pp. 166 – 176.
- [25] Richer, S. F., Blanchard, C., and Vallerandi, R. J. (2002). A motivational model of work turnover. *Journal of Applied Social Psychology*, Vol. 32(10), pp. 2089-2113.
- [26] Rupp, D., Ganapathi, J., Aguilera, R. V., and Williams, C. (2006). Employee Reactions to Corporate Social Responsibility: An organizational Justice Framework. *Journal of Organizational Behavior*, Vol. 27, pp. 537–543. Sleeper, B. J., Schneider, K. C., Weber, P. S., and Weber, J. E. (2006). Scale and Study of Students Attitudes toward Business Education's Role in Addressing Social Issues. *Journal of Business Ethics*, Vol.68(4),pp.381391.

The factors determine the Coconut Production in Sri Lanka: An analysis of Cobb-Douglas Model

P.Godwin Phillip^{*1}, A.Thayaparan^{*2}

Department of Economics and management, Vavuniya Campus of the University of Jaffna

Paulinagodwin73@gmail.com

aruppillaithayaparan@yahoo.com

Abstract— The aim of this study is to examine the relationship between coconut production and its usage of inputs in Sri Lanka. For this purpose secondary data related to coconut production and its inputs such as rainfall, inorganic fertilizer, and research expenses were collected from coconut research institute in Srilanka for the period 1994-2014. To identify the trend of coconut production over the above period, growth model was used. In addition to that to investigate the relationship between coconut production and it's inputs, Cobb-Douglas model was applied. The result of growth model identifies that the trend of coconut production has increased by 0.5% in Sri Lanka over the period 1994-2014. The estimated Cobb-Douglas model shows that an increase in rainfall, inorganic fertilizer, and research expenses induce the amount of coconut production by 1.1%, 11.8% and 77% respectively. Except rainfall other two inputs are significantly affecting the coconut production. According to the R^2 value shows that 60% of the variation is explained by this model. The results of the study may help to the policy makers and regulatory institutions to take effort to secure unnecessary fragmentations in coconut production. And also the farmers should be encouraged to cultivate coconut production with the usage of organic fertilizer to sustain the coconut production and protect the environment in Sri Lanka.

Keywords—Coconut Production Cobb-Douglas model, rain fall, fertilizer

I. INTRODUCTION

The agricultural sector of Sri Lanka is dominated by four plantation crops, namely coconut, tea, rubber and sugarcane. Among them coconut is the most widely cultivated crop which is spread through most parts of the country. Currently, the contribution of coconut sector to the Gross Domestic Product (GDP) is about 1.5 percent. And its contribution to the total foreign exchange earnings is 1.8% in 2013(Central Bank of Srilanka,2014).

Sri Lanka is considered as the 4th largest coconut producing country in the world. Contribution from the coconut industry to GDP plays pivotal role in sustaining a

viable economy at village, district, and regional levels in Sri Lanka. Despite this dominant role of the coconut industry in the country's economy and the culture, the area under coconut is reducing substantially. The total land extent under coconut in the country has been reduced from 416,253 ha from 1982 to 2002 it is 5% (census of agriculture in 2002, department of senses and statistics). The coconut lands in Sri Lanka are categorized mainly as the "Smallholding sector (less than 20 acres) and the Estate Sector (less than 20 acres and less than 50 acres). Under this classification, almost 99% of coconut growers become smallholders, and the extent under smallholding is 81.9% of the total coconut land extent. (According to the senses of coconut lands carried out in 2002).

Even though the extent of land under coconut has been reduced gradually, the national production of coconut has shown a slight increase during the last 20 years suggesting that the "productivity" of existing coconut lands increase overtime. Nevertheless, the potential per capita availability of coconut has been reduced overtime indicating that the production has not been increased sufficiently to meet the requirement of growing population.

The potential per capita availability of coconut has been reduced overtime indicating that the production has not been increased sufficiently to meet the requirement of growing population (Coconut Development Authority, 2006).The literature suggest that there exists an inverse relationship between the size o f a farm and its productivity (Bardhan, 1973; Zyl *et al.*, 1996). The empirical study (K.V.N.N.Jeyalath, P.M.E.K.Pathiraja 2004/05) shows that there exists a significant negative relationship between land size and productivity of coconut lands in Sri Lanka for home gardens and smallholders.

The literature (E.C.Mwachiro, R.W.Gakure, 2011)

Indicating that low prices of the coconut products, unclear legal framework, lack of proper markets, poor farming

method, low productivity and lack of financial support of the factors that hinder the indigenous community from benefiting from the coconut product in Kenya.

The purpose of this study was to evaluate the production and selected inputs such as fertilizer usage, research expenses and rainfall in Sri Lanka.

II. METHODOLOGY

A. Data collection

The secondary data were collected from the Central Bank Annual reports from 1994-2014, Coconut Research Institute of Sri Lanka and other sources such as economic review and magazines. The period covered from 1994-2014. Total coconut production was measured in metrics ("000"), usage of fertilizer also measured in metrics tons ("000"), research expenses measured in rupee value and rainfall was measured in terms of millimeter ("0000") in Sri Lanka.

B. Log-linear model (growth model)

The log linear model is one of the specialized model which used to identify the trend. So it is used to look the trend of the variable in this research study. The log linear model can be written as follows.

$$Y = \beta_0 + \beta_1 \ln X_1 + u \quad (1)$$

Where,

Y = Total coconut production

β_0 = constant variable

X_1 = year (time)

u = error term

C. Simple and Multiple regression Model (Cobb-Douglas production function)

The simple model explained the independent variables "contribution towards productivity. Multiple regressions was applied for in this study to measure or examine how the independent variables (rainfall, fertilizer and research expenses) are related to a dependent variable (coconut production). Cobb-Douglas production function is used to find out the important concepts of production.

The Cobb-Douglas production function model can be written as follows.

$$Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + u \quad (2)$$

Where,

Y = Total coconut production

β_0 = constant variable

X_1 = rainfall

X_2 = fertilizer

X_3 = research expenses

u = error term

The above Cobb-Douglas production function model Y is represent total output of coconut production as dependent variable, β_0 represent constant variable, X_1 , X_2 and X_3 are the inputs as independent variables rainfall,

from the government and financial institutions are some fertilizer and research expenses and finally u is error terms of the model.

III. RESULTS AND DISCUSSION

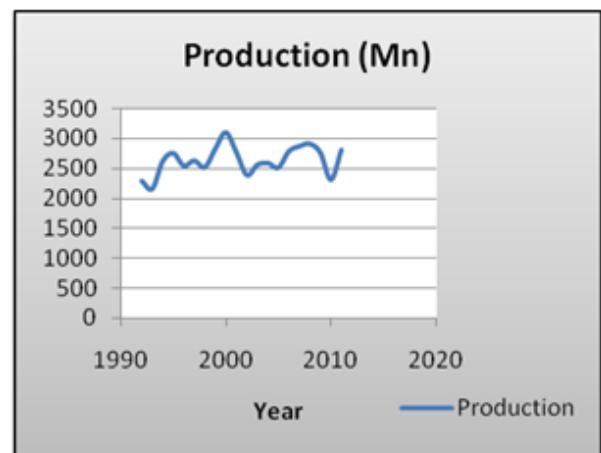


Figure 1. Trend of coconut production in Sri Lanka

The figure 1 shows that during the period of 1994-2014 productivity of coconut has fluctuated. The data varies within 2000 to 3000 within 25 years. The higher production reported in year 2000 and 3096 (Mn). There is a slight fluctuation throughout the period. Even if there is a slight decrease at the beginning, they were able to keep it above 2200 after that period. Even the graph reaches to its peak in the year 2000, after that the graph shows a downward trend.

A. The estimated Growth Model

$$Y = -9.766 + 0.005 \ln X_1 \quad (3)$$

$$Se = (6.659) \quad (0.003)$$

The estimated growth model shows trend of growth in coconut production and according to that coconut production has increased 0.5% from 1994-2014.

B. The estimated result of Simple regression models (Cobb-Douglas production function)

Relationship between rainfall and coconut production

$$Y = 0.962 + 0.01 \ln X_1 \quad (4)$$

$$Se = (0.039) \quad (0.077)$$

$$Sig = (0.000) \quad (0.902) \quad R^2 = 0.3$$

The above result shows that rainfall increase by one millimetre coconut production will increase by 1%. Further the coefficient of rainfall indicates that elasticity of coconut production with respect to the rainfall. But the rainfall is not statistically significant. The R^2 value represent that the 30% of the variation in production is explained by the rainfall.

Relationship between fertilizer and coconut production.

$$Y = 0.828 + 0.040 \ln X_1 \quad (5)$$

Se = (0.151) (0.044)

Sig = (0.000) (0.020) $R^2 = 0.4$

The above result shows as usage of fertilizer usage increase by one percentage coconut production will increase by 4%. Further the coefficient of fertilizer usage indicates that elasticity of coconut production with respect to the fertilizer usage. It has significant effect on coconut production. The R^2 value represent that the 40% of the variation in production is explained by the fertilizer.

Relationship Between coconut production and research expenses

$$Y = 0.589 + 0.041 \ln X_1 \quad (6)$$

Se = (0.202) (0.022)

Sig = (0.009) (0.040) $R^2 = 0.5$

The above result shows as usage of research expenses increase by one rupee coconut production will increase by 4.1%. Further the coefficient of money usage indicates that elasticity of coconut production with respect to the research expenses .Research expenses has significant impact on coconut production. The R^2 value represent that the 50% of the variation in production is explained by the research expenses.

C. The estimated multiple Cobb-Douglas production function

$$Y = -0.141 + 0.011 \ln X_1 + 0.118 \ln X_2 + 0.77 \ln X_3 \quad (7)$$

Se = (0.316) (0.061) (0.043) (0.023)

Sig = (0.661) (0.862) (0.014) (0.004) $R^2 = 0.7$

The above result shows as in multiple regression one percentage increase in rainfall induce coconut production by 1.1%, while other factor is constant. Increase the fertilizer by one percentage, coconut production will increase by 11.8% when other inputs are hold constant, And if research expenses increases by one percentage amount of coconut production will expand by 77%. Further the coefficients of Cobb-Douglas production function represent the elasticities of coconut production with respect to the rainfall, fertilizer and research expenses. Elasticity measures the extent to which the amount of coconut production changes following a change in inputs. The result shows that except rainfall other two explanatory variables are significantly affecting the coconut production. The R^2 value represent that the 70% of the variation in production is explained by the independent variables.

D. The result of ANOVA

TABLE 1. ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.066	3	.022	4.130	.024 ^a
Residual	.085	16	.005		
Total	.152	19			

The above table suggested that multiple Cobb-Douglas model is good fitted and it coefficient shows significant.

IV. CONCLUSION

The results emphasize the importance of inputs in coconut production. All the explanatory variables are individually influencing on coconut production significantly. According to the multiple function except rainfall other two explanatory variables are significant impact on coconut production. Government should protect the production of the small holding coconut production sector. Provide some promotion of coconut cultivation amongst small holding farmers. Government should provide subsidies to encourage the cultivators and have taken necessary action to promote the farmers to use organic fertilizer in coconut production. Government can arrange awareness program to encourage using organic fertilizer in the coconut production. And also government should give assurance to the producers to market their product.

REFERENCES

- [1] Abeywardana, V 1971 'Yield variations in coconut' Coconut Research Institute of Sri Lanka Ceylon Coconut Quarterly, vol.22, pp.97-103
- [2] Bardhan, P K 1973 'Size productivity and returns to scale' An Analysis of farm-level data in Indian agriculture. The Journal of Political Economy, vol.81(6), pp.1370-1386
- [3] Central Bank of Sri Lanka 2014. Annual Report, Colombo, Sri Lanka
- [4] Dissanayake, A M U 2005 'Progress of Coconut Cultivation 1962-2002' Department of Census and Statistics Colombo Sri Lanka.
- [5] Department of Census and Statistics 2011 'Coconut Extent 'Colombo, Srilanka.
- [6] Jayalath K V N N, Pathiraja P M E K, Jayasinghe-Mudalige U K, Fernando M T N 2006 'Effect of Land Size on Productivity of Coconut Cultivation in Sri Lanka' Second Symposium on Plantation Crop Research.
- [7] Mwachiro E C, Gakure R W 2011 'Factors Affecting the Coconut Industry from Benefitting the Indigenous Communities of Kilifi District, Kenya' International Journal of Humanities and Social Science, vol.1, pp.214-23

The role of Heuristics in Investment Decisions: An empirical assessment

A. Hanis Sultana¹, R Venkatapathy²

¹*Maulana Azad – Junior Research Fellow, Bharathiar School of Management and Entrepreneur Development, Bharathiar University, Coimbatore, TamilNadu, India.*

hanissultana1988@gmail.com

Bharathiar School of Management and Entrepreneur Development, Bharathiar University, Coimbatore, TamilNadu, India.

rvenkatapathy@rediffmail.com

Abstract— Decision-making from investment point of view is basically defined as a rational choice among alternatives or as the conscious selection of a course of action from available alternatives. Investors are also assumed to be a rational creature. The process of decision making in individuals is subject to various psychological changes, which therefore result in behaviour. Prior to decision making, individuals undergo with several cognitive and emotional illusions which may result in irrationality. Decision-making is required of everyone, but it is more complex in case of individuals. Individual's find numerous models in the extensive literature on decision-making with two basic assumptions based on Simon's work: First assumption that decision making is an orderly, rational process that possesses an inherent logic; and the second assumption that steps in the process follow one another with logical and sequential flow. A decision is the result of making a judgement or reaching a conclusion. In Heuristic decision making there is a lack of emphasis on hierarchical structure; role behaviour is characterized by freedom for every individual to explore all ideas. The emotional and social tone is relatively relaxed; openness, originality and seeking of consensus are the essentials of heuristic decision making. In a nutshell, it is a creative type of decision. When it comes to investment, heuristics - highly influences the decision making of individuals than ordinary decisions made by the investors. Hence, it is necessary to configure the influence of behavioural finance theory (heuristics) into individual investor decision making. This paper has attempted to find out the influence of heuristics using three dimensions considered as (behavioural dimensions) among PG final year students (potential investors).

Keywords—Heuristics, Behavioural Finance Theories, Decision making.

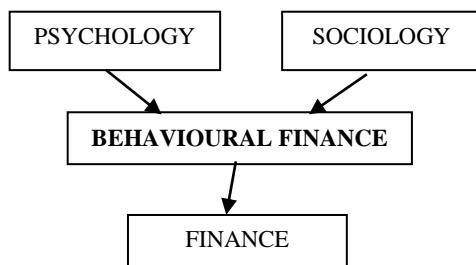
I. INTRODUCTION

Rational choice is basically arrived from Efficient Market Hypothesis (EMH) introduced by Markowitz (1952) and subsequently named by Fama in 1970, assumes that financial markets incorporate all public information and state that share prices reflect all relevant

information, which considers the market as a whole and considers investors to behave rationally while making decisions related to their investment. But in reality, individual's investment choices may be rational based on the market movements as stated in the EMH, their actual end result (behaviour) could be irrational because they undergo into several psychological transformations before they invest. Investing is a practice, where people believe investing will lead to definite gain for the future or some extra benefit out of capital (principle) invested in the form of equities, stocks, currencies etc., Individuals invest mainly for two reasons viz., either for the sake of return or for safety purposes. Return seeking investors looks for high return or normal return. Whereas, investors who invest for safety alone will aim for normal return or even low return. An investor firstly decides on, in what he invests (type of investment), then decides what for he invests (return or safety). Each and every step of investing requires variety of choices and reasons for choosing particular investment. These choices may be sometimes unique and most of the time investor's choice may also depend on others. The reason for choosing investment by investor may be because of variety of positive opinion/beliefs based on the benefit on that particular investment. After choosing and finding the reasons for appropriate investment is therefore end result (behaviour) of investor called decision or decision making.

Human decision making is a continuous process in which investments will lead to several cognitive and psychological illusions. These factors may result in irrationality, which may affect or influence decision making process of individuals. Cognitive illusions are due to thinking and analysing about the particular investment choice. This choice may vary or impact the actual decisions depending upon the emotional level of the individual. Emotional level of the individuals is not equal or same among the individuals. These emotional imbalances are due to psychological transformations.

This change and variation among the individuals (investors) can be studied using the behaviour of investors in stock market. This is formerly known as behavioural finance. Therefore, behavioural finance not only analyses the investor behaviour (investment pattern), it also aims on the psychological variations of the investors which lay outcome for their decisions with respect to their investments. The concept of behavioural finance can be understood from the underlying theories which built the foundation and intervention for the discipline.



Evolution of Behavioural Finance, Source: Schindler (2007)

Psychology: Individuals believe and prefer certain choices which may affect the individual decision.

Sociology: Large number of financial decisions is the outcome of social interaction rather than being made in isolation.

Bernstein(1998) says that the “evidence reveals repeated patterns of irrationality, inconsistency, and incompetence in the ways human beings arrive at decisions and choices when faced with uncertainty”. Behavioural finance extends this analysis to the role of heuristics in financial decision making, heuristics - simple rules of thumb (mental shortcuts) which makes decision making easier in terms of complex decisions. In other words, behavioural finance takes the insights of psychological research and applies them to financial decision-making.

Behavioural Finance: Traditional or conventional finance theories like Efficient Market Hypotheses (EMH) and Modern Portfolio Theory (MPT) focused on the rationale of the investors whereas, behavioural finance works on the actual behaviour (Irrationality) of the individual investors. Thus, Behavioural finance studies the psychology of financial decision-making. Most people know that emotions affect investment decisions. These emotions cannot be measured directly. It can be measured based on various approaches, behavioural aspects and underlying theories. These behavioural aspects are taken from various behavioural

factors and behavioural variables resulting in behavioural theories.

(Barber and Odean 1999) “Behavioural finance relaxes the traditional assumptions of financial economics by incorporating these observable, systematic, and very human departures from rationality into standard models of financial markets. The tendency for human beings to be overconfident causes the first bias in investors, and the human desire to avoid regret prompts the second”

Fathers of Behavioural Finance and their contribution to Behavioural Finance: Daniel Kahneman and Amos Tversky were recognised as the fathers of behavioural finance. Though, many literary works are carried out by them in behavioural finance, Kahneman and Tversky also focussed on different lines of research based on the normative theory. Their first contribution in behavioural finance titled “Belief in the law of small numbers” published in 1971 reported – ‘People have erroneous intuitions about the law of chance’. Followed by that in 1972 the paper concentrated on “Subjective probability: A judgement of representativeness”. In 1974, it paved the way for “Judgement under uncertainty: Heuristics and Biases” discussed on “Better understanding of the heuristics will lead judgement and could improve decisions in times of complexity (uncertainty).

Theories of Behavioural finance: In order to explain the irrational behaviour and inefficient markets, behavioural economists draw on the attention and knowledge of human cognitive behavioural theories which is derived from psychology, sociology and anthropology subsequently fall under two most important behavioural theories known as; Prospect and Heuristics theory.

Major interventions:

Daniel Kahneman (2002), studied human judgement and decision making under uncertainty.

Vernon Smith (1999) conducted experimental research on alternative market mechanism

History and Development

Most of the studies in behavioural finance talks about the investor behaviour analysing the investment pattern, which tells about their investment behaviour. But many authors have argued on investor irrationality (decision making) based on the heuristics theory.

Comprehensive Literature pool: Slovic, Fischhoff and Lichtenstein (1977), Sage (1981), Einhorn and Hogarth (1981), Pitz and Sachs (1984), Taylor (1984), Hogarth (1987), Dawes (1988), Yates (1990), Keren (1996), Crozier and Ranyard (1997), Pinker (1997), and Bazerman (1998) provide general coverage of the area. In addition, Tversky

and Kahneman (1974), Kahneman, Slovic and Tversky (1982), Evans (1989, 1992), Caverni, Fabre and Gonzalez (1990), and Sutherland (1992) added their contribution on decision biases. Wallsten (1980), Hogarth (1981), Berkeley and Humphreys (1982), March and Shapiro (1982), Anderson (1986), Keren (1990), Dawes and Mulford (1996), and Gigerenzer (1991, 1996) provide critiques of heuristics and bias theory. The position adopted in this report is that the biases documented in the studies referred to below indicate a predictable propensity of human decision makers towards irrationality in some important circumstances. While the nature of the underlying psychological processes that lead to biased behaviour is the subject of debate, the experimental findings on biases (decision process artefacts) show persistent biasing in laboratory studies. This behaviour has also been shown in many cases to generalise to real world situations albeit with reduced effect (e.g. Joyce & Biddle 1981). Bias generalisation remains an area in need of considerable research. But this present paper focuses on the positive relationship and impact on heuristics which results in decision-making.

Human Perspectives of making Decisions (Based on the literature survey)

Decision types	Approaches	Rationale	Meaning
Individual falls under certainty	Normative	Rationality	What the optimal choice or decision would be ?
Individual falls under uncertainty	Prescriptive		What people should do ? (Cognitive illusion)
Under Risk	Descriptive	Irrationality	What people actually do? (Psychological illusion)

II. REVIEW OF LITERATURE

Investor behaviour

Over the past fifty years conventional finance theories has assumed that investors have little difficulty in making financial decisions and are well-informed, careful and consistent. The traditional theory holds that investors are not confused by how information is presented to them and not swayed by their emotions. But reality does not match these assumptions. Behavioural finance has been growing over the last twenty years specifically because of the observation that investors rarely behave according to the assumptions made in traditional finance theory

Palanivelu & K.Chandrakuma (2013) highlights that certain factors of salaried employees like education level, awareness about the current financial system, age of investors etc. Make significant impact while deciding the investment avenues.

Sanjay Kanti Das (2012) summarized that the bank deposits remain the most popular instrument of investment

followed by insurance and small saving scheme to get benefit of safety and security of their life and investment. It was found that there is a need for increasing the financial literacy among the middle class households.

Giridhar Mohanta & Sathya Swaroop Debasish (2011) states that people were ready to invest in meeting their financial, social and psychological need. But the investor always had a mindset of safety and security, higher capital gain, secured future, tax benefit, getting periodic return or dividends, easy purchase and meeting future contingency.

Syed Tabassum Sultana (2010) concluded that individual investor still prefer to invest in financial products which give risk free returns. The study confirmed that Indian investors even if they are of high income, well-educated, salaried, and independent are conservative investors who prefer to play safe in the market.

Behavioural Finance and Decision making : (Thaler, 2005) Behavioural finance essentially tries to achieve is to supplement the traditional finance theories by merging it with cognitive psychology in an attempt to create a more complete model of human behaviour in the process of decision making.

Literature Review on Irrationality (Irrational Decisions):

Hoffmann, Shefrin and Pennings (2010) analyzed how systematic differences in investors 'investment objectives and strategies affect the portfolios. The data were obtained through an online questionnaire. It is found that investors who rely on fundamental analysis have higher aspirations and turnover, take more risks, are more overconfident, and outperform investors who rely on technical analysis. The findings provide support for the behavioural approach to portfolio theory and shed new light on the traditional approach to portfolio theory.

Chandra (2008) explored the impact of behavioural factors and investor psychology on their decision-making, and to examine the relationship between investor's attitude towards risk and behavioural decision-making. The research was based on the secondary data. The investment decision-making is influenced, largely, by behavioural factors like greed and fear, Cognitive Dissonance, heuristics, Mental Accounting, and Anchoring. These behavioural factors must be taken into account as risk factors while making investment decisions.

Heuristics:

"Heuristics are simple efficient rules of the thumb which have been proposed to explain how people make decisions, come to judgments and solve problems, typically when facing complex problems or incomplete information. These rules work well under most

circumstances, but in certain cases lead to systematic cognitive biases" – Daniel Kahneman (Parikh, 2011). Tversky and Kahneman identified the influence of human heuristics on the decision making process. Tversky defined heuristic as a strategy, which can be applied to a variety of problems, that usually—but not always—yields a correct solution. People often use heuristics (or shortcuts) that reduce complex problem solving to more simple judgmental operations (Tversky and Kahneman, 1981).

Heuristics and decision making

Heuristic principle is a method of decision making using rules of thumb, to find solutions or answers. Based on Simon's proposition, Stoner & Freeman (1992) mentioned that in most situations decision makers actually use simpler methods. In making decisions, individual tend to ignore the complicated methods and adopt less complex methods to speed up the process. As a replacement for the rational model, decision makers practically make their decision by applying alternative approaches, such as bounded rationality and rules of thumb called heuristics.

Potential Investors: The term potential derives the meaning, "having or showing the capacity to develop into something in the future". A potential investor is considered as having or showing the capacity to develop a thought of investing and their way of making decision which may result positive gain into something in the future. Here for the present study students are considered as potential investors

Research Questions:

1. Whether the students are potential investors?
2. Whether the students are really interested to invest for future?
3. Whether the students are aware of investment schemes irrespective of their education stream?
4. Whether the students will significantly differ with respect to gender with measured behavioural dimensions?
5. Whether the education stream significantly shows variation in behavioural dimensions?

In order to achieve the answers for above research questions, the following research objectives is been established to proceed with analysis and discussions.

Objectives

- To identify the potential investors among students.
- To measure the significant difference between gender and education stream with decision making dimensions.

Hypotheses:

To test the significant difference between gender and scores of behavioural dimensions the following null hypotheses has been formulated;

H_01 -There is no significant difference between gender and representativeness dimension.

H_02 -There is no significant difference between gender and overconfidence dimension.

H_03 -There is no significant difference between gender and anchoring dimension.

III. Methodology

This particular research paper is descriptive and explanatory in nature. It describes the theoretical concepts, conceptual definition, literature survey, research questions, objectives and methodology. It tries to explain the prior assessed attitude which may result in behaviour. It is designed to assess the potential individual investor's decision making approach towards one particular investment with the help of measured behavioural dimensions (Representativeness, Overconfidence and Anchoring). The respondents considered for the study are students (treated as potential investors) to achieve the research objective. With addition to that their awareness, preferences were also identified. The final year post graduate students belonging to Bharathiar University are considered as sample for the study. Questionnaires were distributed to 15 departments comprising of arts, science and social science. A total of 180 questionnaires were distributed out of which 168 are considered as usable for the further analysis after rejecting the unfilled responses. Systematic random sampling technique was adopted to get responses from target population. Every 2nd student from science stream, 4th student from arts and 6th student from social science stream are taken as respondents.

Instrumentation:

To measure the heuristics, in – depth literature pool was done to gather relevant work and research papers. Earlier scale development includes the following works. "The framing of decisions and the psychology of choice" developed by Tversky and Kahneman consisting of 4 constructs and 4 items measuring each construct includes the 16 items "The Development of the Heuristics and Biases Scale (HBS)" - 2013 developed by marcin skald and rene diekstra which consists of 40 items measuring the cognitive heuristics an education psychometric scale. In order to attain the above objectives the existing scales were adopted, modified and added a few items for ease of understanding and to fit in the present researcher's context. In order to assess the potential investor's influence towards behavioural dimensions, questionnaires were distributed to respondents and responses recorded using 4 points scale ranging from (Strongly Agree - 4, Agree - 3, Disagree - 2, Strongly Disagree - 1). The below table indicates the number of items/statements measured in

each dimensions. Reliability scores for each scale using cronbach's alpha method for representativeness, overconfidence and anchoring are .893, .900, and .683 respectively. Nunnaly (1978) has indicated 0.7 to be an acceptable reliability coefficient.

Table 1**Measured Dimensions:**

S.NO	Dimensions	Items		
		Positive	Negative	Total
1.	Representativeness Items (1-12)	10	2	12
2.	Overconfidence Items (13-22)	8	2	10
3.	Anchoring Items (23-12)	9	2	11
Total Items		33		

Judgement under Uncertainty:

Tversky and Kahneman (1974) identified the influence of human heuristics in the decision-making process. Tversky at el. Defined heuristic as a strategy that can be applied to a variety of problems and that usually, but not always yields a correct solution. People often use heuristics (or shortcuts) that reduce complex problem solving to more simple judgmental operations. Three of the most popular heuristics discussed by Tversky at el. include the following.

Representativeness heuristics:

Representativeness is “the degree to which an event is similar in essential characteristics to its parent population and reflects the salient features of the process by which it is generated” Representative Heuristic is a cognitive action in which an individual categorizes a situation based on a pattern of previous experiences or beliefs about the scenario.

Over Confidence heuristic:

People are poorly calibrated in estimating probabilities and usually overestimate the precision of their knowledge and ability to do well and about good things happening in future than bad. This theory summarizes how people form beliefs under uncertainty.

Anchoring heuristic:

People who make judgments under uncertainty use this heuristic by starting with a certain reference point (anchor) with little available information and then adjust it insufficient to reach a final conclusion i.e., decision. Studies done in this area are related to stock market behaviour. Some studies are contributed to find out the investment preferences, risk behaviour etc., Most of the studies are done using secondary data and experimental method. Major findings of these studies tell about investment behaviour and biases. Qualitative method has also followed to test the heuristics, the results of the previous work shows the negative effect (biases). But this paper is attempting to find the positive impact using the above

three dimensions which could directly measure the decision making of potential investors using 4 point scale.

Table showing the Mean and Standard Deviation for Behavioural Dimensions

S.No	Statements	Mean	S.D
1	I completely rely on expert's recommendations before investing	3.42	.542
2	I consider the information from my friends and relatives as reliable source for investment	3.42	.542
3	People believe investment with high sales growth yield higher earnings	3.37	.653
4	I avoid stocks with poor performance in the past	3.42	.542
5	The information i receive is accurate all the time	3.39	.579
6	I invest in stocks based on sturdy fundamental analysis	3.39	.578
7	I use past performance as an indicator for my investments	3.36	.604
8	<i>I give preference to my own choice for investing</i>	1.72	.895
	<i>I wont rely on others for my investment</i>	1.84	.918
10	I frequently have check with my investments	3.22	.822
11	My knowledge in investments is based on other's experience	3.21	.790
12	I react quickly to the changes of other investors' decisions	3.12	.860
13	My investment decisions are accurate all the time	3.22	.822
14	Due to my specific investment skills I earned adequate profit	3.21	.790
15	The return rate of my investment is usually higher	3.12	.860
16	I am conceit with past investment decisions	3.17	.848
17	Investing in equities always confer high return	3.09	.940
18	My investments choices are superior than others	3.10	.926
19	I am non - egoistic person	3.11	.905
20	My abilities in assessing the investment is always good	3.03	.905
21	I feel my choice of stocks are always good	2.93	.919
22	My confidence in choosing investments is bad	1.89	.892
23	I stick to stocks giving immediate return	3.13	.338
24	People add their own ideas with already available information about stock	3.12	.597
25	Most people invest in stocks based on the available information	3.32	.505
26	People do not access to the current financial information	2.32	1.016
27	While selling, i always keep price at which i bought the stock	3.30	.533
28	I follow other's reactions to the stock market.	2.27	1.054
29	My investment is based on my own knowledge and understanding	2.90	.616

30	Piece of information might influence my investment decision	2.99	.579
31	My idea of investing changes based on the information reliability	2.99	.609
32	Often people invest based on the intuitive assessment of information about stocks`	2.90	.596
33	People buy a stock which has high market growth at present	2.89	.579

Table 2.1 Demographic Characteristics

Gender	Frequency	Percent	Education Stream	Frequency	Percent
Male	80	47.6	Science	61	36.3
Female	88	52.4	Social Science	51	30.4
			Arts	56	33.3
Total	168	100.0	Total	168	100.0

Table 2.2 Investment awareness and preference

	Level of Awareness	Frequency	Percent
Awareness on Investment Schemes	Yes	95	56.5
	No	73	43.5
	Total	168	100.0
Preference of Tenure	Long term	90	53.6
	Short term	78	46.4
	Total	168	100.0
Awareness on Equity shares	Yes	120	71.4
	No	48	28.6
	Total	168	100.0

IV. RESULTS AND DISCUSSION

Table 3.1 Showing the Z – Scores of Representativeness Dimension

Gender	N	Mean	S.D	Z Score
Male	80	39.4250	5.52961	5.941
Female	88	34.5909	4.96340	

The above table 3.1 gives the z score of gender with behavioural dimension representativeness. The z score for the above tables is 5.941 which is greater than the critical ratio 1.96 at 5% confidence level. Hence H_{01} is rejected. Therefore, male and female are significantly differing in their opinion towards representativeness. Male group with mean value of 39.4250 have higher degree of representativeness compared to female group, which means male group depend more on others to make decisions relating to investments.

Table 3.2 Showing the Z – Scores of Overconfidence Dimension

Gender	N	Mean	S.D	Z Score
Male	80	32.6375	5.77477	5.842
Female	88	27.3636	5.91935	

The above table 3.2 gives the z score of gender with behavioural dimension overconfidence. The z score for the above table is 5.842 which is greater than the critical ratio 1.96 at 5% confidence level. Hence H_{02} is rejected. Therefore male and female are significantly differing in their opinion towards overconfidence. Male group with mean value of 32.6375 have higher degree of overconfidence compared to female group which means male are highly confident with their investment decisions compared to female respondents.

Table 3.3 Showing the Z – Scores of Anchoring Dimension

Gender	N	Mean	S.D	Z Score
Male	80	33.1750	2.96296	4.489
Female	88	31.1818	2.77321	

The above table 3.3 gives the z score for gender with behavioural dimension anchoring. The z score for the above is 4.489 which is greater than the critical ratio 1.96 at 5% confidence level. Hence H_{03} is rejected. Therefore male and female are significantly differing in their opinion towards anchoring. Male group with mean value of 33.1750 have higher degree of anchoring compared to female group, which means male group are more updated with recent information and they consider the updated and current information before they make decisions compared to female group.

Scope for further research:

This particular research paper focused on the behavioural dimensions such as representativeness, overconfidence and anchoring and its influence on decision making of students, who are considered as potential investors for the present study. The results are projected based on the responses, but these measured and calculated responses are not actual decisions. This paper work is carried out to see the difference of opinion based on the gender. In future it is necessary to study the actual behaviour (decision) with this prior assessed attitude (present work) and to make comparative study, to see the differences in decision making. In addition to that, stream of education and other demographic variables should also be considered. Some additional variables like personality traits and attitude towards risk will also influence the decision of the individuals. A further study can be carried out with the above combinations.

V. Conclusion

The present paper aimed at identifying the contribution, major interventions, theoretical perspectives and the influence of behavioural dimensions in decision making of individual investors. The preference of long term investments is found to be high among potential investors. This paper gives clear evidence that potential investors prefer long term investments, where the return is guaranteed with less risk, because they foresee the risk in advance. But in reality, the local investors may lack with analytical tools and they often undergo with rumours especially in short term investments. These behavioural dimensions have more impact on short term investments than long term investments. Hence this study is considered as initialisation, based on the findings to make further study as stated above in the scope.

REFERENCES:

- [1] Alghalith, M., Floros, C., & Dukharan, M. (2012). Testing dominant theories and assumptions in behavioral finance.
- [2] Ameriks, J., Wranik, T., & Salovey, P. (2009). Emotional Intelligence and Investor Behavior. CFA Institute.
- [3] Brown, M. G. (2008). Examining investor perceptions of obsolescence and value through a behavioural economics lens. <http://doi.org/10.1108/17539260810924436>
- [4] Cossio, M. L. T., Giesen, L. F., Araya, G., Pérez-Cotapos, M. L. S., VERGARA, R. L., Manca, M., ... Héritier, F. (2012). Emotional Intelligence and risk taking in investment decision-making. *Uma Ética Para Quantos?*, XXXIII(2), 81–87.
- [5] Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297–334.
- [6] Dittenhofer, M., & Dittenhofer, M. (1997). Behavioural aspects of internal auditing “ revisited .”
- [7] Herbert, W. E. (1996). PARADIGM IN ACCOUNTING AND FINANCE : THE CASE FOR RESPONSIVE.
- [8] Hoffmann, A. O. I., & Shefrin, H. (n.d.). Behavioural Portfolio Analysis of Individual Investors 1, 1–45.
- [9] Hong, H. (2007). Behavioural finance: Introduction. *European Financial Management*, 13(3), 389–393. Huyghebaert, N., & Hulle, C. Van. (2004). The Role of Institutional Investors in Corporate Finance, XLIX.
- [10] Iqbal, S., Hussain, N., Latif, M., & Aslam, S. (2013). Investor Type and Financial Market Anomalies : A Comparison of Individual, Institutional and Foreign Investors and Role of Their Behaviors in Investing Decisions, 17(11), Islam, S. (2012). Behavioural Finance of an Inefficient Market, 12(14).
- [11] Jains, D. (2010). “A Study on Impact of Market Movements on Investment Decision an Empirical Analysis” With Respect To Investors in Udaipur , Rajasthan
- [12] Kothari, H. (2013). Investors Behaviour Towards Investment Avenues: A Study With Reference To Indore City. *Altius.Ac.in*, 476–480. Retrieved from <http://www.altius.ac.in/pdf/76.pdf>
- [13] Kwong, C., Piers, D. J., & Jones-evans, D. (2012). Differences in perceptions of access to finance between potential male and female entrepreneurs
- [14] Lusardi, A., Mitchell, O. S., & Curto, V. (2010). Financial Literacy among the Young, 44(2), 358–380.
- [15] Maccowan, R. J., Orr, A. M., & Towler, C. (2012). A behavioural study of the decision processes underpinning disposals by property fund managers.
- [16] Mcnally, K., & Mcnally, K. (2012). Corporate venture capital .
- [17] Nunnaly, J. (1978). *Psychometric theory*. New York: McGraw-Hill..
- [18] Ritsatos, T., & Ritsatos, T. (2014). Tax evasion and compliance ; from the neo classical paradigm to behavioural economics , A review
- [19] Samantha, A., Irwin, M., Choo, K. R., Liu, L., Samantha, A., Irwin, M., Liu, L. (2012). Users who downloaded this article also downloaded : Modelling of money laundering and terrorism financing typologies.
- [20] Shamsadini, A. An Investigation of the relationship between aspects of behavioural finance and attitude of investors towards volatility of general index in Tehran Stock Exchange (TSE).
- [21] Sharma, A. J. (2014). Understanding Cognitive Dissonance-The Behavioural Finance Principle, 3(1).
- [22] Stanovich, K. E., Toplak, M. E., & West, R. F. (2008). THE DEVELOPMENT OF RATIONAL THOUGHT : I. Introduction II . Experimentally Tractable Definitions of Rational Thought. *Advances in Child Development and Behaviour*, 251–285.
- [23] Studies, E. (2012). Charles University in Prague Faculty of Social Sciences Institute of Economic Studies Role of Behavioural Finance in Portfolio Investment Decisions : Evidence from India.
- [24] Vekkila, J. (2014). Engaging and disengaging doctoral experiences in the behavioural sciences.
- [25] Vella, J., Caruana, A., & Pitt, L. F. (2013). The effect of behavioural activation and inhibition on CRM adoption.
- [26] Wilson, R. (1993). *Equity Finance of Economic Development : Feasibility and Ethical Desirability*

A Study on Financial Management Practices of the Small and Medium Enterprises in Kegalle District

Jayawardhana J.R.N.N

Department of Commerce, Eastern University, Sri Lanka

jrnirasha@gmail.com

Abstract— Small and Medium Enterprises (SMEs) are considered backbone of economic growth in all countries and Small and Medium Scale Enterprises make up a large part of Sri Lanka's economy, accounting for 80 percent of all businesses and currently, financial management is one of the challenges of SMEs. Combination of both insufficient knowledge of financial management and uncertainty of the business environment often leads SMEs to serious problems regarding financial performances. In this context, the research is carried to find the extent of financial management practices of small and Medium Enterprises in Kegalle district. Further, researcher aims to find out what extent the financial reporting and analysis is practiced, the working capital management is practiced, the financial planning and controlling is practiced in the Small and Medium Enterprises in Kegalle district and to investigate how does the usage of financial management practices vary with personal characteristics of the owner and business characteristics. Extent of the financial management practices are measured using three variables as financial reporting and analysis practices, working capital management practices and financial planning and controlling practices. Data were collected using structured questionnaires from 100 Small and Medium Enterprises Owners. According to the descriptive analysis, usage level of financial management practices is moderate level of the Small and Medium Enterprises in Kegalle district. Based on results of the ANOVA and independent sample t test, usage level of financial management practices are not varying with the type of the industry, age level of the business, gender of the owner, and level of profitability of the business. But, there are significant differences in usage level of financial management practices among age level of the owner and education level of the owner. Therefore in order to improve the usage level of financial management practices researcher recommends improving the knowledge regarding financial management to the business owners and high involvement of the Sri Lankan government to providing training programs through each division in Kegalle district.

Keywords — Financial Management Practices, Small and Medium Enterprises

I. INTRODUCTION

Financial management refers to the efficient and effective management of financial resources in such a manner as to accomplish the objectives of the organization. It is the specialized function directly associated with the top

management. It includes how to raise the capital, how to allocate it i.e. capital budgeting. Not only about long term budgeting but also how to allocate the short term resources like current liabilities. It also deals with the dividend policies of the share holders. It was a branch of economics till 1890. It has been defined differently by different experts in the field.

SMEs are privately owned and operated business. A small or medium business typically has a small number of employees. The definition for SMEs determined by the Department of small industries is Micro < 5 employees, Small 5- 29 employees, medium 30-149 employees and large 150 employees and above. Researcher carried out this survey based on that definition of SMEs throughout the Kegalle District.

Financial management practices in the SME sector have long attracted the attention of researchers in many other countries. Depending on different objectives, researchers emphasize different aspects of financial management practices. McMahon, Holmes, Hutchinson and Forsaith (1993) and McMahon (1998) summarize their review of financial management practices in Australia, UK and USA. In their review the context of financial management practices includes the following areas: Financial structure management, working capital management, financial reporting and analysis, accounting information systems, financial planning and controlling.

However, with the employment of financial management practices in Sri Lanka SMEs, the extent of the financial management practices which are practice among the Small and medium enterprises is still lack of investigation, especially for Kegalle District. And, most empirical evidence comes from the developed economies such as the United States of America (USA), the United Kingdom (UK), Canada and Australia. There seems to be a lack of evidence from developing countries, especially from Sri Lanka. Therefore, studying about the extent of financial management which is practiced among the SMEs in Kegalle District will have belief in increasing the effectiveness of financial management and be helpful in understanding the financial management of SMEs in Kegalle District.

Most SMEs have not appointed financial managers to be in charge of financial management of the company. Usually, the owner-managers with the assistance of the chief-accountant control financial matters of the company. However, most owner-managers have no formal training in management skills, especially financial management. So, currently, financial management is one of the challenges of SMEs. Combination of both insufficient knowledge of financial management and uncertainty of the business environment often lead SMEs to serious problems regarding

financial performances. In this context, the research problem for this study is defined as **“To what extent the financial management techniques are practiced among the small and medium Enterprises in Kegalle District?”**

Based on the research problem identified above and literature review the following research questions are raised for the study.

- i. To what extent the financial reporting and analysis is practiced in the Small and Medium Enterprises in Kegalle District?
- ii. To what extent the working capital management is practiced in the small and medium enterprises in Kegalle District?
- iii. To what extent the financial planning and controlling is practiced in the Small and Medium Enterprises in Kegalle District?
- iv. How does the usage of financial management practices vary with personal characteristics of the owner and business characteristics?

II. LITERATURE REVIEW

McMahon et al. (1993) defines financial management based on mobilizing and using sources of funds: Financial management is related to raising the funds needed to finance the enterprise's assets and activities, the allocation of these scarce funds between competing uses, and with ensuring that the funds are used effectively and efficiently in achieving the enterprise's goal. According to Meredith (1986) financial management is one of several functional areas of management but it is the central to the success of any small business.

McMahon, Holmes, Hutchinson and Forsaith (1993) and McMahon (1998) summarize their review of financial management practices in Australia, the UK and the USA. In their review the context of financial management practices includes the following areas:

Financial reporting and analysis – the nature, frequency and purpose of financial reporting, auditing, analysis and interpretation of financial performance

Working capital management – non-financial and financial considerations in asset acquisition, quantitative techniques for capital project evaluation, investment hurdle rate determination and handling risk and uncertainty in this context

Financial structure management – financial leverage or gearing, accounting to lenders, knowledge of sources and uses of finance, non-financial and financial considerations in financial structure decisions and non-financial and financial considerations in profit distribution decisions

Financial planning and control – financial objectives and targets, cost-volume-profit analysis, pricing, financial budgeting and control, and management responsibility centers

Accounting information systems – the nature and purpose of financial records, bookkeeping, cost accounting, and use of computers in financial record keeping and financial management

III. THE RESEARCH MODEL

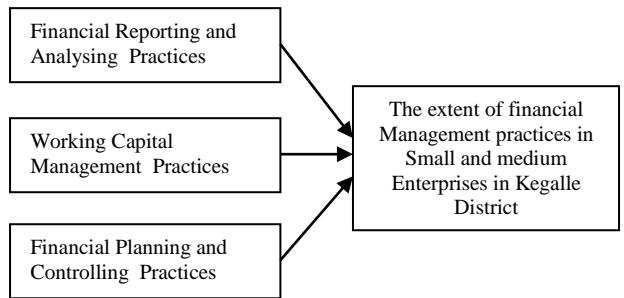


Figure I. Conceptual Framework of the study

IV. METHODOLOGY

As the data for this study was collected at a single point of time, the study was cross – sectional in the time horizon. Population consisted of SME owners from multiple businesses located across the Kegalle District, and the survey was carried among the sample of 100 SMEs owners from multiple firms located across the Kegalle District who were selected randomly on a Random Sampling basis. The data required to conduct the research were collected by questionnaires. These questionnaires consisted of 34 questions. The first 06 questions were designed with Nominal Scale and second 28 statements were designed with Five point Likert Scales to measure the various variables and dimensions in the research model.

The Univariate Analysis, Cross Tabulation Analysis, one way ANOVA testing and independent sample t testing were applied as the techniques to analyze and evaluate the data collected using the software SPSS version 19.

TABLE I. DECISION CRITERIA FOR USAGE LEVEL OF FINANCIAL MANAGEMENT PRACTICES

Range	Decision attributes
$1 < X \leq 2.5$	Low level of financial management practices
$2.5 < X \leq 3.5$	Moderate level of financial management practices
$3.5 < X \leq 5$	High level of financial management practices

Table I shows the decision criteria for measuring the level of financial management practices.

The Univariate Analysis was made to find out the mean and standard deviation for the each and every variable. Cross Tabulation Analysis examining relationship between two categorical variables by cross tabulating its set of values with other variables. ANOVA test were used to analyse usage level of financial management practices by age level of the owner, education level of the owner, type of industry, and age level of the business. If the p value is less than or equal to α level (0.05) for this test, then reject the H_0 that the variances are equal. If the p value is greater than α level for this test, then fail to reject H_0 , which increases our confidence that the variances are equal and the homogeneity of variance assumption has been met. The difference between gender and level of profitability with financial

management practices were analyzed by using independent sample t test using same decision criteria in ANOVA.

V. ANALYSIS AND FINDINGS

The inter item consistency reliability was examined with Cronbach's Alpha test.

TABLE II. CRONBACH'S ALPHA COEFFICIENTS

Instruments	Cronbach's Alpha
Financial Reporting and Analysis practices	0.916
Working Capital management practices	0.840
Financial Planning and controlling Practices	0.885

The results of Cronbach's alpha test are given in the table II, which suggests that the internal reliability of each instrument is satisfactory.

TABLE III. RESULTS OF THE NORMALITY TEST

	Kolmogorov-Smirnova	Shapiro-Wilk Sig.
Financial Reporting and analysis practices	.200*	.072
Working Capital Management Practices	.200*	.220
Financial Planning and Controlling practices	.200*	.072
Financial Management Practices	.200*	.677

According to the data of the Table III, all the variables are distributed normally.

According to the table IV, mean value of the financial management practices 2.8528 reflects moderate level of financial management practices among small and medium business owners in Kegalle district. The standard deviation of financial management techniques is 0.68805 and it shows how much dispersion of data from mean. That is, average level of financial management practices can be varied within the range of 2.16 and 3.54.

TABLE IV. MEAN AND STANDARD DEVIATION OF FINANCIAL MANAGEMENT PRACTICES

Measure	Mean	Standard Deviation	Maximum	Minimum
Financial Management Practices	2.8528	0.68805	4.57	1.00

Table V shows that, average level of Financial Reporting and analysis practices is 2.7471 and it can vary by 0.97164. When considering the mean values of dimensions and indicators of financial reporting and analysis practices, there is moderate level of financial statement preparation, analyzing financial statements and use of financial statements for decision making. But, financial statement interpretation is in the low level. However, *average level of financial reporting and analysis practices of small and medium enterprises in Kegalle district is moderate level*. Maintaining their financial records for a week or month by owner is the normal practice among many small businesses and normally they have low level of involvement for interpret those statements. Only 8 outside accountant and 13

in house book keepers are assigned to those activities out of 100 small and medium enterprises. That is a problem face by the small and medium enterprises due to lack of financial resources, human resources, and low level of knowledge regarding the financial reporting and analysis practices of the owner.

TABLE V. MEAN AND STANDARD DEVIATION OF FINANCIAL REPORTING ANALYSIS PRACTICES

Dimension/Indicators	Mean	Standard deviation
Preparation of Financial Statements	2.8833	1.00546
Interpretation of Financial statements	2.4500	1.18386
Analyzing the financial Statements	2.6250	1.06689
Use of financial statements for decision making	2.8800	1.09434
Overall Financial Reporting and Analysis	2.7471	0.97164

According to the table VI, average usage level of working capital management practices is 2.8412 and it can vary by 0.61664. The point should be discussed is the level of application of cash management theories, Receivable management theories and inventory management theories in determining those balances. That indicates that lack of knowledge about theories regarding cash management, Receivable management and inventory management among small and medium business owners. However, *usage level of overall working capital management practices of small and medium enterprises is moderate (2.8412)*.

TABLE VI. MEAN AND STANDARD DEVIATION OF WORKING CAPITAL MANAGEMENT

Dimension/Indicators	Mean	Standard Deviation
Cash Management Practices	2.8440	0.62382
Receivable Management Practices	2.9433	0.62382
Inventory Management Practices	2.7160	0.71587
Level of Working Capital Management practices	2.8412	0.61664

As shown in the table VII, *usage level of financial planning and controlling practices is in moderate level*. All indicators of financial budgeting have moderate level of usage. This level should be improved. Because of, high level of financial planning and controlling practices are essential for the success of the small and medium enterprises.

TABLE VII. MEAN AND STANDARD DEVIATION OF FINANCIAL PLANNING AND CONTROLLING PRACTICES

Dimension/ Indicator	Mean	Standard Deviation
Financial budget	2.9700	0.98653
Level of Financial Planning and Controlling Practices	2.9700	0.98653

ANOVA test and t test

ANOVA test was used to test with respect to the effect of personal factors (except gender) and business characteristics (except level of profitability) on usage level of financial management practices.

Independent sample t test was used to test the effect of gender and level of profitability on usage level of financial management practices.

Table VIII indicates that usage level of financial management practices are not varying with the type of the industry, age level of the business, gender and level of profitability. But, there are significant differences in usage level of financial management practices among age level of the owner and education level of the owner.

TABLE VIII. RESULTS OF THE ANOVA TEST FOR PERSONAL FACTORS AND BUSINESS CHARACTERISTICS

Factor Practices	Age Level	Educa tion Level	Type of the indust ry	Age of the busines s	Gen der	Level of profita bility
P value						
Financial Reporting and Analysis	.053	.000	.393	.861	.780	.737
Working capital Management	.287	.009	.788	.245	.771	.183
Financial planning and controlling	.048	.535	.782	.622	.045	.167
Financial management practices	.025	.009	.595	.728	.478	.436

Table IX shows that the variable financial reporting & analysis practices and working capital management practices for male owners have a higher mean values (2.7657 and 2.8517 respectively) than the female owners (2.6914 and 2.8100 respectively) and it indicates usage of financial reporting & analysis practices is high among the male owners comparatively to the female owners , and for the financial planning and controlling practices female owners have higher mean value (3.3120) than male owners (2.8560) by indicating high usage of financial planning and controlling practices among the female owners comparatively to the male owners. However, when take the overall financial management practices; female owners have higher mean value (2.9378) than male owners (2.8245). That indicates average usage level of financial management practices is higher among the female owners than among male owners.

TABLE IX. MEAN COMPARISON OF GENDER AND LEVEL OF FINANCIAL MANAGEMENT PRACTICES

Gender of the Owner		Financial Reporting and analysis practices	Working Capital Management Practices	Financial Planning and Controlling practices	Financial Management Practices
Male	Mean	2.7657	2.8517	2.8560	2.8245
Female	Mean	2.6914	2.8100	3.3120	2.9378

When considering the results of the independent sample t test, it shows there is no significant difference in usage level of financial reporting & analysis practices, working capital management practices, or usage level in overall financial management practices between the male and female owners and only there is significant differences in usage level of financial planning and controlling practices by gender of the owner. It indicates that, usage level of financial management practices are significantly not varying with the gender of the owner.

Table X shows that the variable of financial reporting and analysis practices, working capital management practices, financial planning and controlling practices and overall financial management practices for age group below 30 owners have a higher mean values (3.3061, 3.1071, 3.3571, and 3.2568 respectively) than other age levels. That indicates that young business owners are more considering about financial management than others.

TABLE X. MEAN COMPARISON OF AGE LEVEL AND LEVEL OF FINANCIAL MANAGEMENT PRACTICES

Age Level f the Owner		Financial Reporting and analysis practices	Working Capital Management Practices	Financial Planning and Controlling practices	Financial Manageme nt Practices
Below 30	Mean	3.3061	3.1071	3.3571	3.2568
30-34	Mean	2.5714	2.6667	3.0333	2.7571
35-39	Mean	2.8571	2.8496	3.1813	2.9627
Above 39	Mean	2.5272	2.7961	2.6619	2.6617

When take the results of ANOVA test and hypothesis testing, there is no significant different in usage level of financial reporting and analysis and working capital management by age level of the owner (P values 0.53 and 0.287). But, there is significant different in usage level of financial planning and controlling practices by age level of the owner according to the 0.048 p value. However, there is a significant different in usage level of overall financial management practices by age level of the owner. That indicates that, *usage level of financial management is varying by the age level of the owner.*

According to the table XI, When compare with educational levels *owners who are having higher education level use high level of financial management techniques.* Because of, owners who are educated with any other diploma/ degree have high mean values for financial reporting and analysis practices, working capital management practices, financial planning and controlling practices, and financial management techniques as 3.3401, 3.1458, 3.0857, and 3.1906 respectively.

TABLE XI. MEAN COMPARISON OF EDUCATION LEVEL AND LEVEL OF FINANCIAL MANAGEMENT PRACTICES

Education Level of the Owner		Education Level of the Owner	Working Capital Manageme nt Practices	Financial Planning and Controlling practices	Financial Manageme nt Practices
Below GCE O/L	Below GCE O/L	2.2679	2.7474	3.0333	2.6829
GCE O/L	GCE O/L	2.4286	2.5250	2.6800	2.5445
GCE A/L	GCE A/L	2.9020	2.9036	3.0229	2.9428
Education Level of the Owner	Education Level of the Owner	3.3401	3.1458	3.0857	3.1906

When considering the ANOVA test, there is no significant difference in usage level of financial planning and controlling practices by educational level based on 0.535 p value. But, there are significant differences in usage level of financial reporting & analysis practices, working capital management and in usage level of overall financial management techniques with p values of 0.000, 0.009 and 0.009 respectively. That indicates that *usage level of financial management techniques are varying with the education level of the owner of the small and medium enterprises.*

TABLE XII. MEAN COMPARISON OF TYPE OF THE INDUSTRY AND LEVEL OF FINANCIAL MANAGEMENT PRACTICES

Type of the Industry		Financial Reporting and analysis practices	Working Capital Management Practices	Financial Planning and Controlling practices	Financial Management Practices
Manufacturing	Mean	2.4571	2.6938	2.8400	2.6636
Beverage food & Tobacco	Mean	2.9610	2.8693	3.0182	2.9495
Textiles and foot wear	Mean	3.0417	2.8750	3.0833	3.0000
Hotels and travel	Mean	2.5714	2.7831	2.8588	2.7378
Services	Mean	2.7857	2.8828	2.8125	2.8270
Others	Mean	2.6429	3.0208	3.2833	2.9823

According to the table XII, average usage level of financial reporting and analysis practices is high in the industry of textiles and foot wear (3.0417) and average usage level of the working capital management practices (3.0208) and financial planning and controlling practices (3.2833) are high in the industry type categorized as others. However, overall financial management techniques are high with the mean value of 3.0000 in textiles and foot wear industry.

When considering the results of the ANOVA test, there is no significant difference in usage level of financial reporting and analysis practices, working capital management practices, financial planning and controlling practices and usage level of overall financial management techniques by type of the industry. (P values are 0.393, 0.788, 0.782 and 0.595 respectively). Those results indicate usage level of financial management techniques is not varying by the type of the industry of the small and medium enterprises in Kegalle district.

TABLE XIII. MEAN COMPARISON OF AGE OF THE BUSINESS AND LEVEL OF FINANCIAL MANAGEMENT PRACTICES

Age of the business		Financial Reporting and analysis practices	Working Capital Management Practices	Financial Planning and Controlling practices	Financial Management Practices
Less than 2 years	Mean	2.9286	2.9955	3.2143	3.0461
2-5 Years	Mean	2.6327	2.8929	2.9571	2.8276
6-10 Years	Mean	2.7073	2.6936	3.0146	2.8052
More than 10 Years	Mean	2.7696	2.9435	2.8065	2.8399

According to the table XIII, when take mean value of the variable of financial reporting and analysis practices, working capital management practices, financial planning and controlling practices and overall financial management practices is high in the small and medium enterprises which are operated since less than 2 years (2.9286, 2.9955, 3.2143 and 3.0461 respectively).

When considering the results of ANOVA test, there is no significant difference in usage level of financial reporting and analysis practices, working capital management practices, financial reporting and analysis practices and usage level of financial management practices by age level of the small and medium enterprises in Kegalle district with the p values of 0.861, 0.245, 0.622 and 0.728 respectively for each practice. That is *usage level of financial management practices is not varying by age level of the business.*

TABLE XIV. MEAN COMPARISON OF LEVEL OF PROFITABILITY OF THE BUSINESS AND LEVEL OF FINANCIAL MANAGEMENT PRACTICES

Level of Profitability		Financial Reporting and analysis practices	Working Capital Management Practices	Financial Planning and Controlling practices	Financial Management Practices
Profitability	Mean	2.7604	2.8789	2.9979	2.8791
Not Profitability	Mean	2.4286	1.9375	2.3000	2.2220

Table XIV shows that, when take the mean values of financial reporting & analysis practices, working capital management practices, financial planning and controlling practices and financial management practices, profitable business have high mean value than not profitable business.

When considering the results of independent sample t test, there is no significant differences in usage level of financial planning and controlling practices, financial reporting and analysis practices, working capital management practices and usage level of overall financial management practices by level of profitability of the business. That indicates *usage level of financial management practice is not varying by level of profitability of the business.*

VI. CONCLUSION

Based on the findings, specially highlighted point is a low level of theoretical knowledge of owners about financial management techniques. Based on these research findings, conclusion and researcher's experience throughout this research the researcher highly recommends to small and medium enterprises owners to obtain theoretical and practical knowledge about financial management by referring various source such as books, workshops, internet or through social relationships.

Since Small and Medium Enterprises continue to play important roles in developing the multi.-sector economy, government should implement policies to promote and support development of Small and Medium Enterprises. Government policies will be more effective

if the policy makers understand current practices of financial management of Small and Medium Enterprises. Based on the descriptive findings of financial management practices of SMEs in the survey,

This study recommends the government policy makers to formulate their policies in relation to providing training programs or workshops regarding financial management to the small and medium enterprises. This recommendation can be easily implemented through the development division in each divisional secretariat office in the Kegalle district.

REFERENCES

[1] Ang, J. S. (1992) *The theory of finance for privately held firms*, The Journal of Small Business Finance.

[2] Back, D (1985) *Success in Small Business and the Role of the Financial Adviser*, Longman Professional, Sydney.

[3] Belt, B. and Smith, K. V. (1992) *Recent changes in working capital management practices*, Midwestern Journal of Business and Economics

[4] Blinder, A. S. and Maccini, L. J. (1991) *The Resurgence of Inventory Research: What Have We Learned*, Journal of Economic Survey

[5] Burns, R. and Walker, J. (1991) *A survey of working capital policy among small manufacturing firms*, The Journal of Small Business Finance

[6] Deloof, M. (2003) *Does Working Capital Management Affect Profitability of Belgian Firms*, Journal of Business, Finance and Accounting.

[7] Elliehausen, G. E., and Wolken, J. D (1993) *The Demand for Trade Credit: An Investigation of Motives for Trade Credit Use by Small Businesses*, Working Paper: The Federal Reserve Board. English,

[8] J. W. (1990) *Small Business Financial Management in Australia*

[9] Fazzari, S. M. and Petersen, B. (1993) *Working Capital and Fixed Investment: New evidence on Financing Constraints*, Rand Journal of Economics

[10] Khoury, N. T., Smith, K. V. and MacKay, P. I. (1999) *Comparing working capital practices in Canada, the United States, and Australia*, Canadian Journal of Administrative Sciences.

[11] Kieu, M. N. (2004) *Financial Management and Profitability of Small and Medium Enterprises*. McMahon, R. G. P. (1995) *Financial Management for Small Business*, CCH Australia.

[12] McMahon, R. G. P. (1998) *Business growth and performance and the financial reporting practices of Australia manufacturing SMEs*, Doctoral Thesis: the University of New England, NSW, Australia

[13] McMahon, R. G. P. and Holmes, S. (1991) *Small business financial management practices in North America*, Journal of Small Business Management

[14] McMahon, R. G. P. and Stanger, A. M. J. (1995) *Understanding the Small Enterprise Financial Objective Function, Entrepreneurship: Theory and Practice*.

[15] McMahon, R. G. P., Holmes, S., Hutchinson, P. J. and Forsaith, D. M. (1993) *Small Enterprise Financial Management: Theory and Practice*, : Harcourt Brace, Sydney

[16] Meredith, G. G. (1986) *Financial Management of the Small Enterprise*, : McGraw- Hill, Sydney, New South Wales

[17] Paramasivan, C. and Subramanian, T. (2009) *Financial management*, : New Age International (P) Ltd., Publishers.

[18] Pell, M. J. and Wilson, N. (1996) *Working capital and financial management practices in the small firm sector*, International Small Business Journal

[19] Rajesh, K. S., Suresh, K. G. and Deshmukh, S. G. (2008) *Strategy development by SMEs for competitiveness*, An International Journal.

[20] Ray, G. and Hutchison, P. J. (1983) *The financing and financial control of small enterprise development*, : Gower Publishing, Aldershot, England.

[21] Shin, H. H. and Soenen, L. (1998) *Efficiency of Working Capital and Corporate Profitability, Financial Practice and Education*.

[22] Thomas, J. and Evanson, R. V. (1987) *An empirical investigation of association between financial ratio use and small business success*, Journal of Business and Accounting.

[23] Walker, E. W. and Petty, J. (1978) *Financial differences between large and small firms*, Financial Management.

[24] Weston, J. F. and Brigham, E. F. (2005) *Intermediate Financial Management*, The Dryden Press.

[25] Whited, T. M. (1992) *Debt, Liquidity Constraints, and Corporate Investment: Evidence from Panel Data*, Journal of Finance.

Relationship between Education and Poverty

Jeyapraba Suresh*¹

*Senior Lecturer, Department of Economics, Eastern University, Sri Lanka

¹pjpraball@yahoo.com.au

Abstract— The study mainly focuses on the relationship between education and poverty. Endogenous growth theories recognize that education plays an important role in the formation of human capital, and investment in human capital has a significant effect on economic growth (Melike, 2005). While education contributes to economic growth, its contribution to an individual's welfare is much more important. Thus, to what extent does education increase income and reduce poverty?. Put another way, Tilak(2002) indicates by citing Galbraith (1994) "there is no poor among well-educated literate population and no non- poor among illiterate population". Hence, Causality works both ways between poverty and education. Poor are more likely to be less educated because of many reasons such as lack of finances, poor home environment, lack of parental education and poor educational system. The study used the most recently available unit level household consumption survey data (Household Income and Expenditure Survey 2012/13) of Sri Lanka to assess the factors associated with an individual being poor and being less educated. Descriptive statistics and different measures of poverty suggest that the less educated are more likely to be poor. The marginal effect of logistic regression results also reports that low education has a positive and significant relationship to poverty while more educated being less likely to be poor. The findings of the study, as well as those of previous studies, suggest that policy makers would first need to concentrate on improving poor households' access to better education.

Keywords— education, human capital, poverty, poor.

I. INTRODUCTION

Poverty in a broader sense is defined as a lack of wellbeing. Conventionally, wellbeing has been described as a monetary phenomenon, meaning a lack of income or resources to fulfil the basic needs of the household. Later, with the capability approach of Amartya Sen, the concept of poverty became multi dimensional. It includes various dimensions and indicators to cover all aspects of deprivation among the poor. Low educational attainment is often associated with poverty because people with little education are less likely to be employed, are less productive and less able to earn sufficient income (Mtey and Sulle, 2013). This is explained by human capital theory which sees education as being positively correlated with earnings as education provides skills and knowledge and improve the productivity of the individual (Schultz, T. W.; 1961, Blaug, 1972; Boeri and Ours, 2008). On the other hand, lack of income, child labour, lack of parental education, poor educational system, unfavourable home environment and violent conflict are associated with poverty who are less likely to be more educated. Poverty in Sri Lanka had been high and widespread over a long period.

It was 26percent when the Millennium Development Goals agenda was formulated in 2000. Now, however, Sri Lanka has been termed an "Early achiever" for achieving MDG targets, including recording a national poverty rate of 6.7 per cent in 2013 (Department of Census and Statistics, 2015). Education in Sri Lanka also has been placed in a better position compared to other developing countries. Sri Lanka's literacy rate was on average 92.5 percent and it was 93.5 percent for males and 91.6 per cent for females in 2014 (Central Bank of Sri Lanka, 2014). Moreover, 98.77 percent of children ages 5-14 were enrolled school in 2013. The government of Sri Lanka also prepared a "New Educational Policies and Proposals for General Education in Sri Lanka" in 2013 to enhance the quality of education service.

The rest of the paper is organized as follows: Section II is devoted to the theory and empirical evidence. Methodology, including types of data, data sources and analytical techniques, is explained in Section III. Section IV describes the main findings of the empirical analysis, and lastly Section V discusses conclusions and policy implications arising from the study.

II. THEORY AND EMPIRICAL EVIDENCE

The impact of education is largely works through the labour market. The more educated are also more likely to work (Fulford, 2014). This is because education is an important determinant of the probability of finding a job. Educated workers enjoy three basic benefits in the labour market compare to less educated workers; they enjoy a higher wage, greater upward mobility in income and occupation, and greater sustainability of employment (Mincer, 1991). There is a substantial difference in employment rate between better educated and less educated. For example, Boeri and Ours (2008) present employment rates relative to educational attainment in OECD countries and show that the employment rate increases with the level of education. For example, the individual who has completed less than upper secondary education has 27.3 percent of employment rate compared to 88.2 per cent employment rate among who has completed tertiary education in Slovak Republic which has the biggest gap between better educated and less educated. Education also lowers the risk of unemployment. McIntosh(2008) presents the unemployment rates relative to educational attainment in OECD countries and clearly shows that unemployment rates are higher among the less educated and lower among the better- educated. There is a significant difference in the unemployment rate observed between less educated and the better educated in Eastern European countries while the difference is far less marked in Western Europe. McIntosh(2008) also argues that the less educated are more likely to be unemployed because higher skilled workers can do both low skilled and high skilled work unlike the skilled who low, can only do low skilled work. So

when firms need to reduce the labour force, they will release the low skilled employees who will become unemployed.

Poverty is largely prevalent among people who are less educated. Tilak(2002) cites Galbraith (1994) in arguing that there is “no well educated literate population that is poor, and there is no illiterate population that is other than poor” (pp. 199). Several empirical studies have found significant differences in education between the poor and non-poor. For instance, Datt et al.(2001) found the average years of schooling for the poor people was 4.4 while the non-poor have attended school 7.0 years on average in Egypt. Meanwhile in Egypt, 66.5 per cent of the non-poor could read and while only 48.4 per cent of the poor could read. Using Ethiopian household data for the years 1994, 1995 and 1996, Girma and Kedir(2005) reported that the poor benefit more from education than the rich. Their quantile regression estimates found that the return to education is more than 10 percentage points higher at the 25th quantile than the returns to education at the 90th quantile.

Robust empirical evidence of negative relationship between poverty and education in Fiji is found in the study by Gounder(2013) who used Household Income and Expenditure survey of 2002/2003 to show that the coefficient on education was significant and negative to the probability of being poor. He further suggested that higher levels of education appear to support agricultural growth in rural areas in Fiji. Apata et al.(2010) found that better education improves the incomes of the rural people who are mostly dependent on agriculture in Nigeria as it helps them access and conceptualize information about good farming methods. Education also helped them to access better paying rural job. Using Pakistan Integrated Household Survey of 2001/02 and Pakistan Social and Living standards Measurement Survey of 2004/05, Hyder and Sadiq (2010) found that education significantly decreases the odds of being poor and extremely poor in Pakistan. Awan et al. (2011) also used the same data and found that the attainment of middle, matriculation, intermediate and bachelor or professional level of education decreases the likelihood of being poor compared to the primary level of education.

In Sri Lanka, De Silva (2008) used Sri Lanka Integrated Survey (SLIS) of 2000, found that the probability of being in poverty to decline monotonically with years of education. The probability of being in poverty was 43 per cent for household with no schooling while it was only 5 per cent for household with tertiary education. Ranathunga (2010) used the 2006/07 Household Income and Expenditure Survey (HIES) data, to show that as the number of years of schooling increases, it reduces the probability of an individual being poor. This was found to be the case in all residential sectors in Sri Lanka. In fact, the study revealed significant negative correlation between poverty and all education related variables such as education level of head of the household, education of the spouse and the highest education level of the other family member. Applying logistic regression analysis to data from HIES 2009/10 Gunatilaka(2014) found the marginal effects of all levels of education were statistically significant and strongly suggested that better education reduces the likelihood of being poor.

The empirical literature also identifies the reasons why poor people are more likely to be less educated. Poverty is associated with the lack of income, child labour, lack of parental education, poor educational system, unfavourable home environment and violent conflict all of which factors are associated with a lower likelihood of being educated. Income poverty affects every aspect of children’s education. Poor children understand the real cost of schooling and how their parents struggle to pay even small amounts for their education. Therefore, poor children are more aware of the difficulties of life, and how to obtain food, clothing and housing and are less focused on education at school compared to affluent children (Horgan, 2009). Direct costs related to education include school fees, cost of uniform, books, stationary and transport and are barriers to school enrolment and investment on human capital for poor children (Arunatilake, 2006; Borkum, 2012). Even though some countries provide free education, in many developing countries, education is a private good. For example, Nigeria has a policy of free education and no tuition fees are levied in public schools at the primary school level. Nevertheless, parents still have to pay for textbooks and school uniforms (Ogundari and Abdulai, 2014). In addition, low rates of participation in school, high rates of school dropout and low performance are common among poor children due to their income poverty (Tilak, 2002; Ranasinghe & Hartog, 2002). For example, an earlier EFA Global Monitoring Report (2007) reported that only 23 per cent of the children out of school were from the richest 20 percent of households, while it was 77 per cent among the poorest 20 per cent in the sample of 80 developing countries. Primary attainment among the poorest household in Nigeria fell from 35 per cent in 2003 to 22 per cent in 2013 (EFA, Global Monitoring Report, 2015). Knight et al.(2009) used China’s National Household Survey for 2002 to show that low income and credit constraints are adversely affect the completion of middle school and reduce the chances of continuing high school. Using the data from the Nigeria Living Standards Survey (NLSS) of 2003/ 2004, Ogundari and Abdulai (2014) found that household income increases the probability of spending on schooling, indicating that wealthier households are more likely to send their children to school.

III. METHODOLOGY

The study is based on Household Income and Expenditure Survey (HIES) of 2012/13 conducted by the Department of Census and Statistics(DCS), Sri Lanka. It is a nationally representative survey that includes all administrative districts of the country. The total sample of the survey is 20540 households. The poverty line (calculated by DCS based on real per capita consumption expenditure) is Rs. 3624, and is used throughout this analysis as the cut-off to define the poor. Household expenditure data was adjusted for spatial differences in the cost of living by using the district-wise Laspeyres price index for 2012/13 developed by the Department of Census and Statistics based on the same survey data set.

The study is interested in individual welfare, but since consumption expenditure is calculated according to household, the equivalent scale that the study uses to determine a household is poverty based on per capita

consumption. This is a special case of the general definition of equivalent consumption:

Equivalent consumption = total household consumption/n (1) where n is household size and s is equal to one. This definition assumes that each household member receives an equal allocation of household consumption, and that household members have identical consumption needs and that there are no economies of scale living together.

The study used FGT measures of poverty by computing below formula :

$$P\alpha = (1/n) \sum x_i < z_i [(z_i - x_i)/z_i]^\alpha ; \alpha \geq 0 \quad (2)$$

where x_i is real per capita consumption expenditure, z_i is the poverty line, n is the size of the population, P is the poverty measure which is (a) the Headcount Index when α is zero (b) the Poverty Gap Index when α is 1 and (c) the Squared Poverty Gap Index when α is 2.

Poverty estimates describe the pattern of poverty, but not the effect of each of the factors on the level of consumption expenditure. However, the regression analysis used in this study is commonly used to identify the roots of poverty and identify the effects of each of the characteristics on per capita expenditure. This study follows de Silva (2008) and deploys a logic model to estimate the probability of being poor from a vector of independent variable, X . The binary dependent outcome P takes the value '1' if individual is a poor, and '0' if the individual is non-poor.

The following model is used in this study:

$$\Pr(WP=1|X) = F(\alpha + \beta X) \quad (3)$$

Where $F(z) = e^z / (1 + e^z)$ is the cumulative logistic distribution and the parameters β are estimated by maximum likelihood. It should be noted that the model is not principally concerned with explaining how education contributes to poverty. Instead, it only seeks to identify whether education is associated with poverty.

IV. KEY FINDINGS

This analysis of the educational attainments associated with the probability of being poor investigates the extent to which a total of five educational attainment variables are associated with the likelihood of being poor. Table 1 presents descriptive statistics of years of schooling and educational dummy variables in terms of means or proportions and standard errors. The statistics have been estimated by taking into account the survey design of the data set and the descriptive statistics in the table are for the sub sample of poor, non-poor and the whole population.

Here are five educational attainment variables: No schooling means those who never attend the school; Primary education denotes those who have completed 5 years schooling; Secondary education denotes those who have completed between 6 and 10 years of schooling; Ordinary level denotes those who achieved the General Certificate of Examination at Ordinary Level, which indicates success at the 10 year qualifying examination; and Advanced level is the General Certificate of Examination at Advanced Level denoting those who successfully complete the 12th year qualifying

examination. It is apparent that the better educated are less likely to be poor.

The differences in schooling between the poor and non-poor are quite clear and statistically significant. The average years of schooling for the non-poor is 8.7 years while the poor have attended school for 7.4 years on average. This education gap between the poor and non-poor exists across all five levels of educational attainments, and poor people have significantly less schooling than their non-poor counterparts. For example, a higher proportion of poor people have only primary and secondary education, while a higher proportion of non-poor people have secondary and above educational attainments. For the poor, 12 percent of individuals have never attended school, while only four percent of non-poor have never attended school.

Table 1: Means and proportions of educational attainment for the poor and non-poor individual

Variable	Poor		Non-poor		All	
	Mean	S. error	Mean	S. error	Mean	S. error
Years of Schooling	7.411	.062	8.768	.01450	8.6727	.01432
No schooling	0.126	.004	0.040	0.0007	0.0480	0.0008
Primary Education	0.437	.006	0.245	0.0016	0.2619	0.0015
Secondary Education	0.387	.005	0.455	0.0018	0.4500	0.0017
Ordinary Level	0.028	.002	0.102	0.0011	0.0962	0.0010
Advanced Level	0.004	.000	0.042	0.0007	0.0395	0.0007

Is poverty prevalence higher among less educated? The answer for this question is presented in Table 2. There is a significant negative correlation between educational level and poverty prevalence that suggests poverty declines monotonically with years of education in Sri Lanka. The individuals who have no schooling and fewer educational attainments are poorer than others. Education in Sri Lanka does indeed reduce the risk of being poor.

Education directly relates with individual labour market status. Those who are more educated are more likely to work (Fulford, 2014). Education also determines the probability of finding employment. There is a substantial difference in the employment rate between the better educated and the less educated. Better educated individuals have higher probability to find a job and are able to earn more than those who are low skilled. According to Table 2, there was a higher prevalence of poverty among the unemployed than the employed.

Table 2: Poverty incidence by educational attainment

Variables	$\alpha=0$	$\alpha=1$	$\alpha=2$
Level of Education			
No Schooling	16.9	3.4	1.0
Primary Education	13.0	2.7	0.9
Secondary Education	9.0	1.7	0.5
Ordinary Level	3.9	0.8	0.2
Advanced Level	3.0	0.4	0.1
Status in Labour Market			
Employed	7.5	1.4	0.4
Unemployed	11.6	2.4	0.8

The parameter estimates of the OLS regression are shown in Table 3. The interpretation of the model is a one unit increase in the independent variable, which leads to a change in per capita consumption expenditure equivalent to the estimated regression coefficient of the independent variable. The results show that the coefficient for years of schooling is positive and significant at the 1% level. An additional one year of schooling leads to Rs. 675.5 increases in per capita consumption expenditure.

Table 3: Results from OLS estimates

Variable	Co-efficient	Standard error	t-statistics
Years of schooling	675.5884***	26.58918	25.41
Constant	5674.644	257.3278	22.05
R-squared	0.43		
Sample/household	20534		

Note: Estimated using the Department of Census and Statistics' Household Income and Expenditure Survey Data 2012/13

***denote statistical significance at the one per cent level.

The robustness of the relationship between poverty and education is checked by estimating a logit model. The results from logit regressions are reported in Table 4. The result is consistent with the OLS estimates. The marginal effect values are significant. Different level of educational attainment of the head of the household is associated with the probability of being poor. According to the table 4, Primary and secondary education have positive effect on the probability of being poor while ordinary and advanced level of education has negative and significant effect on poverty. That means the more educated the head of the household is, the less likely that household will be poor.

Like education, other household characteristics such as household size, age and gender are also significantly associated with the probability of being poor. For example, increases in household size is more likely to keep the household in poverty while increases in age of the household keeps them in to less likely to be poor. Gender is another significant factor to the household being poor. The marginal value shows men are less likely to poor than women.

Table 4: Marginal Effect of Logit Regression Estimation

Variable	dy/dx(marginal effect)	Z-Value
Primary Education	.6578214***	16.65
Secondary Education	.2935679***	7.61
Ordinary Level	-.7691309***	-9.30
Advanced Level	-.7073787***	-6.92
Household Size	.2987956***	42.83
Age	-.0058357***	-8.65
Male	-.0643449***	-2.31

Note: Estimated using the Department of Census and Statistics' Household Income and Expenditure Survey Data 2012/13.

The omitted categories in the dummy variable analyses are: no schooling and female

***denote statistical significance at the one per cent level.

V. CONCLUSION

Using data from the Sri Lanka's latest HIES 2012/13 of Department of Census and Statistics, we have examined the statistical association between the head of the household's education and poverty status. Education has emerged as an important determinant of household consumption and poverty. These results have important policy implications for design and implementation of poverty reduction policies. For instance, education and training of the labour force should be a key priority area in the effort against poverty. Thus, the findings support efforts to increase the provision of quality education and to motivate students to stay at school rather than dropping out.

Even though the Sri Lankan labour force is the most educated in South Asia, with the highest literacy rates and the highest primary enrolment and completion rates, the job-specific skills supply is very low. Self-reported reading and writing skills were found to be lower than in the other countries. There are mismatches between demand and supply in the labour market. Workers are low skilled and poorly trained, and employers complain that students in Sri Lanka have low endowments of skills in the combined group of leadership, teamwork, and work ethic. It is clear that the general education system needs to be effectively re-oriented towards student-centred learning, with more emphasis on reading, writing and mathematics and the imparting of problem-solving and communication skills. Policy makers also need to implement a coherent skills sector development strategy that is practical and realistic to equip workers with relevant skills.

REFERENCES

- [1] Appleton Simon, Lina Song and Qingjie Xia, 2010. Growing out of poverty: Trends and Patterns of Urban Poverty in China 1988-2002. *World Development*, 38(5), pp. 665-678.
- [2] Becker Gary S. and Tomes Nigel, 1994. Human Capital and the Rise and Fall of Families. In: G. S. Becker, ed. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. s.l.: The University of Chicago Press, pp. 257 - 298.
- [3] Bogale Ayalneh, Konrad Hagedorn and Benedikt Korf, 2005. Determinants of Poverty in rural Ethiopia. *Quarterly Journal of International Agriculture*, 44(02), pp. 101-120.
- [4] Ogundari Kolawole and Abdulai Awudu, 2014. Determinants of Household's Education and Healthcare Spending in Nigeria: Evidence from Survey Data. *African Development Review*, 26(1), pp. 1-14.
- [5] Psacharopoulos George & Patrinos Harry Anthony, 2004. Returns to investment in education: a further update. *Education Economics*, 12(2), pp. 111-134.
- [6] Ranasinghe Athula and Hartog Joop, 2002. Free-education in Sri Lanka. Does it eliminate the family effect?. *Economics of Education Review*, Volume 21, p. 623-633.
- [7] Anon., 2004. *World Development Report*, Washington, D.C: World Bank

[8] Appleton, S., 2001. Education, Incomes and Poverty in Uganda in the 1990s.. United Kingdom: University of Nottingham.

[9] Awan, M. S., Iqbal, and Wagas, 2011. The impact of human capital on urban poverty: the case of sargodha city. *Journal of Sustainable Development*, 4(1).

[10] Blaug, M., 1972. The Correlation between Education and Earnings: What Does It Signify?. *Higher Education*, 1(1), pp. 53-76.

[11] Borkum, E., 2012. Can Eliminating School Fees in Poor Districts Boost Enrollment? Evidence from South Africa. *Economic Development and Cultural Change*, 60(2), pp. 359-398.

[12] Case, A., 2006. The Primacy of Education. In: R. B. a. D. M. Abhijit Banerjee, ed. *Understanding Poverty Part 11*. s.l.:s.n., pp. 269-284.

[13] Datt Gaurav , Dean Jolliffe and Manohar Sharma, 2001. A Profile of Poverty in Egypt. *African Development Review*, Volume 13, pp. 202-237.

[14] Datt, G. and Jolliffe, D, 2005. Poverty in Egypt: Modelling and Policy simulations. *Economic Development and Cultural Change*, 53(2), pp. 327-346.

[15] De Silva, I., 2008. Micro-Level Determinants of poverty reduction in Sri Lanka: a multivariate approach. *International Journal of Social Economics*, 35(3), pp. 140-158.

[16] Delaney Liam, Colm Harmon and Cathy Redmond, 2011. Parental education, grade attainment and earnings expectations among university students. *Economics of Education Review*, Volume 30, p. 1136-1152.

[17] Devereux Paul J. and Fan Wen , 2011. Earnings returns to the British education expansion. *Economics of Education Review*, Volume 30, pp. 1153-1166.

[18] Frances Stewart, Caterina Ruggeri Ladershi and Ruhi Saith, 2007. Introduction: Four Approaches to defining and measuring poverty. In: *Defining Poverty in the Developing World*. s.l.:s.n., pp. 1-35.

[19] Ganegodage K.Renuka and Rambaldi AliciaN., 2011. The impact of education investment on Sri Lankan economic growth. *Economics of Education Review*, Volume 30, p. 1491– 1502.

[20] Girma Sourafel and Kedir Abbi M., 2005. Heterogeneity in returns to schooling: Econometric evidence from Ethiopia. *The Journal of Development studies*, 41(8), pp. 1405-1416.

[21] Gounder, N., 2013. Correlates of poverty in fiji: An analysis of individual, household and community factors related to poverty. *International Journal of Social Economics*, 40(10), pp. 923-938.

[22] Gunatilaka, R., 2014. Women and Poverty in Sri Lanka , s.l.: Centre for Women's Research (CENWOR).

[23] Household Income and Expenditure Survey 2012/13, Department of Census and Statistics.

[24] Horgan, G., 2009. 'That child is smart because he's rich': the impact of poverty on young children's experiences of school. *International Journal of Inclusive Education*, 13(4), pp. 359-376.

[25] Knight John Li shi and Deng Quheng, 2003. Education and the Poverty Trap in Rural China: Setting the Trap. *Oxford Development Studies*, 37(4), pp. 311-332.

[26] Lloyd Cynthia B. and Blanc Ann K. , 1996. Children's Schooling in sub-Saharan Africa: The Role of Fathers, Mothers, and Others. *Population and Development Review*, 22(2), pp. 265-298.

[27] Melike, B., 2005. Determinants of human capital theory, Growth and Brain Drain; An economic Analysis for 77 countries. *Applied Econometrics and International Development*, 5(2), pp. 109-140.

[28] Morisson, C., 2002. Heal, Education and Poverty Reduction. Paris: Organization for Economic Co-operation and Development.

[29] Mtey Kany P Feksi and Sulle Andrew , 2013. The role of education in poverty reduction in Tanzania. *Global Advanced Research Journal of Educational Research and Review*, 2(1), pp. 06-14.

[30] Nussbaum, M. C., 2003. Capabilities as fundamental entitlements: Sen and Social Justice. *Feminist Economics*, 9(2-3), pp. 33-59.

[31] Olavarria-Gambi, M., 2003. Poverty Reduction in Chile: Has economic growth been enough?. *Journal of Human Development: A Multi-Disciplinary Journal for People-Centered Development*, 4(1), pp. 103-123.

[32] Pallegedara, A., 2011. Demand for private tuition classes underthe free education policy. Evidence based on Sri Lanka, s.l.: Munich Personal RePEc Archive.

[33] Pandey, P. Y. P. H. S., 2007. Human capital as structural vulnerability of US poverty. *Equal Opportunities International*, Vol. 26 Iss 1 pp. 18 - 43, 26(1), pp. 18-43.

[34] Park, S., 2011. Returning to school for higher returns. *Economics of Education Review* , Volume 30, p. 1215– 1228.

[35] Psacharopoulos, G., 1994. Returns to Investment in Education: A Global Update. *Journal of world Development*, 22(9), pp. 1325-1343.

[36] Ranasinghe Athula and Hartog Joop, 1997. Investment in post-compulsory Education in Sri Lanka. Amsterdam: Tinbergen Institute.

[37] Robeyns, I., 2003. Sen's Capability Approach and Gender Inequality: Selecting Relevant Capabilities. *Feminist Economics*, 9(2-3), pp. 61-92.

[38] Robeyns, I., 2007. The Capability Approach: a theoretical survey. *Journal of Human Development*, 6(1), pp. 93-117.

[39] Rozana , H., 2010. Intrahousehold Allocation of Education Expenditure: The Case of Sri Lanka. *Economic Development and Cultural Change*, 58(2), pp. 231-258.

- [40] Schultz, T. W., 1961. Investment in Human Capital. *The American Economic Review*, 51(1), pp. 1-17.
- [41] Seetha, R. P., 2010. Determinants of Household Poverty in Sri Lanka. s.l.:MPRA Paper No. 34174.
- [42] Sen, A., 1999. Development as freedom. New Delhi: Oxford University Press.
- [43] Sen, A., 2008. Capabilities and well-being. In: D. M. HAUSMAN, ed. *The Philosophy of Economics*. New York: Cambridge University Press, pp. 270-293.
- [44] Tilak B.G., J., 2002. Education and Poverty. *Journal of Development*, 3(2), pp. 191-207.

Estimating willingness to pay for recreational services of Lighthouse Park, Palameenmadu, Batticaloa

V.Kanagasingam^{*1}, N.Nallarajah^{*2}

^{*1}Trincomalee Campus, Eastern University, Sri Lanka.

^{*2}Eastern International College, Batticaloa

kana692002@yahoo.co.in

nnallarajah@yahoo.co.uk

Abstract— The lighthouse park is situated near the estuary in Palameenadu, Batticaloa. The lighthouse was built in 1913 and is 28 meters high. Built to serve as a navigational aid for marine pilots at sea or on inland waterways. The lighthouse park is a remarkable recreational site which combines the attraction of marine environment with exceptional plant biodiversity, rural tranquillity. As this is a public good market cannot assign a full value. The present paper estimates willingness to pay (WTP) for recreational services of Lighthouse park in Palameenmadu, Batticaloa. The data were collected from a sample of 160 respondents in February- April 2015. The paper aims to answer the following questions: What determines visitors' WTP? Whether improvement in recreational benefits would lead to a higher demand for park visitation with people willing to pay a higher price for better quality of environmental services? In order to understand the determinants of the visitors' WTP responses and to see whether these determinants are consistent with economic theory, multivariate analyses were performed to explore variation in various measures of the respondents' WTP. Cost of travel, visitors' income, and distance from home to park, education, and quality of recreational services were significant determinants of WTP. Own-price elasticities of demand were negative in all cases. Park demand visitation was significantly income elastic

Keywords— recreation, willingness to pay, demand for park visitation, consumer surplus, Contingent valuation method

I. INTRODUCTION

Batticaloa is a beautiful and tranquil fishing town located in the eastern part of Sri Lanka. Home to many picturesque lagoon beaches, the town lies upon a flat coastal plain that is bordered by the aquamarine waters of the Indian ocean.

The lighthouse park is one of the exotic and picturesque that lies in Palameenmadu, five kilometre from Batticaloa town.

It is now opened to the visitors after three decades of civil war and was reconstructed by USAID.

To enjoy the natural beauty of the environment, climb the bird viewing tower to observe local birds and animals, animal statutes, picnic huts, resting shelters, volley-ball field and proceed to the beach.

Also can visit the adjoining additional recreational facilities such as Environmental learning centre, environmental library, Children Park, boat rides organized by the Palameenmadu sports club, bathing area, lighthouse, and Palmyrah development board sales centre ect..... These are adding values to the lighthouse park recreational value.

II. RESEARCH PROBLEM

Lighthouse Park is a public good benefits society in many different ways. The park performs not only ecological function but also provide recreational facilities to visitors. As the service provided by the park is unable to value by using market price. Recreational uses of environmental resources of services. This study seeks to answer two research questions.

1. What are the factors that determine visitors'Willingness To Pay (WTP) for recreational services of Lighthouse Park?
2. Whether improvement in recreational benefits of park would lead to a higher demand for recreational benefits with people willing to pay a higher price for better quality of environmental services?

III. LITERATURE REVIEW

In the absence of market price, economists use specific monetary valuation techniques to measure use and non-use values the recreational value of the park is multifaceted, the technique must cover a broad range of effects, including economic, cultural, and ecological effects (Costanza et.al-1993, Nune and Van den Bergh -2004) The tools that have been identified in the literature are hedonic pricing, aggregate market analysis contingent valuation method

(CVM), statedchoice (SC), travel cost method (TCM), (Nune and de Blaeij-2005).

The contingent valuation method involves directly asking people, in a survey, how much they would be willing to pay for specific environmental services. In some cases, people are asked for the amount of compensation they would be willing to accept to give up specific environmental services. It is called "contingent" valuation, because people are asked to state their willingness to pay, contingent on a specific hypothetical scenario and description of the environmental service.

The contingent valuation method (CVM) is used to estimate economic values for all kinds of ecosystem and environmental services. The method has great flexibility, allowing valuation of a wider variety of non-market goods and services than is possible with any other non-market valuation technique. It can be used to estimate both use and non-use values, and it is the most widely used method for estimating non-use values. It is also the most controversial of the non-market valuation methods. (Ecosystem valuation)

Willingness to pay is measured with the contingent valuation (CVM) method. The CVM directly elicits economic values in highly structured hypothetical scenarios (Mitchell and Carson 1980.)

Logit function is the inverse of the sigmoidal "logistic" function or logistic transform used in mathematics, especially in statistics. When the function's parameter represents a probability p, the **logit** function gives the log-odds, or the logarithm of the odds $p/(1 - p)$. (N. Gujarati (1995)

IV. RESEARCH METHODOLOGY

This study employs the contingent valuation method. In order to understand the determinants of the visitor's WTP responses and to see whether these determinants of the visitor's WTP responses and to see whether these determinants are consistent with economic demand theory.

A series of multivariate analysis were performed with the data obtained from the questionnaire. Various independent variables were used to attempt to explain the variation in different measures of visitor's WTP for improved recreational services of the park.

This study was conducted with the individual visitors as respondents for interviews. The survey was conducted in February- April 2015The data were collected with the help of a pre-tested questionnaire The analysis were done in using SPSS and MINITAB.

Econometric models

1. Ordinary least squares (OLS)

$$Y_i = \beta_0 + \beta_1 TC + \beta_2 Inc + \beta_3 Edu + \beta_4 Age + \beta_5 Dis + \beta_6 D_1 + \beta_7 D_2 + \epsilon_i$$

Y_i =The final bid for WTP , TC = The total travel cost (Rs), Inc = House hold's income(Rs/month), Edu =Respondent's educational qualification(grades passed), Age =Respondent's age(years), Dis = Distance(km), $D_1 = 1$ if male and 0 otherwise, $D_2 = 1$ if park's recreational facilities is good and = 0 if bad.

2. Logit model

Visitor's willingness to pay was also regressed using Logit model.

In dealing with qualitative data probit is thought to better suit the experimental data while logit might be more appropriate for the survey data (Bann-1998)For more detailed discussion see Environmental Valuation: Theory and Application-Hearth M Gunatilake-2003. (pg-218)

This model was chosen because of its ability to deal with a dichotomous dependent variable and a well established theoretical background.(Kannen-1995), (D.N Gujarati-1995)

Used model

$$P_t = E(Y=1| X_i) = [1 / \{1 + e^{-(\beta_0 + \beta_1 \sum X_i)}\}]$$

Where P_t is the probability that $Y=1$, X_i is a set of independent variables explained above and β_i are coefficients to be estimated corresponding to logistic distribution. Taking a natural logarithm to the above equation

$$Li = \ln\{pt/(1-pt)\} = \beta_0 + \beta_1 \sum X_i + \epsilon_i$$

Where Li (logit) is the log of the odd ratios and is linear. In both independent variables and parameters. The estimation method to be used will be maximum likelihood estimator (MLE)

One of five rupees amount Rs 10, Rs 25, Rs 50, Rs 75, or Rs 100 was randomly assigned to each respondent.

V. RESULTS AND DISCUSSION

Table 1- Willingness to pay (WTP)

Rupees (Rs)	Cases(Respondents)	Percentage yes (% yes)
10	61	38.12
25	38	23.75
50	27	16.87
75	16	10.00
100	18	11.25
Total respondents	160	100.00

The above table shows the amount of willingness to pay in Rs and the number of respondents and the percentages. When the amount increases the number of respondents too decreases.

Table-2 Descriptive statistics of the respondents

Variables	Mean	Std.dev	Min	Max
No.of trips to park	12.56	12.80	1.00	19.00
Distance (km)	12.25	16.25	1.50	75.65
Age (yes)	46.4	10.25	15.4	64.36
Household size	6.54	9.54	4.47	9.43
Monthly income	21000	3245.45	8000	52000
Male	58%			
Female	42 %			
Single	40 %			
Married	60 %			
No-education	19 %			
Up to GCE(O/L)	58 %			
GCE (A/L)	12 %			
Technical diplomas	04 %			
Degrees and above	07 %			
Visitors from Batticaloa town	58 %			
Other areas	42 %			

The mean monthly income of the visitors is Rs 21000, About 58 % of respondents are male, and 43 % are female. As many as 60 % were married and 40 % are single. The average age of the respondents was 46.4 years and the average household size was about 6.5. The average distance is 12.25 km from their place of residence. More than 50% of the respondents had GCE (O/L) education and 19 % were illiterate. Only 12 % had GCE(A/L). The rest had got technical diplomas, bachelor's degrees and graduate degree.

Over 50 % of the visitors visited occasionally and 24 % visited only once in a year. Less than 58 % of the visitors considered quality of the park as good compared to 32 % who believed it bad or very bad, with about 10 % answering with do not know. These data illustrates that more of the respondents were satisfied with recreational facilities of the park.

Visitors judgement on quality of recreational facilities seems to have impact on their willingness to pay or unwillingness

to pay. About 58 % of the visitors are from Batticaloa city and suburban area and 42 % of the visitors are from outside of Batticaloa city.

Results from Multivariate analysis model

Table-3 Ordinary Least Square (OLS) Model of

the determinants of visitors' WTP responses

$$Y_i = \beta_0 + \beta_1 TC + \beta_2 Inc + \beta_3 Edu + \beta_4 Age + \beta_5 Dis + \beta_6 D_1 + \beta_7 D_2 + \varepsilon_i$$

Variables	OLS Model
Dependent variable	Final bid
Intercept (β_0)	7.29 (0.82)
Total travel cost (TC) (β_1)	-0.067 (-2.31)***
Visitors' income(Inc) (β_2)	1.92 (2.92)***
Education (Edu) (β_3)	1.02 (2.03)**
Age (β_4)	0.07 (1.23)*
Distance (Dis) (β_5)	-12.67 (-2.19)***
Sex(Male=1 and female=0) (β_6)	1.52 (0.54)
Quality of recreational facilities(Good=1 and bad=0)	2.98 (4.84)***
R ²	56.32
F-Statistic	18.95
Sample size	160

***; **, * implies statistical significance at 1%, 5 %, and 100 % respectively.

Results from OLS analysis shows the determinants of respondents' Willingness To Pay (WTP) responses and to see whether these determinants are consistent with economic demand theory a series of multivariate analyses were conducted with the survey data. Table-3 shows the results of the OLS models of the determinants of the WTP responses.

The respondents' income is statistically significant indicating a positive correlation with visitors' WTP for improved recreational facilities of the park.

Education level and age of the respondents have also positive but small. Travel cost is statistically significant and has a negative effect coefficient implying that higher travel costs to park reduces visitors WTP.

Sex variable has no impact on WTP amounts.

The R-squared value for the OLS model is 56.32 per cent and more significant independent variables indicate the WTP responses are not random to respondents' and households' characteristics.

Table-4 Logit model of the determinants of visitors' WTP responses.

Variables	Logit Model
Dependent variable	Final bid
Intercept	-0.0023 (-0.16)
Total travel cost (TC)	-0.014 (-5.06)***
Visitors' income(Inc)	0.065 (5.58)***
Education (Edu)	0.016 (2.08)**
Age	0.59 (0.98)
Distance (Dis)	-0.18 (-3.01)***
Sex(Male=1 and female=0)	0.043 (0.43)
Quality of recreational facilities(Good=1 and bad=0)	0.47 (3.84)***
Log (L)	376.27
Sample size	160
% predicted correctly	75.65

***; **, * implies statistical significance at 1%, 5 %, and 100 % respectively.

Table-5 The estimated Elasticities of lighthouse park visitation demand

Variable	Elasticity
Price	-1.54 (0.37)***
Income	0.002 (0.004)**

Significant at 1 % level, significant at 5 % level

VI. CONCLUSION

Regarding determinants of respondents WTP responses income, age of respondents, education and quality of recreational services of park is positively related to visitors' WTP responses. Thus education play an important role in environmental conservation.

The estimated elasticity associated with the own-price and income negative and positive respectively. The park demand visitation is significantly income elastic.

Policy implication

The local community is the direct stake holders of this park and responsible for managing and protecting the park. To manage the park sustainably, it may be appropriate to create funds for the proper management and conservation of the park.

It is recommended that authorities adopt a systematic approach in determining the entrance fee to provide more recreational services.

REFERENCES.

- [1] Bann, Camille (1998) The Economic Valuation of Tropical Forest land Use Option; A Manual for Researchers, Economic and Environmental program for Southeast Asia, Singapore.
- [2] Ltd Damodar N. Gujarati (1995) Basic Econometrics, Third edition Mc Graw-Hill, Inc
- [3] Dixon, J A, and P B Sherman (1991) Economics of Protected Areas
- [4] GunatilakeH.M (2003) Environmental Valuation: Theory and Application , Postgraduate Institute of Agriculture University of Peradeniya, Peradeniya
- [5] Koutsoyianni. A, (1977) Theory of Econometrics , Macmillan
- [6] Nunes, P.A.I.D .,and Van den Bergh, J.C.J.M, (2004) Valuing nonmarket benefits for protection against exotic marine species in the Netherlands using TC and CVdata Environment and resource economics
- [7] Singh P.s,(1991), Econometrics S.Chand and co Ltd

Determinant of Organizational Learning Capability in financial Sector Organizations in Trincomalee District

S. Laavanyah

Department of Business and Management Studies, Trincomalee Campus, Eastern University, Koneshapuri, Nilaveli, Trincomalee, Sri Lanka
slaavanyah@gmail.com

Abstract— The organizational literature shows that Organizational Learning Capabilities (OLC) plays a critical role in the development and promotions of companies. The aim of the research is to identify the key determinants of organizational learning capability. For primary data some financial sector organizations have been selected randomly in Trincomlaee district with the sample size of 100. We used the sophisticated statistical model Principal Component Analysis (PCA). Results of this analyzed study based on factor analysis, indicate the two important factors considered by the respondents when developing organizational learning capability such as: policy making and open communication.

Keywords— Organizational leaning capability, Financial sector organizations, Open communication, policy making

I. INTRODUCTION

Today organizations are operating in a highly changing and complex environment in a rapidly increasing pace. Organizations are facing many challenges such as technological challenges, changing customer behavior, unstable economic condition etc. organizational survival will be determined by the extent to which an organization successfully faces those challenges. Organizational leaders will seek to develop flexibility and adaptability in their organizations. To build sufficient organizational flexibility for the new environment, leaders can tap into the learning capacity, creative energy, and adaptive capabilities of organizational members. By engaging and committing to the people who comprise their organizations, and building organizational learning capability, have an opportunity to create organizations that are prepared for the unpredictable future that lies ahead. The study was undertaken to investigate the nature and level of organizational learning capability in contemporary organizations. (Chiva, 2007)

II. RESEARCH PROBLEM

Sri Lanka is developing country, after the war Sri Lanka develops many sectors such as manufacturing industry and service sector. Service sector gain higher yield, their contribution to GDP is 59.5% in Sri Lanka. In this 59.5% contribution banking, insurance and real estate etc., contributing 8.8%. The performance of the financial sector improved significantly with the continued expansion in economic activities, while the stability of the system was maintained. Credit growth accelerated during the year and the performance of financial institutions improved with enhanced

growth in assets, healthy profitability, higher capitalization and lower risk levels.

The banking, finance, leasing, and insurance sectors expanded their branch network around the country, particularly in the Northern and Eastern Provinces, thereby increasing access to financial services. (Central bank report 2015) Expansion of business is a growth stage of business at these stage organizations must attempt to introduce innovations and hence company management must emphasize creativity at this point in order to attract customers increase their market share for promotional activities through this they will try to sustain their competitive advantage. For this purpose organization must have adaptive capacity it will be developed through developing their learning capability. Organizational learning capability is not only must for the growth stage of the organization but also it is needed for sustain the organization in changing environment. That is why all branches of all organization must continuously increase their learning capability in order to adopt both internal and external changes.

The present study focuses on organizational learning capability in the financial sector organizations in Tricomalee district. According to the literature mostly consider relationship between organizational leaning capability and several other variables. but there are lack studies to identify factors determining organizational learning capability. The external environment of the financial sector is highly competitive due to the globalization and the demand of business community. Therefore creating an organizational learning capability to adopt changes is very important to the survival of the industry.

III. LITERATURE REVIEW

Organizational must be competitive in order to survive in the global economy. Therefore organizations encourage their employees to learn continuously. Today's achievement of the organization is a result of yesterday's learning and tomorrow's performance is a result of today's learning (Templeton, Lewis, and Snyder 2002).

Many scholars already define organizational learning in a verity of ways. Argyris, (1977) define the process of finding and rectify errors in called as organizational learning. According to Templeton, Lewis, and Snyder, (2002) organizational learning including knowledge acquisition, information distribution, information interpretation and organizational memory,heses factor are positively influence

organizational change both intentional and unintentional ways.

Fang, Chang, and Chen, (2011) stated Organizational learning capability is an essential factor for an organization's growth and innovation, and Organizational learning capability is a combination of resources and/or skills. These skills can be tangible or intangible and organizational learning capability is important to gain competitive advantage.

Organizational learning capability is defined as the organizational and managerial characteristics or factors that facilitate the organizational learning process or allow an organization to learn (Dibella, Nevis, and Gould, 1996; Goh and Richards, 1997; Yeung, Ulrich, Nason, and Von Glinow, 1999)

According to Allameh, Abbasi, and Reza Shokrani, (2010) organizational learning capability influenced by many factors at the same time the organizational learning capability infusing many factors. in this sense intellectual capital is a valuable knowledge of an organization gain through its employees. it is including intellectual activities, knowledge acquisition, innovation, and creation. Intellectual capital improves organizational learning capability by affect and advanced knowledge management.

Many authors mentioned about the relationship between job satisfaction and organizational learning capability indirectly. job satisfaction incorporated with any of the dimensions that determine organizational learning capability. According to Daniels & Bailey, (1999) participative decision making increase the level of job satisfaction, participative decision making is one of the dimension of OLC. Johnson & McIntey, (1998) conclude that some of the measures of culture such as empowerment, involvement, and recognition are strongly related to job satisfaction. Gaertner, (2000) find that leadership behaviors related to inspiring team work, challenging tradition have significant effect on job satisfaction. Allameh et al.,(2010) concluded that intellectual capital exists in an organization it will make the employees to work in a condition that propitiate their skills and abilities it will increase their job satisfaction. OLC significantly explained by the intellectual capital and OLC determine job satisfaction .

According to Venkatesh & Balaji, (2012) emotional intelligence can be define as a fit between environment and person, an organization have high level of organizational learning capability making a path where emotional intelligent individual tend to work in conditions that propitiate their emotional and social abilities and it will lead them to have a high level of organizational commitment. Therefore Venkatesh & Balaji, (2012) conclude that organizational commitment is the results of the relationship between organizational learning capability and emotional intelligence. Organizational learning capability is a key factor that determines organizations effectiveness and potential to innovate (Je'rez-Go' mez, Cespedes-Lorente, and Valle-Cabrera 2005). Alegre and Chiva, (2008) stated Innovation includes development and/or adopting ideas and behaviors.

According to (Fang, Chang, & Chen, 2011) there is a positive relationship between organizational learning

capability and organizational innovation. Lynn and Akgun (2000) and Hult, Hurly, and Knight, (2004) stated that organizational learning capability is an enabling factor of product development and through that improves the organizational performance.

According to Goh & Ryan, (2002) there is no relationship between financial performance of the organization and organizational learning capability. But developing learning capability within the firm will increase the moral of the employees such as employee satisfaction. Some time it will help to reduce the employee turnover and absenteeism. the size of the organization and organizational learning capability have negative relationship that mean creating high OLC in large organization is harder than creating OLC in small organization.

According to (Chiva et al., (2007) Chive & Alegre, (2009b) Organizational learning capability including five facilitating factors they are experimentation, dialog, risk taking, interaction with external environment, and participation. Risk taking is one of the factors which are closely related to trust. That is why trust become a factor that determining organizational learning capability. Then organizational learning capability facilitates innovation of an organization it will lead to good performance.

IV. OBJECTIVES OF THE STUDY

The present study has the following objectives

- To find out necessary indicators for the organizational learning capability of the financial sector organizations in Trincomalee district
- To determine the key indicators for the organizational learning capability of the financial sector organizations in Trincomalee district

V. METHODOLOGY

Primary and secondary data was used for the study. Primary data was collected through the written questionnaire following direct personal interviewing technique. The secondary data was gathered from journals, books, magazines, etc.

The sample for this study consisted of financial sector organizations in Trincomalee district. A purposive sampling technique was used to select the organizations. Initially researchers identified sixty companies, then, decided to distribute questionnaires among each company to the manager and assistant manager.

The questionnaire was administered among managers and assistant manager of financial sector organization. The questionnaire was designed by the researcher as a likert's scale from strong disagreement (1) to strong agreement (5) adopted to identify key favorable organizational learning capability indicators. In this study, "Factor Analysis" model (Principal Component Varimax Roated Factor Analysis Method) has been used to group the indicators. Final ranking of the indicators has been made on the basis of mean scores.

TABLE-1 -SAMPLE SIZE OF MANAGERS, ASSITANT MANAGERS OR OFFICER INCHRGE IN FINANASL SECTOR ORGANIZATIONS

Financial Institution	Population	Sample
Hatton National Bank	15	10
Sampath Bank	8	6
Commercial Bank	2	2
Seylan Bank	2	2
Pan Asia Bank	2	2
Nation Trust Bank	4	2
Bank of Ceylon	20	12
Regional Development Bank	10	8
People's Bank	20	12
Union Bank	2	2
National Development Bank	2	2
HDFC Bank	2	2
DFCC Bank	2	2
Merchant Bank	2	2
MBSL	4	4
Union Insurance	3	2
Amana Insurance	2	2
Bartleet Finance Company	2	2
Sri Lanka Insurance	10	8
CDB	2	2
Sanasa Development Bank	2	2
NCF	2	2
Celinco Insurance	15	10
Co-op Insurance	10	8
Peoples Leasing and Finance PLC	4	2
Total	149	100

VI. RESULTS AND DISCUSSION

To identify potential underlying dimensions of the organizational learning capability in financial sector organizations this study used structured questionnaire and the response of the participants were subjected to factor analysis. Before doing analysis, checking reliability is very important. Overall Cronbach's Alpha for organizational learning capability is 0.806, the alpha value above 0.60 is considered as good reliable instrument (L.J.Cronbach, 1951, N.K.Malhotra, 2000, S.Moss, P.Patel, & H.Prosser, 1993), in this case alpha is 0.806, and so it is indicated measurement which was used in this study also good instrument.

After checking the reliability of scale, we tested whether the data so collected is appropriate for factor analysis or not. The appropriateness of factor analysis is dependent upon the sample size. In this connection, Kaiser – Meyer- Olkin (KMO) measurement of sampling adequacy is still another useful method to show the appropriateness of data for factor analysis. The KMO statistics varies between 0 and 1 H.F.Kaiser, (1974) recommends that values greater than 0.5 are acceptable. Between 0.5 and 0.7 are mediocre, between 0.7 and 0.8 are good, between 0.8 and 0.9 is superb H.F.Kaiser, (1974). In this study, the value of KMO for

overall matrix is 0.857 (For details please see table 1), thereby indicating that the sample taken to process the factor analysis is statistically significant.

TABLE 11-KMO AND BARTLETT'S TEST

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.857
Bartlett's Test of Sphericity	Approx.Chi-Square	1357.19
	df	91
	Sig.	0.00

Bartlett's test of sphericity (Barlett, 1950) is the third statistical test applied in the study for verifying its appropriateness. This test should be significant i.e., having a significance value less than 0.5. In the present study, test value of Chi-Square 1357.19 is significant (as also given in Table II) indicating that the data is appropriate for the factor analysis.

According to the below table, carried out factor analysis to identify the key favourable factors for organizational learning capability. In order to find out the factors, researcher employed Principal Component Analysis (PCA) followed by the varimax rotation, (Generally, researchers' recommend as varimax). Statistical Package for Social Science (SPSS) software (version 20.0) was used for this purpose. Two variables were extracted from the analysis with an Eigen value greater than 1, which explained 72.829 percent of the total variance (For details please see Table-III)

TABLE III. TOTAL VARIANCE EXPLAINED

Initial Eigenvalues			Extraction Sums of Squared Loadings		
Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
8.263	59.021	59.021	8.263	59.021	59.021
1.933	13.808	72.829	1.933	13.808	72.829
.789	5.632	78.461			
.710	5.071	83.532			
.544	3.883	87.415			
.361	2.581	89.996			
.325	2.322	92.318			
.262	1.873	94.191			
.230	1.641	95.833			
.207	1.475	97.308			
.125	.894	98.202			
.097	.694	98.896			
.092	.660	99.555			
.062	.445	100.000			

One method to reduce the number of factors to something below that found by using the "eigenvalue greater than unity" rule is to apply the scree test (R.B.Cattell, 1966). In this test, eigenvalues are plotted against the factors arranged in descending order along the X-axis. The number of factors that correspond to the point at which the function, so produced, appears to change slope, is deemed to be the number of useful factors extracted. This is a somewhat arbitrary procedure (for details please see Figure 1).

Figure1: Scree Plot

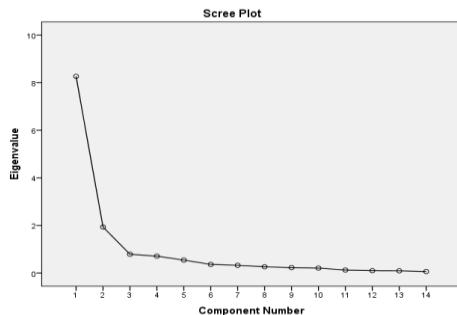


TABLE IV. ROTATED COMPONENT MATRICES

	Component	
	1	2
Policy Making	.873	
External Information system	.855	
Interaction with external environment	.843	
Regular participation	.824	
Engage in different tasks in different place	.794	
Risk taking	.778	
Knowledge of external environment	.762	
Employee empowerment	.737	
Creative thinking	.669	
Open communication		.906
Communication facilities		.885
Cross functional team work		.764
Interaction with internal parties		.731
Interaction with external parties	.523	.723
% of Variance	59.021	13.808
Cumulative %	59.021	72.829

Source: Survey Data

Factor 1: Policy Making – This factor was represented by nine variables with factor loadings ranging from .873 to .523. These were: Policy Making, External Information system, Interaction with external environment, Regular participation, Engage in different tasks in different place, Risk taking, Knowledge of external environment, Employee empowerment, Creative thinking, Open communication,

Communication facilities, Cross functional team work, Interaction with internal parties. This competency accounted for 59.021% of the rated variance.

Factor II: Open communication – six variables with loadings ranging from .906 to .723 belonged to this factor and they included Open communication, Communication facilities, Cross functional team work, Interaction with internal parties, Interaction with external parties. Furthermore, although the variable “Interaction with external parties” was loaded fairly high on Factor I as well, because of its higher loading and greater relevance it was also included in this factor. This factor explained 13.808% of the rated variance.

Ranking of the above two factors in order of their importance, along with mean, is shown in Table V. The importance of these factors, as perceived by the respondents, has been ranked on the basis of their mean values.

TABLE V. TOTAL VARIANCE EXPLAINED

Factors	No. of Variables	Mean	Rank
Policy Making	9	0.12	1
Open Communication	5	0.21	2

According to table V, the ranking evinced the following order: (1) Policy making (2) open communication from 0.12 to 0.21

VII. CONCLUSION

Through an empirical investigation, this study has identified two important factors as key favourable environment for organizational learning capability. In financial sector organizations.. The dominant factors are: policy making and open communication.

REFERENCE

- [1] Allameh, S., Abbasi, S., & Reza Shokrani, S. (2010). The Mediating Role of Organizational Learning Capability Between Intellectual Capital and Job Satisfaction. European Journal of Social Sciences, 17, 125-136.
- [2] Alegre, J., & Chiva, R. (2008). Assessing the impact of organizational learning capability on production innovation performance: An empirical test. Technovation, 28, 315-326.
- [3] Argyris, C. (1977). Double loop learning in organizations. Harvard Business Review, 115-125.
- [4] Cattell, R. B. (1966). The scree test for the number of factors. Multivariate Behavioural Research, 1, 245-276.
- [5] Chiva, J. A. (2007). Measuring organisational learning capability among the workforce. International Journal of Manpower, 28 (3), 224-242.
- [6] Cronbach, L. J. (1951). Coefficient Alpha and the Internal Structure of tests. Psychometrika, 6 (3), 297-334.

[7] Daniels, K., & Bailey, A. (1999). Strategy development processes and participation in decision making: predictors of role stressors and job satisfaction. *Journal of Applied Management Studies*, 8, 27-42.

[8] Dibella, A., Nevis, E., & Gould, J. (1996). Understanding organizational learning capability. *Journal of Management Studies*, 33, 361-379.

[9] Fang, C., Change, S., & Chen, G. (2011). Organizational learning capability and organizational innovation: The moderating role of knowledge inertia. *African Journal of Business Management*, 1864-1870.

[10] Field, A. (2000). *Discovering Statistics Using SPSS for Windows*. London: Sage Publications.

[11] Gaertner, S. (2000). Structural determinants of job satisfaction and organizational commitment in turnover models. *Human Resource Management Review*, 9, 479-493.

[12] Goh, S. C., & Ryan, P. J. (2002). Learning Capability, Organizational Factors and Firm Performance. *Third European Conference on Organizational Knowledge, Learning and Capabilities* (pp. 5-6). Athens: Greece.

[13] Goh, S., & Richards, G. (1997). Benchmarking the learning capability of the organization. *European Management Journal*, 15, 575-583.

[14] Hult, G., Hurly, R., & Knight, G. (2004). Innovativeness: its antecedents and impact on business performance. *Industrial marketing management*, 33, 429-438.

[15] Je'rez-Go'mez, P., Cespedes-Lorente, J., & Valle-Cabrera, R. (2005). Organizational learning and compensation strategies: from the Spanish chemical industry. *Human Resources Management*, 44(3), 279-299.

[16] Johnson, J., & McIntey, C. (1998). Organization culture and climate correlates

[17] of job satisfaction. *Psychological Reports*, 82, 843-850.

[18] Kaiser, H. F. (1974). An Index of Factoral Simplicity. *Psychometrika*, 39, 31-36.

[19] Lynn, G., & Akgun, A. (2000). A new product development learning model: antecedents and consequences of declarative and procedural knowledge. *International Journal of Technology Management*, 20, 490-510.

[20] Malhotra, N. K. (2000). *Marketing Research: An Applied Orientation*. New Delhi, India: Pearson Education Asia.

[21] Moss, S. Patel, P. & Prosser, H. (1993). Psychiatric morbidity in older people with moderate and severe learning disability. I: Development and reliability of the patient interview (PAS-ADD). *British Journal of Psychiatry*, 471-480.

[22] Templeton, G., Lewis, B., & Snyder, C. (2002). Development of a measure for the organizational learning construct. *Journal of Management Information Systems*, 175-218.

[23] Venkatesh, J., & Balaji, D. (2012, March). Emotional Intelligence Develops Organizational Learning Capabilities. *ZENITH International Journal of Business Economics & Management Research*, 2(3), 43-49.

[24] Yeung, A., Ulrich, D., Nason, S., & Von Glinow, M. (1999). *Organizational learning capability*. New York: Oxford University Press, New York.

The Impact of Personality Traits on Physical Engagement: The Study on Financial Institutions in Trincomalee District

Ms. K. Lakshika^{*1}, D. Thavakumar^{*2}

Department of Management, Faculty of Commerce & Management, Eastern University, Sri Lanka

¹klakshika90@gmail.com

²dila1981@gmail.com

Abstract— Work engagement is a positive, fulfilling, affective-motivational state of work-related well-being that is characterized by physical, emotional, and cognitive. Hence organizations may be better off improving on their employees with certain personality traits if they want to create an engaged workforce. This research investigates the impact of personality traits on physical engagement in a context of selected financial institutions in Trincomalee District. In this study, big five traits were used to measure various dimensions of personality which are extroversion, agreeableness, conscientiousness, neuroticism, and openness to experience. To attain the objectives, the quantitative method was used and data were collected through questionnaires. A total of 200 questionnaires were distributed and only 191 questionnaires were accepted employees in financial institutions in Trincomalee District. The data were analysed using Pearson correlation and multiple regression analysis. The findings exhibited that, there were relationship between personality traits with physical engagement and also personality traits of financial institutions in Trincomalee District is in high level and also physical engagement of employees is in high level. However, dimensions of personality traits are positively and significantly correlated with work engagement except extroversion. Lastly, the regression analysis between personality traits and physical engagement indicated that 91% of total variance of physical engagement was explained by personality traits. In conclusion, it is observed that personality traits have influence on the employees' physical engagement. Results of this study suggest that the personality traits are useful for examining the dispositional source of physical engagement.

Keywords— Personality traits, Physical engagement

I. INTRODUCTION

In studying workers' well-being, attention has traditionally been focused on the construct of job satisfaction, a relatively passive experience of low to moderate activation. Recently, this type of well-being has been complemented by the more energized form referred to as work engagement. Engaged workers feel positively about their situation, but beyond mere satisfaction, they are motivated to expend energy on a task.

Physical engagement is an integral factor for organizational performance and success, as it seems to have a significant potential to affect employee retention, their loyalty and productivity, and also with some link to customer satisfaction, organizational reputation and the overall stakeholder value.

Hence in order to achieve a better understanding of physical engagement, the present study also investigates some personality characteristics in their role as personal antecedents of physical engagement. Personality of the employees can be considered as an important variable to affect their engagement levels. For instance, two employees working in the same environment may have different levels of engagement. This difference can exist because of their different personality traits

II. RESEARCH PROBLEM

In recent times, the physical engagement is an emerging and new concept. Until now researcher has been slow to studying it. Therefore, it leads to lack of research and also few empirical academic studies (Macey & Schneider, 2008) and few antecedents of physical engagement like job characteristics, rewards and recognition, perceived organizational and supervisor support, organizational justice, job resources and personal resources have been identified (Llorens, Schaufeli, Bakker & Salanova, 2007). There is a dearth of academic research on physical engagement (Robinson, Perryman & Hayday, 2004).

Personality factors and physical engagement at workplace are yet as its initial stages and has become an area for dearth of research. So there is an empirical study in personality traits and physical engagement in financial institutions in Trincomalee District.

Thus there exists a clear the empirical knowledge gap. Researcher examines this problem in this study and attempts to fill this empirical knowledge gap. Therefore, the following research problem is advanced in this study.

“What is the impact of personality traits on physical engagement of employees in financial institutions in Trincomalee District?”

III. RESEARCH QUESTIONS

I. To what extent the personality traits exist in financial institutions in Trincomalee District?

- II. To what degree the level of physical engagement of employees in financial institutions in Trincomalee District?
- III. What the impact of personality traits of employees on physical engagement in financial institutions in Trincomalee District?

IV. RESEARCH OBJECTIVES

- 1. To determine the extent to personality traits exist in financial institutions in Trincomalee District.
- 2. To examine the level of physical engagement of employees in financial institutions in Trincomalee District.
- 3. To evaluate the impact of personality traits of employees on physical engagement in financial institutions in Trincomalee District.

V. LITERATURE REVIEW

A. Personality

Personality concerns the most important, most noticeable parts of an individual's psychological life. Personality concerns whether a person is happy or sad, energetic or apathetic, smart or dull. Over the years, many different definitions have been proposed for personality. Most of the definitions refer to a mental system a collection of psychological parts including motives, emotions and thoughts. The big five factors are extroversion, agreeableness, conscientiousness, neuroticism (also called emotional stability) and openness to experience (also called intellect or culture). These factors represent personality at the broadest level of abstraction. Each factor summarizes a large number of distinct, more specific, personality characteristics.

Extroversion is indicated by positive feelings (emotions) and tendency to seek company of others. It represents the tendency to be sociable, assertive, active, upbeat, cheerful, optimistic, and talkative. Agreeableness is the tendency to be trusting, compliant, caring, considerate, generous, and gentle. Such individuals have an optimistic view of human nature. They are sympathetic to others and have a desire to help others; in return they expect others to be helpful.

Conscientiousness describes socially prescribed impulse control that facilitates task- and goal-directed behaviour, such as thinking before acting, delaying gratification, following norms and rules, and planning, organizing, and prioritizing tasks (Costa and McCrae, 1992; John and Srivastava, 1999). Neuroticism measures the continuum between emotional adjustment or stability and emotional maladjustment or neuroticism (Costa and McCrae, 1992). People who have the tendency to experience fear, nervousness, sadness, tension, anger, and guilt are at high end of neuroticism.

Openness to experience is the tendency of the individual to be imaginative, sensitive, original in thinking, attentive to inner feelings, appreciative of art, intellectually curious, and sensitive to beauty (Costa and McCrae,

1992; John and Srivastava, 1999). Such individuals are willing to entertain new ideas and unconventional values.

People who are engaged in their jobs those who are enthusiastic and involved in their day to day work tend to do better work. People who are highly engaged in their jobs identify personality with the jobs and are motivated by the work itself.

They tend to work harder and more productivity than others and are more likely to produce the results their customers and organizations want. Work engagement is related to organizational commitment but the two have important differences. People who are engaged in their jobs tend to be committed to their organizations and vice versa.

B. Physical Engagement

The definition of Kahn indicates that engagement have physical, cognitive and emotional engagement dimensions. In order to have a high engagement level, three dimensions of engagement should be occurred at the same time in the work environment. Rich (2006) summarised physical engagement according to the conceptualization of Kahn as the exertion of effort on one's job. The physical aspect of job engagement concerns the physical energies exerted by individuals to accomplish their roles.

However, Mostert and Rothmann (2006) and Widermuth (2008) investigated relationship between all five traits and engagement. Extraversion is a strong predictor of positive well-being and neuroticism of negative well-being. Relative to neurotic individuals, extraverted individuals are more likely to experience vigor, one of the core dimensions of work engagement. Given that work engagement is defined as relatively activated and energized, it can be predicted that aspects of personality that are themselves more activated and energized will be reflected in physical engagement.

IV. CONCEPTUAL FRAMEWORK

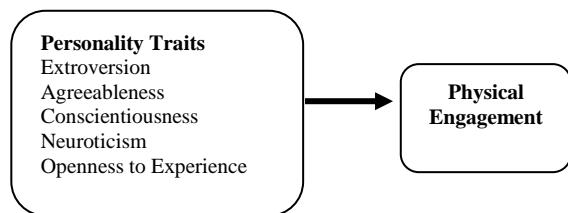


Figure 1: Conceptual Model

(Formed for this Research)

DEFINITION OF KEY CONCEPTS

I. Personality

“Personality is the entire mental organization of a human being at any stage of his development.

It embraces every phase of human character: intellect, temperament, skill, morality and every attitude that has been built up in the course of one's life.” (Warren &

Carmichael, 1930, p.333). The big five personality traits are described below.

Extroversion refers to characterizes people who are outgoing, talkative, sociable and assertive. Agreeableness includes the traits of being courteous, good-natured, empathic and caring.

Conscientiousness refers to people who are careful, dependable and self- disciplined.

Neuroticism is people with high emotional stability are poised, secure and calm. Openness to experience generally refers to the extent that people are sensitive, flexible, creative and curious.

II. Work Engagement

Work engagement is defined as a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption (Schaufeli et al., 2002). Thus, from the perspective of Kahn, work engagement is best described as a multi-dimensional motivational concept reflecting the simultaneous investment of an individual's physical, cognitive, and emotional energy in active, full work performance.

With the help of literature, hypothesis was generated to properly test the relationship between Personality traits and work engagement of employees of financial institutions in Trincomalee. Based on the assumed causal relationship given in the conceptual model, the following research hypotheses formulated for this study are as follows:

Hypothesis: Personality traits are positively and significantly related to physical engagement

V. METHODOLOGY

Researcher applied quantitative methodology for this study. Thus survey method has been adopted. Constructs such as personality factors and physical engagement are well defined and measurable.

And this study was conducted as theoretical based deductive type of study. The extent of researcher inference with the study is low because of it did not affect normal follow of activities. This study was carried out in a non-contrived environment where things and events occur normally in the workplace.

A. Population and sample selection

The sample for the study comprises of all permanent employees to represent the population of all types of employees that total to 380 from selected seven financial institutions in Trincomalee District. Simple random sampling which falls under random sampling was used as the sampling strategy. Following the survey method, self-reported questionnaires were distributed as the instrument for data collection, out of 200 questionnaires distributed, only 191 questionnaires were accepted as properly filled.

B. Survey instruments development

Questionnaire was developed with the support of previous studies carried out by experts in the relevant subject areas.

TABLE I. QUESTIONNAIRE DEVELOPMENT

Dimension	No. of Items	Adopted from Authors
Personality Traits		
Extroversion	10	Neo et.al. (1991)
Agreeableness	09	Neo et.al. (1991)
Conscientiousness	07	Neo et.al. (1991)
Neuroticism	06	Neo et.al. (1991)
Openness to experience	12	Neo et.al. (1991)
Physical Engagement		
Physical engagement	12	Rich et.al. (2010)

C. Method of data analysis

Data has been presented using tables. Meanwhile descriptive analysis was used for data analysis. Hence under the descriptive analysis, mean and standard deviation were derived. Statistical package of SPSS 19.0 has been used for this purpose.

VI. RESULTS AND DISCUSSION

This study provides findings and discussion on personality traits and physical engagement of employees in financial institutions in order to meet the first and second objective of this study.

A. Analysis of Reliability

The reliability of the instrument was measured using cronbach's alpha analysis. The result of cronbach's alpha test is given in Table II which suggests that the internal reliability of each instrument was satisfactory.

TABLE II. RELIABILITY ANALYSES

Dimension	Cronbach's Alpha value
Personality Traits	0.759
Extroversion	0.810
Agreeableness	0.761
Conscientiousness	0.778
Neuroticism	0.818
Openness to Experience	0.784
Physical Engagement	0.775

(Source: Survey data)

B. Summary of the findings on Personality traits

TABLE III. SUMMARY OF THE FINDINGS ON PERSONALITY TRAITS

Variable	Mean	Std. Dev
Personality	3.64	.289
Extroversion	3.43	.402
Agreeableness	3.95	.429
Conscientiousness	3.51	.388
Neuroticism	3.46	.462
Openness to experience	3.87	.343

(Source: Data analysis)

As presented in table III, financial institutions in Trincomalee District are having high level of personality traits since the mean value of personality traits construct is 3.64. It shows companies in financial institutions sector has to take steps to each employees change their attitudes related to work and retaining them through the good personality traits. So, employees have to more concentrate to develop their personal characteristics which will be high influenced on employees' positive attitudes and behaviours. Regarding agreeableness, it has the mean value of 3.95. The influence of agreeableness in the dimension of personality indicates as high. Most of the respondents consist of agreeableness personality about the work. Engaged individuals tend to be helpful, trusting, considerate, and likes to cooperate with others. Moreover, they are kind to almost everyone. The reason could be the attitude of the agreeableness is the tendency to be trusting, compliant, caring, considerate, generous, and gentle. Such individuals have an optimistic view of human nature (Ongore, O. 2013).

Conscientiousness affects work engagement through internal motivational process. Reason is that conscientious individuals are more likely to have high levels of achievement orientation and are less affected by external interferences (e.g. family), and thus exhibit more energy at work (Halbesleben et al., 2009; Kim et al., 2009). Therefore, this study is consistent with the previous study. Extraversion has the lower mean value of 3.43. Because, extraversion implies an energetic approach and includes traits such as sociability, activity, assertiveness and negative emotionality. Different financial institutions employees have different personality but in overall views it has moderate influence.

B. Summary of the findings on Physical engagement

TABLE IV. SUMMARY OF THE FINDINGS ON PHYSICAL ENGAGEMENT

Variable	Mean	Std. Dev
Physical engagement	4.69	.625
Working with happy	4.74	.714
Full effort of job	4.68	.833
Hardest performance	4.67	.840
Continue working	4.66	.843

(Source: Data analysis)

As in table IV, work engagement of employees in financial institutions in Trincomalee District is at higher level because mean value of work engagement is 4.69. Furthermore, out of four dimensions of physical engagement, mean values effort of job (4.68) hardest performance (4.67) and continue working (4.66) are lower than the values of working with happy (4.74). Meanwhile employees in financial institutions in

Trincomalee District has to be achieve their individual and team targets through the more energy, dedication and high job concentration.

Employees of financial institutions in Trincomalee District are having high work demands and high control. Therefore, higher work engagement of them in the companies. The result was consistent to empirical evidence in the literature (Demerouti et al. 2001), which reported that high-work demands and high control were associated with higher engagement. This is caused by the higher level of physical engagement contribution made by employees.

Thus work with intensity on job, devote a lot of energy to job and hardest to perform well on job are in the high level of employees of financial institutions in Trincomalee District. It has resulted in the significantly higher level of physical engagement. As such mind focused on job and engrossed in the work to such activities are at higher level of employees. This has led to the higher level of cognitive engagement.

C. Regression Analysis

TABLE V. MULTIPLE REGRESSION MODEL

Model	Unstandardized Coefficients		Sig.
	B	Std. Error	
Constant	1.030	.163	.000
Extroversion	.341	.051	.000
Agreeableness	.917	.052	.000
Conscientiousness	.953	.063	.000
Neuroticism	-.014	.090	.875
Openness to experience	.530	.098	.000

(Source: Data analysis)

R square between components of personality traits and work engagement 0.914, F statistic between components of personality traits and work engagement 393.803. In addition, r square statistic is 0.914 which means that 91% variance in work engagement can be attributed to the variance in personality traits. Hence it can be derived that personality traits significantly impact work engagement in the financial institutions in Trincomalee District.

91% of work engagement of employees can be explained with the personality traits variables ($p < 0.05$).

Regression equation for work engagement can be formed as follows.

$$WE = 1.030 + 0.341(E) + 0.917 (A) + .953 (C) + (.014) (N) + 0.530 (O)$$

According to Inceoglu and Warr (2012), no study has yet examined the relationship between engagement and all five dimensions of personality that is, extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. However, Mostert and Rothmann (2006) and Widermuth (2008) investigated relationship

between all five traits and engagement. In this study the outcome or value of dependent variable (work engagement) depends on one independent variable (personality traits). Therefore, to quantify the effect of different independent variables on the behaviour of dependent variable, it is necessary to apply the technique of multiple regressions (Cooper & Schindler, 2007; Levin & Rubin, 1991).

According to Inceoglu and Warr (2012), no study has yet examined the relationship between engagement and all five dimensions of personality that is, extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. However, Mostert and Rothmann (2006) and Widermuth (2008) investigated relationship between all five traits and engagement. In this study the outcome or value of dependent variable (work engagement) depends on one independent variable (personality traits). Therefore, to quantify the effect of different independent variables on the behaviour of dependent variable, it is necessary to apply the technique of multiple regressions (Cooper & Schindler, 2007; Levin & Rubin, 1991).

D. Hypothesis Testing

TABLE VI. HYPOTHESIS TESTING

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	31.880	1	31.880	392.939	.000
Residual	15.334	189	.081		
Total	47.215	190			

(Source: Survey Data)

Based on the Table 5.27 for the linear regression ($F(1, 189) = 392.939, p < 0.001$), According to Beta value ($B = 1.416$) the independent variable "Personality traits" are significantly influence dependent variable "work engagement". Since the probability of the F statistic ($p < 0.001$) was less than the level of significance (0.05).

Thus, accept the H1 and conclude that Personality traits are positively and significantly related to work engagement.

Personality traits were found to be a significant factor in exerting work engagement in this particular study. The result was consistent to findings in previous studies (e.g. Costa and McCrae, 1992; John and Srivastava, 1999) that showed positive and significant influence of training and development on employees' outcomes like commitment, engagement and motivation. Personality traits are significantly influenced on work engagement of all types of employees because of that this research mainly focused all types of employees. Therefore, each and every employee is having good personality and ability needed to perform jobs at this level.

VII. CONCLUSIONS

This research focuses personality traits are at high level in financial institutions in Trincomalee District. Therefore, financial institutions need to develop good personality traits to attract the qualified and efficient employees and

also retain them. Meanwhile physical engagement of employees in financial institutions in Trincomalee District is at high level. According to finding among the five personality traits of different employees, Agreeableness has the high influence. Agreeableness is needed to work in peace and resolve the conflicts. Agreeable employees can be more positive and motivated to resolve the problems and conflicts. Therefore, agreeable employees can be more engaged to their job because they can save their energy and flow it to their work roles (Ongore, O., 2013).

Thus their engagement towards the job and organization is at higher level. In addition, physical engagement is critical to business success (Bhagawati, Shailaja & Aralelimath; 2010). In the current scenario the financial institutions in Trincomalee District have to comprehend that high levels of physical engagement will lead to improve employee commitment and involvement towards job thus creating a motivated workforce that will work together to achieve the common goals of the organization.

A. Key suggestion for improve physical engagement

In order to enhance physical engagement of employees organization use following techniques:

Career opportunities: Engagement continues to be first and foremost about employees' career paths. It is important to note that the line manager is typically the owner of this critical engagement driver.

Recognition: Employees need feedback and positive reinforcement to consistently go above and beyond. It is critical to the motivation and the engagement equation.

Organizational reputation: Employees join organizations that have a reputation as a best employer. They are also engaged by working for a best employer.

Communication: It is impossible for an employee to engage without connection, consistency, and commitment in messages. Effective and engaging communication resonates with the employee in rationally, emotionally, and behaviourally relevant ways.

Pay: Although pay does not show up as the top engagement driver, its prevalence in our study indicates that many organizations are struggling with getting this fundamental component of the employment contract right.

REFERENCES

- [1] Bhagawati Y., Shailaja, M. & Aralelimath, L. (2010) *Employee Work Engagement: Best Practices for Employers: Partnership for Workplace Mental Health*, 1 edn..
- [2] Costa, P. T. & McCrae, R. R (1992) *Employee Work Engagement: Best Practices for Employers: Partnership for Workplace Mental Health*, 1 edn..

- [3] Demerouti, E., Bakker, A. B., De Jonge, J., Janssen, P. P. M., & Schaufeli, W. B. (2007) *Employee Work Engagement: Best PrRevised NEO Personality Inventory (NEO-PI- R)* *Burnout and engagement at work as a function of demands and control:* Journal of Work, Environment and Health: 27, 279–286.
- [4] Goldberg, L. R. (1971) *An alternative "Description of personality": The Big-Five factor structure*, Journal of Personality and Social Psychology: 59, 1216-1229.. Inceoglu,I., and Warr,P. (2012) *Personality and Job Engagement:*, Journal of Personnel Psychology, SHL Group, London, Institute of Work Psychology, Sheffield: .
- [5] Kahn, W. A. (1990) *Psychological conditions of personal engagement and disengagement at work*, Academy of Management Journal: 33, 692-724.
- [6] Kim, H. J., Shin, K. H., & Swanger, N. (2009) *Burnout and engagement: A comparative analysis using the Big Five personality dimensions.*, International Journal of Hospitality Management, 28, 96-104.
- [7] Llorens, S., Schaufeli, W., Bakker, A., & Salanova, M. (2007) *Does a positive gain spiral of resources, efficacy beliefs and engagement exist? Computers in Human Behaviour*, 23, 825–841.
- [8] Macey, W. H., & Schneider, B. (2008) *The meaning of employee engagement:* 1 edn., Industrial and Organizational Psychology, 3-30
- [9] Mostert, K., Rothmann, S. (2006) *Work-related well-being in the South African Police Service*, 1 edn., J. Crim. Justice: 34(5),479-491.
- [10] Ozgur Ongore, A (2013) *A Study of Relationship Between Personality Traits and Job Engagement:* A phd Candidate, Ankara University, Labour Economics and Industrial Relations Department, Ankara, 06590, Turkey:
- [11] Rich, B. L., Lepine, J. A., & Crawford, E. R. (2010) *Job engagement: Antecedents and effects on job performance*, Academy of Management Journal,y: 53(3), 617-635..
- [12] Robinson, D., Perryman, S., & Hayday, S. (2004) *The Drivers of Employee Engagement*, Academy of Management Journal,y: <http://www.wellbeing4business.co.uk/docs/Article%20Engagement%20research.pdf>.
- [13] Schaufeli, W.B., Bakker, A.B., & Salanova, M. (2007) *The measurement of work engagement with a short questionnaire*, A cross-national contact with formal financial services (Anyasi, F. I. and Otubu, P. A. , 2009).study. Educational and Psychological Measurement, 66(4), 701-716.

FACTORS INFLUENCING THE EXAMINATION STRESS: THE SPECIAL REFERENCE TO EASTERN UNIVERSITY UNDERGRADUATES

P. Luckmizankari^{*1}, T. Prabhakaran^{*2}

Department of Management, Faculty of Commerce & Management, Eastern University, Sri Lanka

¹ luckmizankari@gmail.com

² p_thambirajah@yahoo.co.in

Abstract--The objective of this study is to discover the level/factors of examination stress among B.B.Aundergraduates of Eastern University. Lee & Larson, (2000) and Lou & Chi, (2000) stated that examination stress is a student's interactions between environmental stressors, the student's cognitive appraisal of and coping with the academic-related stressors, and psychological or physiological response to the stressors. In addition, this stress leads to various diseases, such as depression, anxiety, ulcer/gastric and blood pressure. Therefore, this study further tries to make a comprehensive investigation into each component of examination stress, such as time, procedures in an exam, physical cognition, medium and physical environment along with an investigation on the consequences of examination stress. The sample comprises of 100 B.B.A Undergraduates from various Year of study spread across the Eastern University, Sri Lanka. Data was collected through self-designed examination stress questionnaire; this was validated by performing reliability test. Through this survey researcher can conclude that as, there is a high-level examination stress exist among B.B.A students. Female students are having high stress than male students. Among the factors, physical cognition has the highest contribution in examination stress and depression is a common consequence among most of the undergraduates who has examination stress than others.

Keyword— Examination Stress.

I. INTRODUCTION

Nowadays stress become a common issue which causes ill-health to humans. Whatever they do, they will final resulted by having stress. This is because of focusing on their affiliation needs while linking their busy life with jobs and studies. Stress is a real or perceived imbalance between environmental demands required for survival and an individual's capacity to adapt to these requirements (Lazarus and Folkman, 1984; Chrouzos and Gold, 1992; Lovallo, 1997; Pearlin, Lieberman, Menaghan, and Mullen, 1981; Weiner, 1992). It creates psychological as well as physical sickness in one person's life as anxiety, depression, irritation, headache, neck pain, asthma, ulcer etc. There are numbers of

reasons available for someone feels stress in their life, those are may be afraid of missing loved one, family pressure, financial insufficient, work overload, etc. when concentrate on student's side, there is evidence that students do experience some stress (Aherne, 2001), while others found that students suffer significant levels of stress (Brown & Ralph, 1999). Their stressor may be huge; among those, examination is a common factor, which induces stress in students' lifespan.

Lee & Larson, (2000) and Lou & Chi, (2000) stated that examination stress is a student's interactions between environmental stressors, the student's cognitive appraisal of and coping with the academic-related stressors, and psychological or physiological response to the stressors. It is a specific kind of disturbance and pressure perceive by students during examination period. Many Researches revealed that, suffer of stress in examination days is a main reason for numerous emotional disorders which are basement to trauma disorder. This examination stress occurs due to several factors like, pressures from parents' side, concentrate on others' opinion, thinking about future growth etc. Fairbrother & Warn, (2003) stated that, stress among students have been researched from several years, based on that researchers have found stressors as too many assignments, competitions with other students, failures and poor relationships with other students or lecturers.

Especially, Management students are encounter too much of pressures while studying in university, because management education is a base for enhancing the qualities and skills, which are relevant to cope in organizational environment. Therefore, management education agendas in university consist of varieties of curriculums, which seem to be stressor to students. When consider in students of Eastern University, the medium of education also considers as a stress-creating factor for vast amount of students. However, there is no field of researches carried out to investigate the actual factors, which induce stress among Management students in Eastern University.

Moreover, there are many studies were conducted to evaluate stress of students in universities, still there is also a lack of empirical work involve in investigate factors

affecting the examination stress of students during the exam time. Thus, there has not been suitable argument about the methodological and statistical matters linked with them. Therefore, this study engaged to study the level of examination stress and factors of examination stress of B.B.A undergraduates of Eastern University.

II. LITERATURE REVIEW

University students have many barriers to overcome in order to achieve their optimum result in university life. Among that, Examinations are considered as a factor, which creates stress in research as well, and it was just considered as one of the aspect in stressors, which create stress to students. Exam stress is a set of responses that includes excessive worry, depression, nervousness and irrelevant thinking to a class of stimuli from an individual's experience of assessment and outcome (Gajalakshmi G & et al., 2012). The various causes that create examination as a stressor are categorized as follows;

Time

Time consider as an important factor which create more anxiety and depression during the examination time. Duration of examination, urge to cover all syllabus quickly before examination, time interval between an examination to another and inadequate or vast revised periods come under time related factors, which produce stress during examination period. Based on Goodman (1993), time is considered as one of stressors which affecting the students.

Medium

Medium is defined as a language through the subjects and lectures can be delivered to students. Difference in medium between students' primary/ intermediary education and higher education can considered as a factor to induce stress. The effect of different medium can be severally affecting the students during their examination time.

Physical environment

Physical environment of examination hall can considered as a stress-inducing factor during exam time. Noisy environment, damaged furniture, improper lighting of environment should create irritation and anger during the examination.

Procedures in exam

Disturbance during examination also create stress among students. Exams' procedures like ID card verification, signing in application form, long instruction in answer sheet to fill can trouble the students during exams, through this pressure will increase in examination hall.

Personal cognition

Personal thoughts of students during the examination also create stress to them. Thought of fail in examination, comparing themselves with others, fear of losing grades can induce depression and pressures during examination. As stated by Goodman (1993), self-imposed stressors also affecting students like other stressors (e.g. financial, health-related and academic).

According to Abouserje, (1994), Students suffering stress at each semester with the extreme sources of stress from taking exams, struggle for grade in exam, and the large amount of syllabus to study in a small amount of time. Meanwhile, study of Erkutlu & Chafra (2006), revealed that, pressure to perform well in the examination and time allocated creates stressful situation among university students.

Zeidner (1987) found that multiple choice type exams are more favorable than essay type questions in examination, by both boys and girls. It revealed that the content of exam paper also a factors to create examination stress among students. On the research of Sources of Academic Stress – A Study on Management Students of Prabhakar P.N and Gowthami .C stated that, pressure to get good grades through the exam was the cause of worry for about 50% of the students whereas around 40% were worried about sitting for the exam. Thus, examinations are the ostensible stressors for management students. Takatsui K & et al. (2008) reported on their research as, the time of examinations is an ideal factor which creates mental stress in students.

Researches of Manjula G and Vijaylaxmi A.H.M. (2012) and Edmunds (1984) they found, change in medium of instructions, test anxiety, fear of failure and competition for grades are the factors, which are responsible for examination stress and anxiety.

A study conducted by Saima R & Qadir B (2011) as factor affecting students' performance in examination at university level in Pakistan was explored mean score of factors such as environment of exam hall, shorter attendance in class, examination pattern, and behavior of invigilation staffs were more than 3. Therefore, research was concluded as psychological, physical and educational factors affect performance of university students in examination.

In this regard, this study tries to identify the factors, which create examination stress for management students during the examination period in Eastern University, Sri Lanka.

III. RESEARCH QUESTIONS

1. What is the level of examination stress among the BBA undergraduates EUSL?
2. What factor contributes more on examination stress among undergraduates EUSL during the examination period?
3. What consequences are arising among undergraduates through of examination stress in EUSL?

IV. RESEARCH OBJECTIVES

The main objective of the study is,

1. To identify the level of examination stress among B.B.A undergraduates of EUSL
2. To find out the factor that contributes more on examination stress among undergraduates EUSL during the examination period.
3. To study the consequences of the stress among undergraduates of the EUSL

V. METHODOLOGY

A. Study Setting, Study Design

This research study was fully depended on Primary data. Primary data were collected through a closed ended questionnaire.

B. Sample

The study population of this study is undergraduates of faculty of commerce & management of Eastern University from which about 100 undergraduates were selected as a sample. In this investigation Simple Random Sampling procedure was used. Based on a percentage of the total number of undergraduates in all four years, 100 individuals were randomly selected for data collection. However, only 91 questionnaires fully completed and considered for data analysis. Following equation was used for sample selection;

$$\text{Sample} = \frac{\text{No. of undergraduates in each year of study}}{\text{Total population}} \times \text{Total sample (200)}$$

Sampling framework for 100-sample size is given as follows;

Table I. Sampling Framework

No.	Year of study	Population	Sample	Received questionnaire
1.	First year	104	27	27
2.	Second year	90	24	20
3.	Third year	99	26	21
4.	Fourth year	87	23	23
Total		380	100	91

(Source: Faculty of commerce & management students' details)

C. Data analysis

Univariate and bivariate technique was used for evaluating respondents' views. Descriptive statistics and correlation analysis were used for analysis of the summarized data.

VI. FINDINGS

Analysis of the collected data was carried out based on research objectives of this study under different topics as shown as follows:

A. Reliability test

Reliability test has been conducted through SPSS for measures the internal consistency of the instrument, based on the average inter-item correlation. The result of Cronbach's alpha test of each variable and results are shown in table II.

TABLE II. Reliability test of each dimension

Cronbach's Alpha	N of Items
.650	5

(Source: Survey data)

The Cronbach's alpha value above 0.60 is considered as good reliable instrument and high level of internal consistency of data and scale. Based on that, each five dimensions of Examination stress's results show good reliability, overall result shown as 0.650. Therefore, it is indicated measurement, which was used, in this study also good instrument.

B. Personnel information

This information is related to undergraduates' important personal detail such as gender, year of study, field of study, marital status and residence during the exam. There are follows,

- A. **Gender distribution:** Out of 91 respondents, there were 54.9% of females and 45.1% of males, who participated and responded to the questionnaire.
- B. **Distribution of year of study:** Among the 91 respondents, 1st year students were in high number as 29.7%, followed by 4th year students as 25.3%, 3rd year students (23.1%) and 2nd year students (22%) respectively.
- C. **Distribution of field of study:** Out of 91 respondents, most of the respondents are following the general course (80.2%), followed by marketing course (12.1%) and human resource management course (7.7%) respectively.
- D. **Distribution of marital status:** Among the 91 undergraduates, 98.9% were single and only 1.1% was married.
- E. **Distribution related to residence type:** Among 91 respondents, most of them were from hostel (54.9%), rest of them was from home (45.1%).

C. Research information

This information is related with variable of this research. For this study, Examination stress considered as variable and it has sub dimensions. The analysis was carried out based on research objectives.

- A. **To identify the level of examination stress among the BBA undergraduates EUSL**

Table III. Level of Examination Stress

	N	Mean	Std.
Examination stress	91	3.1707	.62995

(Source: Survey data)

Mean of Overall examination stress is 3.1707. It indicated that there is a high level of examination stress exist among the undergraduates in EUSL. In addition, most of the respondents were expressed the general view regarding the variable of Examination stress (SD = 0.62995).

Table IV. Examination stress

Level	Frequency	Percentage
Low level	30	33
High level	61	67
Total	91	100

(Source: Survey data)

Out of 91 respondents, 67% of respondents indicated there was high-level examination stress, while only about 33% of students was declared as low levels of examination stress exists in EUSL. Therefore, can conclude as most of the students at faculty of commerce & management in EUSL felt a high level of examination stress.

B. To find out the contribution of factors to the stress among undergraduates EUSL during the examination period

Table V. Level of Dimensions of Examination Stress

	N	Mean	Std.
Time	91	3.1868	.69781
Medium	91	3.2088	1.01914
Physical environment	91	3.2088	1.03596
Procedure in exam	91	3.0256	1.09908
Personal cognition	91	3.2234	.97759

(Source: Survey data)

Examination stress includes five dimensions which are Time, Medium, Physical environment, Procedure in exam and Personal cognition. Among these, time, medium, physical environment and personal cognition have contributed to the very much in the Examination stress of EUSL undergraduates. They have the mean value 3.187, 3.209, 3.209 and 3.22. However, a procedure in the exam has only a moderate level of contribution (3.026) and personal cognition has the highest level of contribution in examination stress of undergraduates compared to other dimensions.

C. To study the consequences of the examination stress among undergraduates of the EUSL

Table VI. Frequency Distribution of Consequences of Examination Stress

	Yes		No		Total	
	Fr.	%	Fr.	%	Fr.	%
Depression	62	68.1%	29	31.9%	91	100%
Ulcer/Gastric	44	48.4%	47	51.6%	91	100%
Anxiety	37	40.7%	54	59.3%	91	100%
B.P	22	24.2%	69	75.8%	91	100%

(Source: Survey data)

There were four consequences of examination stress considered in this study. Among that, most of the respondents revealed that they have depression during the exams (68.1%), followed by Ulcer/Gastric (48.4%) and Anxiety (40.7%). However, only 24.2% of undergraduates revealed that they have blood pressure (B.P) during the examinations.

D. Level of Examination stress among gender

Table VII. Gender * Level of examination stress

	Gender	High level		Low level		Total
		Fr.	%	Fr.	%	
Gender	Male	25	27.5%	16	17.5%	41
	Female	36	39.6%	14	15.4%	50
Total		61	67%	30	33%	91

(Source: Survey data)

Out of 91 respondents, 67% of the undergraduates are facing a higher level of examination stress, among that, female students are highly suffering examination stress (39.6%) than male students (27.5%) and only 33% of undergraduates have lower level of examination stress. Among that, 17.5% of males and 15.4% are females.

E. Year of study wise level of examination stress

Table VIII. Year of study * Level of examination stress

	Year of study	High level		Low level		Total
		Fr.	%	Fr.	%	
Year of study	1 st year	17	18.7%	10	11%	27
	2 nd year	12	13.2%	8	8.8%	20
	3 rd year	14	15.4%	7	7.7%	21
	4 th year	18	19.8%	5	5.5%	23
Total		61	67%	30	33%	91

(Source: Survey data)

Out of 91 respondents, 67% of the undergraduates are facing a higher level of examination stress, among that, 4th year students are highly facing examination stress (19.8%) followed by 1st year (18.7%), 3rd year students (15.4%) and 2nd year students (13.2%) respectively. Only 33% of undergraduates have lower level of examination stress.

F. Level of examination stress based on residence during exams.

Out of 91 respondents, 50 students are staying in hostel during the exams among that 37.4% of students facing high level of stress. And 41 students are coming from home during exams. Among them, 29.7% of students are suffering from examination stress.

TABLE IX. Residence during the exams * Level of examination stress

	Residence during exams	High level		Low level		Total
		Fr.	%	Fr.	%	
Residence during exams	Home	27	29.7%	14	15.4%	41
	Hostel	34	37.4%	16	17.6%	50
Total		61	67%	30	33%	91

(Source: Survey data)

G. Level of examination stress based on field of study

TABLE X. Field of study * Level of examination stress

Field of study	High level		Low level		Total
	Fr.	%	Fr.	%	
HR	7	7.7%	0	0%	7
Marketing	6	6.6%	5	5.5%	11
General	48	52.7%	25	27.5%	73
Total	61	67%	30	33%	91

(Source: Survey data)

Out of 91 undergraduates, 73 students are following general course, among that 52.7% are having a higher level of examination stress. 11 students are following Marketing course, among that 6.6% of students are having a higher level of examination stress. And only 7 students are following human resource (HR) course, all of them are having a higher level of examination stress.

VII. CONCLUSION

Based on the analysis, which is carried out in the previous heading, following, is the conclusion draft of the study of factors influencing the examination stress in undergraduates of EUSL.

Eastern university's undergraduates have a higher level of examination stress. Among the dimensions of examination stress, personal cognition has the highest level of contribution to examination stress. However, procedures in exams have only a moderate level of contribution to examination stress among undergraduates.

When concentrate on the consequences of examination stress most of the undergraduates are suffering from depression through examination. Followed by, ulcer/gastric and anxiety. However, less numbers of students are suffering from blood pressure compared to other diseases.

Among all respondents, 67% of students are having a high level of examination stress. 33% of the students are having low level of examination stress. Further, among 41 male students, 27.5% of them are facing high level examination stress and 17.5% of them have low level of stress. And among 50 female students, 39.6% of female students are having higher examination stress and only 15.4% of them have low level of examination stress. It is seen that compared to males, female students having more worries regarding examination and they feel more stress.

Students of different year of study have different stress level in EUSL. There are 19.8% of 4th year students are facing high level stress. It is because of, they are in their latter part of their university life, they have higher level of pressure regarding their examination results and they have lots of other academic work like an internship and final thesis works. Therefore, they definitely have higher stress than other years of students. And 18.7% of 1st year of students having high level stress. Because, they are fresher for university activities. Some may have language barriers and most of them are facing new king of procedures and function

regarding the examination. Further, 11% of them are having low level stress. Because, they never worry about their failures at an earlier stage and they may consider, the 1st year examination is not hugely impact on their class or in final grade. However, 2nd year and 3rd year of students are having 13.2% and 15.4% of higher level of examination stress respectively.

Residence during examination also has some impact on the examination stress of EUSL undergraduate. Mostly, students who are coming from hostel (37.5%) are having a high level of exam stress comparable to those who are coming from home (37.4%). This may occur because, the students who are from hostel missed the attachment of family and support from family. Moreover, comparisons among other students in the hostel will increase their pressure toward the examination. Therefore, it leads to higher examination stress than the students who are coming from home.

When concentrate the field of study, the students who follow human resource management (HRM) course, all they have higher level of stress only. Heavy content of the syllabus and many notes related subjects in HRM may induce higher stress among students. Marketing students are having 6.6% of a high level stress 52.7% of students who follows general course are having high level of stress.

Based on this research, the researcher can conclude that undergraduates of EUSL are having a high level of stress in the examination. Among that, female students are facing high level of stress compared with male students. Among the five factors, which are considered in examination stress, Personal cognition, Physical environment, Medium and Time factors are highly affecting the examination stress. The factor, Procedure in exam is having moderate level affection in examination stress. Moreover, students who have examination stress, they are hugely affected by depression. However, least of them are having blood pressure.

REFERENCES

- [1] Abouserie, R. (1994). Sources and levels of stress in relation to locus of control and self-esteem in university students. *Educational Psychology*, 14(3), pp. 323-330.
- [2] Aherne, D. (2001). Understanding student stress: a qualitative approach. *The Irish Journal of Psychology*, 22(3/4), pp. 176-187.
- [3] Brown, M. & Ralph, S. (1999). Using the DYSA programme to reduce stress and anxiety in first year university students. *Pastoral Care*, 17(3), pp. 8-13.
- [4] Chrousos, G. P. & Gold, P. W. (1992). The concepts of stress and stress system disorders: overview of physical and behavioral homeostasis. *JAMA*, 268(2), pp 267.
- [5] Edmunds, G. J. (1984). Needs assessment strategy for black students: An examination of stressors and program implications. *Journal of Non-White Concerns in Personnel & Guidance*, 12, pp. 48-56.
- [6] Erkutlu, H. V. & Chafra, J. (2006). Relationship between leadership power bases and job stress of

subordinates: example from boutique hotels, *Manage. Res. News* 29(5) pp. 285-297.

[7] Fairbrother, K. & Warn, J. (2003). Workplace dimensions, stress & job satisfaction. *Journal of Managerial Psychology*, 18 (1), pp. 8-21.

[8] Gajalakshmi, V., Whitlock, G. & Peto, R. (2012). Social inequalities, tobacco chewing, and cancer mortality in south India: a case control analysis of 2580 cancer deaths among non-smoking non-drinkers. *Cancer Causes Control*, 23(1), pp. 91-8.

[9] Goodman, E. D. (1993). How to handle the stress of being a student?. *Imprint*, 40(2), pp. 40-43.

[10] Lazarus, R. S. & Folkman, S. (1984). Stress. Appraisal and Coping. New York: Springer.

[11] Lee, M. & Larson, R. (2000). The Korean "Examination Hell": Long hours of studying, distress and depression. *Journal of Youth and Adolescence*, 29(2), pp. 249-271.

[12] Lou, W. & Chi, I. (2000). The stressors and psychological well-being of senior secondary school students. *Psychological Science China*, 23(2), pp. 156-159.

[13] Lovallo, W.R. (1997). Stress and health: Biological and psychological interactions. Newbury Park, CA: Sage.

[14] Manjula, G. and Vijaylaxmi, A.H.M. (2012). Stressors of academic stress- A study on pre university students, *India J. Sci. Res*, 3(1), pp. 171-175.

[15] Pearlin, Leonard, I., Morton, A. Lieberman, Elizabeth, G. Menaghan, & Joseph, T. M. (1981). "The Stress Process." *Journal of Health and Social Behavior*, 22(4), pp. 337-56.

[16] Prabhakar, P. N. and Gowthami, C. (2011). Sources of Academic Stress - a study of management students. *Journal of Management Science*, 1(2), pp. 31-34.

[17] Saima, R. & Qadir, B. (2011). A study of factors affecting students' performance in examination at university level. Procedia- social and behavioral science, 15, pp. 2042-2047.

[18] Takatsuji, K., Sugim oto, Y., Ishizaki, S., Ozaki, Y., Matsuyama, E. & Yamaguchi, Y. (2008). The effects of examination stress on salivary cortisol, immunoglobulin A, and chromogranin A in nursing students. *Biomed Res*, 29(4), pp. 221-4.

[19] Weiner, B. (1992). Human Motivation: Metaphors, Theories, and Research, Sage, Newbury Park, CA.

[20] Zeidner, M. (1987). Essay versus multiple-choice type classroom exams: the student's perspective. *Journal of Educational Research*, 80 (6), pp. 352-358.

FACTORS INFLUENCING MOBILE BANKING ADOPTION IN TRINCOMALEE DISTRICT

M.H.B.A.H. Madana

Assistant Lecturer, Tricomalee Campus, Eastern University Sri Lanka,

mhb.ahmadana@gmail.com

Abstract—This paper reports the findings of a study concerning the adoption of Mobile banking by investigating consumer adoption within the context of Sri Lankan banking services. The research framework was based on Technology Acceptance Model and other previous models. Questionnaire were issued to gather the data and 55 complete responses were gathered from random banking customers who were Mobile Phone users from Trincomalee district. Descriptive analysis was done to provide strength to the research study which showed that even though considerable people were aware about Mobile banking, most of them were resistance to adopt Mobile banking. Correlation was used to examine relationship of seven hypotheses with actual Mobile banking usage. Results revealed that, there is a strong relationship in perceived usefulness and perceived ease of use between mobile banking adoptions, a weak relationship with mobile banking adoption in social influences and compatibility and a negative relationship with Trial Ability, perceived risk and, complexity. It is recommended that, commercial banks should demonstrate to their customers the advantage they are bound to have by adopting and using mobile banking over using conservative banking methods. It is also advisable to examine the effects of mobile banking on profitability of commercial banks in Sri Lanka.

Keywords—Mobile banking and Adoption

I. INTRODUCTION

In a dynamic environment, many banks seek new strategies that facilitate online information sharing and transactions. Linking banking business to customers through mobile devices such as mobile phones or personal digital assistant (PDAs) is one of these competitive strategies. Mobile banking refers to using mobile devices to provide financial information, communication and transactions to customers such as checking account balances, transferring funds and accessing other banking products and services from anywhere, at any time (Ensor, 2012). While mobile becomes a popular access point, there are many emergent benefits of mobile banking for both banks and customers. Services provided through mobile banking include sending and receiving messages and instructions, access (pre- paid or subscription) to a mobile service, and M- banking application installed on user's SIM card to facilitate deposits, withdraws and money transfer between parties (Puschel, 2010).

Technological advancement in the area of telecommunications and information technology has

continued to revolutionize the banking industry. The delivery of financial services has experienced major changes during the past few years. A feature of the banking industry across the globe has been that it is increasingly becoming turbulent and competitive. Banks, aided by technological developments, have responded to the challenges by adopting a new strategy, which emphasizes on attempting to build customer satisfaction through offering better products and services and at the same time to minimize operation costs. (Sohail, 2003). Provision of mobile banking services has been broadly used, and an understanding of the customer adoption process will have important implications for bankers and customers alike.

II. PROBLEM STATEMENT

Mobile banking has been in use since early 2000s in many parts of the world. Indeed, European banks started using the service in 1999 upon the launch of smart phones. In Sri Lanka, almost all commercial banks have embraced the service. It is documented that mobile banking is associated with many benefits which include reduced time of transaction and the need for physical bank branches. Against this backdrop, however, it is observed that, there have been conspicuous challenges that have limited the adoption and use of the mobile banking. The mobile banking market still remains very small when compared to the entire banking transactions. It is further observed that the widespread adoption and large usage of cellular phones did not translate to adoption and usage of mobile banking. Failure of sufficient adoption and use of mobile banking services by commercial banks' customers is bound to deny customers the objected benefits such as portability, labor free, reduced cost, convenience, wider customer reach, high security level, and accessibility etc. On the other hand, given that banks introduce this service with one of the key objectives being to cut down on costs by reducing the number of physical branches and human resources, when the service fails to be adopted and used, they are bound to lose on the benefits; instead they are likely to incur huge losses associated with cost of initiating mobile banking.

III. LITERATURE REVIEW

The use of mobile phones has facilitated the expansion of markets, social business, and public services in both developing and developed countries (Spence, R. and Smith, M. L., 2010). Literature claims that rapid advances in mobile technologies have made M-banking increasingly important in financial services (Lin, J-S. and Chang, H-C, 2011). The use of M-banking offers a way of lower the cost of moving money from place to place (Donner, J. and C. A. Tellez, 2008). At the same time it brings more users into

contact with formal financial services (Anyasi, F. I. and Otubu, P. A. , 2009).

A. Perceived Ease of Use

Perceived ease of use refers to the degree to which a person believes that using a particular system would be free of effort (Davis, 1989; Liu and Li, 2010).

H1: Perceived Ease of Use has direct effect on intention to adopt mobile banking.

B. Perceived Usefulness

Perceived usefulness has been defined as “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989) Perceived usefulness is the primary precursor that determines the behavioral aim to use a computer system (Venkatesh, 2000).

H2: Perceived usefulness has direct effect on intention to adopt mobile banking.

C. Perceived Risk

Perceived risk as defined by (Pavlou, 2001), “It is the user’s subjective expectation of suffering a loss in pursuit of a desired outcome”. The quality of online services offered the possible risk of illegal activities and fraud has always been a concern for both consumer and service providers (Ba, S. and Pavlou, P., 2002).

H3: Perceived Risk Has Direct Effect on Intention to Use Mobile Banking

D. Social Influence

Social influence can be defined as the level to which a person perceives that essential others believe he/she should exercise the technology (Venkatesh, V., Morris, M.G., Davis G.B. and Davis, F.D., 2003).

H4: Social Influence has Direct Effect on Intention to Use Mobile Banking.

E. Trial Ability

Trial Ability refers to the capacity to experiment with new technology before adoption. Potential adopters who are allowed to experiment with an innovation will feel more comfortable with it and are more likely to adopt it(Agarwal, R. and Prasad, J. , 1998); Rogers 2003). Further support is given by (Tan, M. and T. S. H. Teo,, 2000) who argue that if customers are given a chance to try the innovation, it will minimize certain unknown fears, and lead to adoption.

H5: Trial Ability has Direct Effect on Intention to Use Mobile Banking

F. Compatibility

Compatibility refers to the degree to which a service is perceived as consistent with users’ existing values, beliefs, habits and present and previous experiences (Chen, L., M. Gillenson, and D. Sherrell, , 2004). Compatibility is a vital feature of innovation as conformance with user’s lifestyle can propel a rapid rate of adoption (Rogers, 2003).

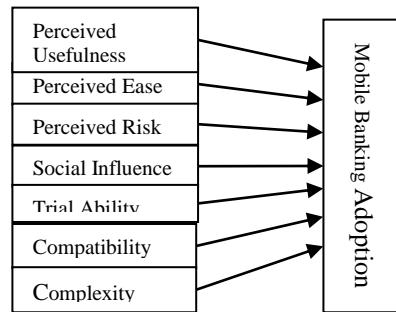
H6: Compatibility has Direct Effect on Intention to Use Mobile Banking

G. Complexity

(Cheung, W., M. K. Chang, and V. S. Lai,, 2000) Defined complexity as the extent to which an innovation can be considered relatively difficult to understand and use.

H7: Complexity has Direct Effect on Intention to Use Mobile Banking

CONCEPTUAL FRAMEWORK



IV. METHODOLOGY

The methodology approach in this research is descriptive. The study focused on bank customers within Trincomalee district. Four commercial banks were purposively selected for this study, namely People’s bank, Bank of Ceylon, Commercial bank and Sampath bank. A convenient sample of 55 customers was selected.

Both interview and survey methods will be used for data collection. Also a pre tested questionnaire survey will be conducted in Trincomalee area. Data were analyzed using both descriptive and inferential statistics. Measures of central tendency we used for descriptive statistics. The researcher used Statistical Package for Social Sciences (SPSS) Version 21.0. The data will be analyzed through “correlations”. In the multiple regression analysis, in this analysis check whether there is any relationship between influential factors and consumer adoption in M-banking in Sri Lanka.

V. RESULTS

The questionnaire was pilot tested to ensure that the items in the questionnaire are clear and appropriate. Literatures recommend Pre-testing of research instruments before use in research. A pilot study for a sample of 10 bank customers were carried out to test the reliability of the instruments. The information collected was used to further improve on the questionnaires.

Factor	Correlation value	Conclusion
Perceived usefulness	0.73	Positive, Strong
Perceived ease of use	0.75	Positive, Strong
Social influences	0.05	Weak
Trial Ability	-0.02	Negative
Compatibility	0.05	Weak
Perceived risk	-0.03	Negative
Complexity	-0.18	Negative

According to Correlation value, there is a strong relationship in perceived usefulness and perceived ease of use between mobile banking adoptions. There is a weak relationship with mobile banking adoption in social influences and compatibility. There is a negative relationship with Trial Ability, perceived risk and, complexity.

VI. CONCLUSION

Perceived usefulness was found to have significant strong positive impact on the consumers' intention to adopt mobile banking services. Similar results were demonstrated from previous studies by (Luarn, P. and H. H. Lin, 2005), (Cheah, 2011). This implied that those customers who find mobile banking services useful, beneficial, and convenient in managing their funds efficiently and effectively would be the potential adopters.

Perceived ease of use was found the most significant strong positive influence on the consumers' intention to adopt mobile Banking. The finding was consistent with past studies conducted related to adoption of mobile banking services (Chung and Kwon, 2009; and Kim et al, 2008). This result implied that if mobile banking application is user friendly, basic skills acquired to use the application, consumers are more likely to adopt mobile banking services.

Social influence had weekly impact on the intention to adopt mobile banking services among consumers. But this determinant had a strong positive impact on adoption in mobile banking on several past studies by (Sripalawat et al, 2011; Puschel and Mazzon, 2010; Schepers and Wetzel, 2007; and Yu, 2012). The finding from this study highlighted that potential adopters of technology can be influenced by people surrounding them, e.g. friends and family.

Trial ability has found that a negative effect on mobile banking adoption. This supported other research finding in the context of PC and phone banking (Kolodinsky et al. 2004). Normally, in the trial period, customers are expected to have full support and awareness about the mobile banking services. Perhaps, banks do not give much attention to the potential customers who are willing to use mobile banking on trial bases. Therefore, such customers are not likely to be convinced with mobile banking as they do not see its benefits in the trial period. Another contrasting explanation is that consumers may have trust in mobile banking, find it useful, and consider it safe and less risky. Hence; they think that there is no need to try it out.

Compatibility has found insignificant determinant on mobile banking adoption. But previous research's findings are similar to previous studies (Koenig-Lewis 2010; Lin 2011). These studies have shown that perceived compatibility of an innovation has a positive influence on the adoption of mobile banking. This implies that mobile banking service fits well in the manner customers manage their finances, is suitable to their working and lifestyle, and therefore, they like to adopt new innovations. When customers or prospective customers perceive that using mobile banking is completely compatible with their current ways of banking and it fits well with the way they like to do banking, they tend to adopt it.

Perceived risk was found to have a negative impact on the customers' intention to adopt mobile banking services, which supported our sixth determinant. This was in line with many past studies by (Al-Jabri and Sohail, 2012; Tan and Teo, 2000; Luo et al, 2010; and Gu et al, 2009). The consumers perceived higher risks and uncertainty such as loss of data and misuse of financial information would discourage them in the adoption of mobile banking services. Therefore, it is imperative for stake holders to plan higher security in providing mobile banking services in order to achieve higher consumer acceptance.

Complexity has found that a negative effect on Mobile is banking adoption. This result is unexpected and contradictory to findings of some prior studies (Jahangir & Begum 2008; Luarn & Lin 2005). However, it is consistent with Wang et al.,'s (2003) findings, which suggested that there was no significant impact of ease of use on behavioral intention to use the internet banking. It can be inferred that since majority, 72.7%, of the sample respondents of this study are young (between ages of 18 and 25), it is possible that they can learn mobile banking easily; and thus the complexity has no impact on their decision whether they adopt mobile banking or not. Since youth are more aware of new innovation, they may have experienced various technologies and therefore have a good foundation of knowledge on how to use and interact with mobile banking.

VII. RECOMMENDATIONS

After reviewing the findings of this study, there are several important implications recommended for banks, service developers and software engineers in order to provide better strategic insight to design and implement mobile banking services that yield higher consumer acceptance in Sri Lanka. Perceived usefulness and Perceived ease of use were found to be the factors that influence consumers' behavior intention in adopting mobile banking, service developers and software engineers should focus on the development of mobile banking facilities. This can be achieved by developing better functions in terms of flexibility, security and accessibility features to enhance consumers' confidence to adopt mobile banking services.

- 1) It is important for customers to be trained on the requirements of mobile banking since customers are not quite sure of whether it requires training or not.
- 2) There is need to address security issues associated with Mobile banking technology so as to ensure success of Mobile banking technology. More specifically, the issues that need to be addressed concerning perceived risk include performance of mobile banking because of network problems.
- 3) The banks should explain to customers how they can get back their cash in case of they lose money while using M-banking technology due to careless mistakes such as wrong input of account number or amount of money. They expressed fear that they would not get compensation from banks when errors occur.

REFERENCES

[1] Agarwal, R. and Prasad, J. , 1998. *A conceptual and operational definition of personal innovativeness in the domain of information technology*”, *Information Systems Research*, s.l.: s.n.

[2] Akturan, U., and Tezcan, N., 2012. *Mobile banking adoption of the youth market: Perceptions and intentions*, s.l.: s.n.

[3] Al-Gahtani, S. S., 2003. *Computer technology adoption in Saudi Arabia: Correlates of Perceived Innovation Attributes*, s.l.: s.n.

[4] Al-Jabri, I. M., 2012. Mobile Banking Adoption: Application of Diffusion Of Innovation. pp. VOL 13, NO 4.

[5] Amin, H. Hamid, M., Lada, S. and Anis, Z., 2008. The adoption of mobile banking in Malaysia: the case of Bank Islam Malaysia Berhad (BIMB). *International Journal of Business and Society*, pp. 43-53.

[6] Amin, H., Baba, R., and Muhammad, M. Z., 2007. An analysis of mobile banking acceptance by Malaysian customers. *Sunway University College Academic Journal*, pp. 1-12.

[7] Anyasi, F. I. and Otubu, P. A. , 2009. Mobile Phone Technology in Banking System: It's Economic Effect. *Research Journal of Information Technology*, Volume 1 (1), pp. 1-5.

[8] Ba, S. and Pavlou, P., 2002. Evidence Of The Effect of Trust Building Technology In Electronic Markets. *Price Premiums And Buyer Behavior*, *MIS Quarterly*, p. 243-268.

[9] Cheah, C. M. T. A. C. S. J. J. O. K. H. a. T. B. I., 2011. Factors Affecting Malaysian Mobile Banking Adoption: An Empirical Analysis. *International Journal of Network and Mobile Technologies*, pp. 149-160.

[10] Chen, L., M. Gillenson, and D. Sherrell, , 2004. Consumer acceptance of virtual stores: A Theoretical Model and Critical Success Factors for Virtual Stores. *ACM SIGMIS Database*, pp. 8-31.

[11] Chen, L., 2008. A model of consumer acceptance of mobile payment. *International Journal of Mobile Communications*, pp. 32-52.

[12] Cheung, W., M. K. Chang, and V. S. Lai,, 2000. Prediction of internet and world wide web usage at work: a test of an extended Triandis mode. *Decision Support Systems*, pp. 83-100.

[13] Chitungo, S. K. a. M. S., 2013. Extending the Technology Acceptance, Model to Mobile Banking Adoption in Rural Zimbabwe. *Journal of Business Administration and Education*, pp. 51-79.

[14] Cruz, P. L. B. F. N. P. M.-G. a. T. L., 2010. Mobile banking rollout in emerging markets: Evidence from Brazil. *International Journal of Bank Marketing*, pp. 6-28.

[15] Dasgupta, S. R. P. a. S. F., 2011. Factors affecting behavioral intentions towards mobile banking usage: Empirical evidence from India. *Romanian Journal of Marketing*, pp. 6-28.

[16] Davis, F. B., 1989. User acceptance of computer technology: a comparison of two theoretical models.. *Management Science*, pp. 982-1003.

[17] Davis, F. D., 1989. Perceived usefulness, perceived ease of use, and end user acceptance of information technology. *MIS Quarterly*, pp. 13(3), 319-340.

[18] Davis, F. D., 1989. Perceived usefulness, perceived ease of use, and end user acceptance of information technology. *MIS Quarterly*, pp. 319-340.

[19] Dineshwar, R., and Steven, M. , 2013. *An Investigation on Mobile Banking Adoption and Usage: A Case Study of Mauritius..* Kuala Lumpur, Malaysia, ISBN, pp. 978-1-922069-19-1.

[20] Donner.J, and C. A. Tellez., 2008. Mobile banking and economic development: Linking adoption impact and use.. *Asian Journal of Communication* , pp. 318-332.

[21] Ensor, B. M. T. a. W. P., 2012. *The state of mobile banking*, s.l.: s.n.

[22] Forsythe, S.M. and Shi, B., 2003. Consumer Patronage and Risk Perceptions in Internet Shopping. *Journal of Business Research*, p. 867-75.

[23] Gu J.C, S. C. Lee, and Y. H. Suh, 2009. *Determinants of behavioral intention to mobile banking*, *Expert Systems with Applications*, s.l.: s.n.

[24] Ha, S., and Stoel, L., 2009. *Consumer e-shopping acceptance: Antecedents in a technology acceptance model.*, s.l.: s.n.

[25] Huang, E., 2008. *Use and gratification in e-consumers*. *Internet Research*, s.l.: s.n.

[26] Huili, Y. a. Z. C., 2011. “*The analysis of influencing factors and promotion strategy for the use of mobile banking*,” *Canadian Social Science*, s.l.: s.n.

[27] Kazi&Mannan, 2013. *International Journal of Research in Business and Social Science*.

[28] Koenig-Lewis, N., A. Palmer, and A. Moll,, 2010. *Predicting young consumers' take up of mobile banking services*, s.l.: s.n.

[29] Laukkanen, T., S. Sinkkonen, M. Kivijarvi, and P. Laukkanen, 2007. “Innovation resistance among mature consumers. *International Journal of Marketing*, pp. 419-427.

[30] Lin, J-S. and Chang, H-C., 2011. The role of technology readiness in self-service technology acceptance. *Managing Service Quality*, pp. 424-444.

[31] Lin, J-S. and Chang, H-C, 2011. The role of technology readiness in self-service technology acceptance. *Managing Service Quality* , .. pp. 424-444.

[32] Luarn, P. and H. H. Lin,, 2005. Toward an understanding of the behavioral intention to use mobile banking. *Computers & Human Behavior*, pp. 873-891.

[33] Lule, I. O. T. K. a. W. T. M., 2012). Application of Technology Acceptance Model (TAM) in M-Banking Adoption in Kenya. *International Journal of Computing and ICT Research*, pp. 31-43.

[34] Ndubisi, N. O. and Q. Sinti,, 2006. Consumer attitudes, system's characteristics and internet banking adoption in Malaysia. *Management Research News*, pp. 16-27.

- [35] Pavlou, P., 2001. *Integrating Trust in Electronic Commerce with the Technology Acceptance Model: Model Development and Validation*. s.l., s.n.
- [36] Puschel, J. J. A. M. a. J. M. C. H., 2010. *Mobile banking: Proposition of an integrated adoption intention framework*, pp. 5: 389-409.
- [37] Riquelme, H. and R. E. Rios,, 2010. The moderating effect of gender in the adoption of mobile banking. *International Journal of Bank Marketing*, pp. 328-341.
- [38] Rogers, E., 2003. *Diffusion of Innovations*. New York, s.n.
- [39] Scornavacca, E. a. H. H., 2007. Mobile banking in Germany: A strategic perspective. *International Journal of Electronic Finance*, pp. 304-320.
- [40] Singh, S., Srivastava, V., and Srivastava, R. K. , 2010. Customer acceptance of mobile banking: A conceptual framework. *SIES Journal of Management*, pp. 55-64.
- [41] Sohail M., Shanmugham B., 2003. *E-banking and customer preferences in Malaysia: An empirical investigation*, s.l.: s.n.
- [42] Sohail, M. a. B. S., 2003. *“E-banking and customer preferences in Malaysia: An empirical investigation*, s.l.: s.n.
- [43] Spence, R. and Smith, M. L., 2010. Development and Poverty Reduction: Five Emerging Stories. *Information Technologies and International Development*, Volume 6, pp. 11-17.
- [44] Sudha, S., Singh, D. K., Singh M. K., and Singh, S.K, 2010. The forecasting of 3G market in India based on revised Technology Acceptance Mode. *International Journal of Next-Generation Networks*, pp. 61-68.
- [45] Tan, M. and T. S. H. Teo,, 2000. Factors influencing the adoption of internet banking. *Journal of the Association for Information Systems*, pp. 1-44.
- [46] Venkatesh, V. and F. D. Davis,, 2000. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, pp. 186-204.
- [47] Venkatesh, V., Morris, M.G., Davis G.B. and Davis, F.D., 2003. User Acceptance of Information Technology. *Toward a unified view*, *MIS Quarterly*, pp. 425-478.
- [48] Venkatesh, V. a. F. D. D., 2000. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, pp. 186-204.
- [49] Wang, Y-S., H-H. Lin, and P. Luarn, , 2006. Predicting consumer intention to use mobile service. *Information Systems Journal*, pp. 157-79.
- [50] Yang, K. C. C., 2004. “A comparison of attitudes towards Internet advertising among lifestyle segments in Taiwan,”. *Journal of Marketing Communications*, pp. 195-212.
- [51] Yousafzai, S. Y., Pallister, J. G. and Foxall, G. R., 2003. *A proposed model of e-trust for electronic banking*, s.l.: Technovation.
- [52] Yu, C.-S., 2012. *Factors affecting individuals to adopt mobile banking: empirical evidence from the UTAUT Model*, s.l.: s.n

RELATIONSHIP BETWEEN EMOTIONAL COMPETENCE AND QWL AMONG NURSES

S. Mohan kumar^{*1}, B.Vimala^{*2}

^{*1}Assistant Professor, Department of Business Administration, Annamalai University, India

^{*2}Assistant Professor, Department of Business Administration, Annamalai University, India

vimohaa@gmail.com

Abstract-This paper aims at understanding the relationship between emotional competence and QWL among nurses. By snowball technique sampling method 133 staff nurses were selected from 8 hospitals. It is founded QWL has positive correlation with Adequate Expression Control on Emotions, Ability to Function with Emotion, Ability to Cope with Problem Emotion, Encourage of Positive Emotion.

Keywords - Emotional Competence, QWL

I. INTRODUCTION

The history of Quality of working Life (QWL) over the last twenty years is an account of organizational philosophy moving from socio technical job design to redesign of organizations as learning units and finally to inter organizational changes, including different spheres of society, particularly enterprises, schools and public administration" (1970). The term "quality of work life" originated from the concept of open socio-technical system designed in the 1970s that helped to ensure autonomy in work, interdependence, and self-involvement with the idea of "best fit" between technology and social organizations (Adhikari & Gautam, 2010). Although the open socio - technical system is a traditional concept for practice, it assumes that optimal system performance and the "right" technical organization coincide with those job conditions under which, the social and psychological needs of the workers are satisfied. A better Quality of work life initiative supports to fulfill technical and social requirements of job in our organizations.

Meaning of Quality of work Life

In simple term QWL refers to the favorableness or unfavourableness of a job environment for people. Quality of Work Life is a set of principles influences upon the goodness and meaning in life as well as people's happiness and well being. The ultimate goal of Quality of Work Life is to enable people to lead quality lives- lives that are both meaningful and enjoyable.

According to **J. L. Lyod Suttle**, "*Quality of work life is the degree to which individuals are able to satisfy their important personal needs through their experience in the organization.*" Quality of work life refers to the level of satisfaction, motivation, involvement and commitment individuals experience with respect to their lives at work. Quality of work life is a process in organizations, which enables its members at all levels to participate actively and

effectively in shaping the work environment, methods, and outcomes.

Socio –Technical System

An improved school of thought from human relations movement is socio- technical system which forms actual basis for present Quality of work life. The basic features of socio technical system is—"The design of the organization must be compatible with its objectives. In order to adopt to change and be capable of using the creative capacities of the individual, a system should provide the people an opportunity to participate in the design of the jobs they are required to perform" as cherns (1979) puts it.

The objectives should be specific.

- There should be the minimal crucial specification of tasks, the minimal critical allocation of tasks to jobs or of jobs to roles, the specification of objective and the minimal critical specification of methods of obtaining them.
- There should be variance control, ie., where possible the people should be allowed to inspect their own work, there by learning from their mistakes and redesigning the number of communication links across departmental boundaries. The fewer the variances, and the more complete the jobs of the people concerned.
- In organizations having a repertoire of different performances to achieve their objectives, multiple functioning should be encouraged. Multiple functioning is achieved by training the same people in repertoire of different performances, each requiring a separate set of rules and role relationships;
- The more the control of activities within a department becomes the responsibilities of the members, the more the role of the supervisor is concentrated on the boundary activities assuring adequate resources to the team to carry out its functions, co-coordinating the activities with other departments and viewing ahead the changes likely to impart upon them. The boundary maintains is the role of the supervisor in a well defined system. In some cases the responsibility for managing their own boundaries is given to the respective teams

while the responsibility of co-ordination is placed on those who activities require to be co-ordinate.

- Information systems should be so designed as to provide information in the first place to the point where action on the basis of it will be need in need. This will be enable the work team to learn to control the variances and to anticipate events likely to have a bearing on their performance.
- The systems of social support should be designed so as to reinforce the behaviors which the organization structure is designed to elicit.
- The objective of organizational design should be to provide a high quality of working life to its members. There are six characteristics of a 'good job' which can be striven for in the design of the organizations and job, viz, variety of opportunity to learn on the job, some minimal area of decision-making that the individual can call some minimal degree of social support and recognition in the work place, ability to relate what the individual produces to his social life and the feeling that the job leads to some sort of desirable future.
- There is a change over period from old to new which requires a transitional organization. The planning or implantation should begin with the beginning of design, this needs planning, organizing, designing and training. A careful rehearsal of roles should be performed during change over and especially the continuing training role of the supervisor.
- Design is reiterative process; the closure of options opens new ones. As soon as design is implemented, its consequences indicate the need for redesign.

No organization is independent social of independent technical system. Organization is an interdependent social and technical system. Socio- technical system requires social and technical system to be jointly optimized. It is from this notion of socio- technical system that the 'quality of work life' emerged.

This study on Quality of Work Life variables depends on approaches adopted to improve Quality of Work Life situation at the organizational level. Three different approaches regarding Quality of Work Life are common in the literature of human resource management. In the era of scientific management, Quality of Work Life is based on extrinsic traits of jobs: Salaries, safety and hygiene, and other tangible benefits of the workplace. The human relations approach stresses that while extrinsic rewards are important, intrinsic traits of job like autonomy, challenges and task contents are key predictors of productivity and efficiency. The third approach - orientation to work - suggests that a focus on extrinsic or intrinsic reward is contingent on the person. However, the success of Quality of Work Life initiatives depends on openness and trust,

information management, organizational culture, and partnership between management and workers (Adhikari & Gautam, 2010). Following is a brief discussion of a number of these models.

- **Job design-** Job content,, meaningful work, team working, independence, rich and challenging work ownership feeling in work, the need of creativity in work, growth opportunity.
- **Work environment and facilities-** Improving the work environment, social and welfare facilities etc.
- **Job security-** Employment on permanent basis.
- **Health, stress and safety –** Health and safety of working conditions, protection against disease and injury within and outside the workplace, occupational stress and lack of job burnout.
- **Wages and Rewards –** Fair and adequate pay, fair and proper payment for good performance, Innovative rewards systems, the circumstances and procedures relating to promotion policies, seniority and merit in promotion and development.
- **Work life balance-** Fair working hours, work life atmosphere, opportunity for doing religious ceremonies, no physical and mental damages, distance between work place and home.
- **Aesthetics and creativity-** General aesthetics, free time in the workplaces, creativity workplace and personal creativity.
- **Conflict-** Cooperative work between colleagues' adequacy of resources, work and organizational equilibrium, and grievance procedure.
- **Learning and growth-** Increased emphasis on employee skill development, possibility of learning and using new skills, training to improve job skills, creating opportunities to learn, growth in the professionalism path, job growth and career progress.
- **Career Growth-** The organization should provide career growth to the employee i.e. promotion, authority with responsibility, and hike in the salary of the talented employee.
- **Workers participation in decision making of the organization-** employees should be encouraged to participate actively in the decision making body of the organization so they should feel that they are also of some value to the employers. As a result they will be more loyal.
- **Leadership and Employee empowerment-** Superior – subordinate relations, Participatory supervision, Communication, desire and motivation to work, Creating work and organizational commitment,

employee involvement, participation and power, Increased autonomy for action and decision making at worker level, access to relevant information and participative problem solving.

It may be defined as an individual's sense of psychological well - being or avowed happiness. It has been argued that Quality of Work Life influences the performance and commitment of employees in various industries, including health care organizations. A high Quality of Work Life is essential to attract new employees and retain a workforce. Consequently, health organizations are seeking ways to address issues of recruitment and retention by achieving a high Quality of Work Life. Focusing on improving Quality of Work Life to increase the happiness and satisfaction of employees can result in many advantages for the employee, organization and consumers. These include strengthening of organizational commitment, improving quality of care and increasing the productivity of both the individual and the organization.

According to Sirgy and Colleagues, a happy employee is productive, dedicated and committed. On the other hand, failure to manage these factors can have a major impact on employee behavioral responses (for example, organizational identification, job satisfaction, job performance, turnover intention, organizational turnover and personal alienation) as well as outcomes of the organization. Some of the following factors contribute to the growing importance on quality of work life in recent years:

- ❖ **Union Pressures**- Trade unions, these days, are much more aggressive in safeguarding the interests of the employees. They strive hard to get fair remuneration and better conditions of service for the working class.
- ❖ **Increases in educational level**- The level of education of the employees, these days, is quite high. As a result, they expect better pay and working conditions. If they find that the working environment is not conducive, they don't hesitate to leave their jobs as they are confident of finding better jobs.
- ❖ **Increase in job aspirations of employees**- The present day employees are also assertive in the matter of choosing their career. They don't accept stagnation in their career path. They look for career advancement at every stage and aspire to move to higher positions.
- ❖ **Increases in legislative measures**- *A number of laws have* been enacted to safeguard the interests of the working class. The minimum wages Act, The Equal Remuneration Act, The Employee provident Fund Act, The Trade Unions Act, The payment of Gratuity Act are a few examples.
- ❖ **Growing importance of the concept of human resource development**- The concept of Human Resource development gets greater focus these days. The very fact that the Government of India has created a separate

Ministry called the Ministry of Human Resource Development to work for the progress of the human resource of the country proves this point.

- ❖ **Greater among employee awareness**- In view of the reasons mentioned above, the awareness among the employees has considerably increased. The employees are now sure of what they want and do not give any scope for anyone to exploit them.

To improve the quality of work life

- **Flexibility of Job**- Flexibility on job means flexible working hours, no fixed working hours, different time intervals etc. By this flexibility in the job can be introduced.
- **Job enrichment**- Job Enrichment focuses on designing the job in such a way that it becomes more interesting and challenging so that it satisfies the higher level needs.
- **Secured job**- Security of job should be provided to the employee to make him feel committed and loyal to the organization.
- **Grievance handling**- The disciplinary procedure, grievance procedures, promotions and transfer matters should be handled with justice, fair and equity.
- **Participate Management**-Employees should be allowed to participate in management participative schemes which may be of several types. The most sophisticated among them is quality circle.

II. REVIEW OF LITERATURE

Prem Singh Khetavarn (2013) has made a comparative study on quality of work life in public and private sector organizations. This study showed that unless good quality of work life is provided, the employees will not be motivated towards work. The study showed that quality of work life is playing a key and prominent role in the employees work. Hence organization should try to strengthen the organizational climate to achieve better quality of work life among employees, which leads to increased productivity of the organizations.

K. Santhanalalshmi et al (2012) examined the work life balance of female nurses in hospitals – comparative study between Government and Private Hospitals in Chennai, Tamil Nadu, India. The study showed that career women are challenged by work and family commitment at the end of each day in Government and Private Hospitals. Majority of women are working throughout week and 53% are struggling to achieve work life balance. The study also showed that the majority of women reported that their life has become a juggling act as they have to shoulder multiple responsibilities at work and home. This article highlights the issues connected with work life balance of female nurses in Government and private hospitals. And the actors such as salary, shift

timings, multitasking, security and work pressure are found to affect the QWL of nurses.

Nanjundeswarasamy and Swamy (2012) conducted study on the quality of work life and leadership styles. This comparative theoretical study confirmed that quality of work life is a process in which organizations recognize their responsibility to develop job and working conditions. This study proved that leadership styles which exist in the organization potentially affect the quality of work life of employees. On the other hand leadership is governed by organization factors. In brief, the study proved that quality of work life is largely affected by leadership style of the organization concerned.

Nipa .S et al (2012) demonstrated the quality of work life practices in a multinational company in Sidney, Australia. The study showed that employee's satisfaction or dissatisfaction is moderated by their abilities, values and expectations. The study also proved that good work environment leads employees' motivation. Finally leads to job satisfaction among them. And all these leads to better Quality of work life of its employees.

Murugasen .T (2012) highlighted the quality of work life and job satisfaction of employees in salem steel plant. The author mainly analyzed the levels of job satisfaction and the various factors influencing the quality of work life. The study showed that better the job satisfaction of employees better the quality of work life of employees. Among many factors which governs job satisfaction and quality of work life, the financial aspects, job securities, welfare measures, scope for career advancement of the organizational are significantly contributing. In short job satisfaction of employee decides the quality of work life.

Barkha Gupta and Anukool Manison Hyde (2012) attempted to study the quality of work life in Banks. An Empirical study has thrown better and deep insights into various aspects which decide quality of work life. Employee's satisfaction was formed to facilitate superior performance and also greater attraction to refrain the best employees. This research further indicated that salary, job security, participative and reasonably healthy working environment significantly contribute to the quality of work life. The most important findings of this study are that there is a significant difference between quality of work life of managerial and non managerial employees of nationalized banks. This study revealed significant differences in overall quality of work life and the determinants of quality of work life.

Beger and knot et al (2008) examined the diagnostic criteria of autism spectrum disorders (ASD) include emotional impairments. However, scientific evidence for these impairments is varied and subtle. In this contribution, recent empirical studies that examined the emotional competence in children and adolescents with ASD are reviewed. Four aspects of emotional competence these are important to children's daily social functioning, differentiating between mentally retarded and normally intelligent children and adolescents with and without ASD in natural and structured contexts. On various accounts , the emotional impairments of children with ASD that are found

in scientific a studies provide a more differentiated view on the impairments suggested by the diagnostic literature. Consistent empirical findings and gaps in the field are discussed. Theoretical and clinical recommendations for assessment procedures are suggested.

Riggs and Jahromi et al (2006) investigated the Executive function is understood as an umbrella term encompassing a number of interested sub-skills necessary for purposeful, goal-directed activity. Research, suggests a vital role for executive function in children's social-emotional development. However, executive function is rarely considered in models of intervention programs that attempt to promote social- emotional competence. This article reviews the literature linking executive function to children's social-emotional development, and proposes three testable models by which executive function may affect interventions: As a mediator, moderator, and outcome of intervention effects. Finally, this paper discusses important implications and future directions for this research.

Lee and paula et al (2006) used three psychological scales, this study examined the level of emotional intelligence, moral judgment, and leadership of more than 200 gifted high school students who participated in an accelerative academic program or an enrichment leadership program through a university-based gifted institute. Major findings include that on emotional intelligence, gifted males were comparable to students in the age normative sample, which gifted females lagged behind the norm group. Regardless of gender, gifted students had higher scores on adaptability but lower scores on stress management and impulse control ability compared to the normative sample. On moral judgment, gifted students were comparable to the levels of individuals with masters or professional degrees, and they showed an above- average level of leadership compared to the normative sample. No differences were found in students 'scores on the 3 scales by the type of program (academic versus leadership).

Goleman (2000) has suggested the following four fundamental capabilities for developing EQ. They are self-awareness, self- management, social awareness and social skills.

Calgiuri (1998) says that the emotional imbalance arises, when an individual carries his positive or negative emotions and attitudes from work life into his home life and vice versa. In leadership area, the change in the emotion of a leader affects the participant's behavior rather than the neutral emotional display of the leader (Lewis Kristi.2000). Those who have developed high emotional quotient know how to regulate one's emotions such as anger or anxiety in a way that enhances success in job and life. Therefore, it is argued that emotional quotient is a significant dimension for effective leadership. As per quantitative evidence, 70 percent to 80 percent of the people suffer from major depression and it could greatly reduce the productivity on shop floor. Therefore, the current need in work place is to manage emotional imbalance due to stress and depression (O'Brien, 1996: Steven E.Hyman, 2002).

III. RESEARCH METHODOLOGY

Research Design

This study is to understand emotional competence and Quality of work life among nurses in government and private hospitals. Hence a descriptive research design was followed by the researcher. This study was conducted among nurses in government and private hospitals with the help of following questionnaire

1. Emotional competence scale - developed by Sharma and Baradwaj (1995)
2. Quality of nursing work life (QNWL) Scale - developed by Brooks and Anderson (2004)

Sampling Technique

Sampling technique provides a range of methods that enable to reduce the amount of data needed to collect by constructing only data from a subgroup rather than all possible cases or elements (Mark Saunders, 2003). By snowball technique sampling method 133 the staff nurses were selected from the 8 hospitals. From 27 private hospital are there with [more than 10 beds above]. Again by snowball sampling method 193 private staff nurses were selected. In both government and private nurses has been collected. Consequently Snowball sampling of non-probability sampling technique that is used by researchers to identify potential subjects in studies where subjects are hard to locate for collecting data for the study. Researchers have the freedom to choose whomever they find, thus the name convenience.

Instrumental Description

Quality of nursing work life (QNWL) Scale by Brooks and Anderson (2004)

According to Brooks and Anderson (2004) subscales are work life/home life, work design, work context and work world. The rating scale was "1 = never" to "6 = Almost. The total possible scale Score for the 42-item questionnaire ranged from 42 to 252. A low total scale score indicates a low overall QNWL, while a high total scale score indicates a high QNWL.

Emotional competence scale by Sharma and Baradwaj (1995)

Sharma and Baradwaj (1995) have constructed and published this scale. It identifies five different competencies in emotional such as a) adequate depth of feeling b) adequate expression and control of emotions, c) ability to function with emotions d)ability to cope with the problem of the emotions, e)encouragement of positive emotions. This scale consists of 30items with five alternative answers. The five alternatives are designed on Likert model of five point scale. The respondent has been asked to respond to anyone alternative of each item by marking a (✓) tick. The following table shows the items numbers in the questionnaire to measure the five different competencies in the scale. The alternative answers to each question have been scored in a system of 1,2,3,4 and 5 from upper to lower end. The direction of the highest score is 150 interpreted as

highly as competent in emotion and the direction of the lowest score is 30 interpreted as highly incompetent in emotions. Factor descriptions in emotional competence scale.

Objectives of the Study

To find out the relationship between Emotional competence and Quality of work Life dimensions of nurses in government and private hospitals

IV. RESULT AND DISCUSSION

The relationship between Emotional Competence and Quality of Work Life among nurses in government and private hospitals

It is found that the home life has positive correlation with adequate expression control on emotions, ability to cope with problem emotion and encourage of positive emotion. The corresponding r- values are 0.407, 0.359 and 0.394 respectively and the result is found to be significant at 1 percent level. This indicates that the increase in home life increases adequate expression control on emotions, ability to cope with problem emotion and encourage of positive emotion.

It is inferred that there is no correlation between adequate depth of feeling, ability to function with emotion and home life.

Work design is found to have positive correlation with ability to function with emotion and the r-value is found to be 0.310 and the result is found to be significant at 1 percent level. And work design has positive correlation with encourage of positive emotion and the r-value is found to be 0.141 and the result is found to be significant at 5 percent level. This indicates that the increase in work design increases ability to function with emotion and encourage of positive emotion.

Work design has negative correlation with adequate depth of feeling and the r-value is found to be -0.118. The result is found to be significant at 5 percent level. This reveals that increases in work design decrease the adequate depth of feeling of the nurses.

It is also noted that there is no correlation between adequate expression control on emotions, ability to function with emotion and the work design.

Work context has positive correlation with ability to function with emotion and encourage of positive emotion. The corresponding r- values are 0.429and 0.162 respectively and the result is found to be significant at 1 percent level. This indicates that the increase in work context increases and ability to function with emotion, encourage of positive emotion.

It is also noted that there is no correlation between adequate depth of feeling, adequate expression control on emotions, ability to cope with problem emotion and the work context.

Work world has positive correlation with adequate depth of feeling and the r-value is found to be 0.119 and the result is found to be significant at 5 percent level. This

indicates that the increase in work world increases with adequate depth of feeling.

It is represented from the table that work world has negative correlation with, adequate expression control on emotions, ability to cope with problem emotion and encourage of positive emotion. The corresponding r-values are -0.266, -0.189, -0.368 respectively. And the result is found to be significant at 1 percent level. This indicates that the increase in work world decreases the adequate expression control on emotions, ability to cope with problem emotion, encourage of positive emotion and work world.

It is also noted that there is no correlation between ability to function with emotion and work world.

Overall Quality of work life has positive correlation with ability to function with emotion, ability to cope with problem emotion and encourage of positive emotion. The correspondingly r-values are 0.319, 0.154, 0.143 and the result is found to be significant at 1 percent level. This indicates that the increase in overall quality of work life increases with ability to function with emotion, ability to cope with problem emotion and encourage of positive emotion.

It is indicated that overall Quality of work life has positive correlation with adequate expression control on emotions with r-value of 0.118 and the result is found to be significant at 5 percent level.

It is noted that there is no correlation between adequate depth of feeling and overall quality of work life.

QWL EC	Home Life	Work design	Work context	Work world	Overall work Life
Adequate Depth of Feeling	-0.089 (NS)	-0.118*	0.025 (NS)	0.119*	-0.004 (NS)
Adequate Expression Control on Emotions	0.407**	0.298 (NS)	-0.029 (NS)	-0.266**	0.118*
Ability to Function with Emotion	0.004	-0.089 (NS)	0.429**	0.054	0.319**
Ability to Cope with Problem Emotion	0.359**	0.310**	-0.018 (NS)	-0.189**	0.154**
Encourage of Positive Emotion.	0.394**	0.141*	0.162**	-0.368**	0.143**

Source: Primary data

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Findings

- In government hospital, 22.56 percent of the nurses have reported high level of adequate depth of feeling, 84.96 percent of adequate expression and control of emotions, 37.59 percent of ability to function with emotions, 64.66 percent of ability to cope with problem emotions and 92.48 percent of encouragement of positive emotions. And 77.44 adequate depth of feeling, 15.04 percent of adequate expression and control of emotions, 62.41 percent of ability to function with emotions, 35.34 percent of ability to cope with problem emotions and 7.52 percent of encouragement of positive emotions is found to be medium level of emotional competence.
- In Private hospital, 26.42 percent of adequate depth of feeling, 72.02 percent of adequate expression and control of emotions, 35.75 percent of ability to function with emotions, 54.40 percent of ability to cope with problem emotions and 88.08 percent of encouragement of positive emotions of nurses are found to be high level of emotional competence. And 73.26 percent of adequate depth of feeling, 27.98 percent of adequate expression and control of emotions, 64.25 percent of ability to function with emotions, 45.60 percent of ability to cope with problem emotions and 11.92 percent of encouragement of positive emotions are found to medium level of emotional competence.
- It is observed that as far as emotional competence is concerned, there is significant difference in the adequate expression and control of emotions, ability to cope with problem emotions and encouragement of positive emotions. There is no significant difference in the adequate depth of feeling and ability to function with emotions.
- Home life has positive correlation with adequate expression control on emotions, ability to cope with problem emotion and encourage of positive emotion. And there is no correlation between adequate depth of feeling, ability to function with emotion and home life. Work design is found to be positive correlation with ability to function with emotion and encourage of positive emotion. And it has no correlation with adequate expression control on emotions and ability to function with emotion. Work context is found to have positive correlation with ability to function with emotion and encourage of positive emotion. And negative correlation with adequate expression control on emotions and ability to cope with problem emotion. Work world has positive correlation with adequate depth of feeling and negative correlation with adequate expression and control of emotions, ability to cope with problem emotions and encouragement of positive emotions and no correlation with ability to function with emotion. Overall work life has positive correlation with adequate expression and control of emotions, ability to function with emotions, ability to cope with problem emotions and encouragement of positive emotions and negative correlation with adequate depth of feeling.
- The covariance effect and comparison between the type of hospital (ie) government and private nurses of home

life dependant variable is significant with the independent variable such as 'monthly family income, work as per designation and double duty'. Other independent variables are found to be not significant.

- Work design (dependant variable) and the covariance effect and comparison between the type of hospitals (ie) government and private nurses are significant with the 'work as per designation (independent variables). And not significant with other independent variables.
- It is notable that in Work context (dependant variable) and the covariance effect and comparison between the type of hospital (ie) government and private nurses are found to be not significant with all the independent variables.
- Work world dependant variable with covariance effect and comparison between the type of hospital (ie) government and private nurses is significant with 'children and work as per designation independent variable. And it is not significant with other independent variables.
- It is observed that overall work life dependant variable with covariance effect and comparison between the type of hospital (ie) government and private nurses is significant with ward (job rotation) independent variable. It is not significant with other independent variables.

V. CONCLUSION

To sum up that the study, the quality of work life is measured in terms of its relationship with *emotional competence*.

REFERENCES

- [1] Barkha gupta et al, (2012), "Quality of work life in Banks : An Empirical study Pacific Business Review International Vol.5 Issue October 2012.
- [2] Begeer et al,(2008), Emotional competence in children with autism; Diagnostic criteria and empirical evidence. Development review, 28(3), pp.342-369.
- [3] Caligiuri, Paula M (1998), "Testing a Theoretical Model for Examining the Relationship between Family Adjustment and Expatriates Work Adjustment". *Journal of applied psychology* 83.4
- [4] Goleman, Daniel.(1995), "Emotional Intelligence: When it can Matter more than IQ." New York.
- [5] Lee and Paula et al (2006): The Emotional intelligence, Moral judgement, and Leadership of academically gifted adolescents. *Journal of the education of the gifted*, 30(1), pp. 29-67.
- [6] Nipa s. Oupparra et al, (2012), " Quality of worklife practices in a Multi national company in Sydney, Australia Procedia –social and behavioral sciences 40 (2012) 116-121.
- [7] Prem singh Khetavath, (2013), "A Comparative

Study of Quality of Work Life in Public and Private Sector Organizations in Andhra Pradesh, " Tenth AIMS International Conference on Management.

- [8] Rose et al (2006), "An Analysis of Quality of Work Life (QWL) and Career-Related Variables", *American Journal of Applied Sciences*, 3(12), 2006, 2151-2159.
- [9] Santhana Lakshmi .k et al, (2012), " *Analysis of work life balance of female nurses in hospitals-comparative study between government and private hospital in Chennai*, *International journal of trade , economics and finance , vol 3.1053-1059*

Entrepreneurial Attitude Orientation – An empirical investigation among students

Ponmani R¹, Annapoorani R²

¹. Associate Professor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, T.N, India
ponmanivenkat@rediffmail.com

²Professor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, T.N, India
annapooranivishnu@gmail.com

Abstract—Generally, individuals don't consider entrepreneurship as a welcoming career option. The study attempts to determine the level of entrepreneurial attitude orientation among students. Robinson et al., (1991) Entrepreneurial Attitude Orientation scale was used to measure four dimensions namely, achievement, innovation, personal control and self-esteem. The reliability and validity of the scale was tested and found to be valid. Specific hypotheses were formulated for each sub-scale. The study was conducted among the post-graduate students in Coimbatore city which is a knowledge and higher education hub. The results revealed that male and female students differ on achievement and innovation subscale of entrepreneurial attitude orientation scale. The gender differences and differences across the various streams of study are discussed in comparison with the results from previous studies. The findings of the study are analysed and recommendations are made.

Keywords— Entrepreneurial attitude orientation, Gender, Arts, Science, Commerce, Students, 2*3 ANOVA

I. INTRODUCTION

Entrepreneurship plays a crucial role in the growth and development of an economy and it is a key contributor to innovativeness and product improvement. As a change agent, entrepreneurs initiate economic activity by taking initiatives through business ventures. Most of the developing countries, consider entrepreneurship as an engine of economic growth, job creation and social adjustment. The role of entrepreneurs is of fundamental importance to a country like India, where the twin problems of poverty and unemployment co-exist. Fostering entrepreneurship has become a topic of highest priority in public policy since well-educated entrepreneurs are of paramount importance. Portals of higher education are the centres where new products and processes consolidate the foundation for the new enterprises. More specifically, college students are the most promising sources of future entrepreneurship. Because attitude and intention are precursors of entrepreneurial action, an understanding of the attitude and the factors influencing the attitude including educational background, is a critical step in promoting greater entrepreneurial initiative.

Jason Fitzshimmons and Douglas (2005), Francisco Linan et al., (2005), Urve Venesaar et al., (2006) and Isidore Ekpe and Norsiah Mat (2012) have examined entrepreneurial attitude orientation and intention of students in various countries such as Thailand, China, Australia and Spain. Despite the importance of entrepreneurship to economic development, the role of students in promoting entrepreneurship remains to be an area scarcely studied and addressed. Thus, a better understanding of the entrepreneurial attitude of the students could have theoretical and practical implications to policy makers.

II. LITERATURE REVIEW

Sandeepvij and Pooja Sharma (2013) examined the entrepreneurial drive of business students and explored the effects of demographics on the entrepreneurial drive of students. An entrepreneurial drive scale developed by Florin et al., (2007) was used to measure the entrepreneurial drive of the students. The results showed that gender and family type do not significantly affect the entrepreneurial drive of business students. However, the mean score for the students (pre-entrepreneurial education and post- entrepreneurial education) was found to be significantly higher for two dimensions viz., self- efficacy and non- conformity out of the five dimensions of entrepreneurial drive. The study proved that entrepreneurial education enhances self-efficacy of the students and gives them confidence to be non-conformists. For three other dimensions of entrepreneurial drive -preference for innovation, achievement motivation and proactive disposition, there was hardly any change in the mean score values after entrepreneurial education.

Nwankwo et al., (2012) investigated gender role orientation and self-efficacy as correlates of entrepreneurial intentions based on 350 students of Enugu State University of Science and Technology, Nigeria. The study noted that dimensions of the gender role orientation showed a significant difference and self-efficacy and entrepreneurial intentions are significantly related.

Kgagara (2011) assessed the attitude and perceptions towards entrepreneurship among students in a higher education institution in the Sedibeng District of the Gauteng Province based on data obtained from 166 university students. The results revealed that the majority of the respondents were predominantly young black Africans from

lower income families and majority of them have favourable attitude towards entrepreneurship as a career.

Levent Altinay and Catherine Wang (2011) examined the relationship between Turkish ethnic entrepreneurs' socio-cultural characteristics (viz., education, experience and religion) and the entrepreneurial orientation of their firms and reported that educational attainment of an entrepreneur makes a positive impact on a firm's entrepreneurial orientation. Educational attainment equips business owners with the skills and reflective mindsets of understanding customers and responding to their needs. Previous business experience of the entrepreneur also affects positively upon a firm's entrepreneurial orientation.

Shanan Gibson et al., (2011) examined the entrepreneurial attitude among university students across the U.S. by considering students from two year college programs and comparing them with students enrolled in business programs at traditional four universities. The on-line survey responded by 395 students showed that the entrepreneurial attitude is associated with the entrepreneurial orientation scale ((EAO)-viz., achievement, innovation, personal control and self-esteem. The results indicated that university students have attitude that were stronger compared to the community college peers on all the four entrepreneurial attitude domains and they were significantly more likely to start their own business than the students from the community colleges.

Akhtar Ali et al., (2011) studied entrepreneurial attitude among potential entrepreneurs in Pakistan based on a sample of 480 students studying management programme from six public Pakistani Universities. The study noted that demographic variables, university, parental income and profession influence the attitude towards entrepreneurship and there was no gender difference in their attitude.

Gary Packham et al., (2010) examined the impact of enterprise education on entrepreneurial attitude in European higher education institutions in France, Germany and Poland. The results indicated that enterprise education has a positive impact on entrepreneurial attitude of French and Polish students. The course had a negative impact on male German students. While female students are more likely to perceive a greater benefit from the learning experience, the impact of enterprise education on entrepreneurial attitude is actually more significant for male students.

Tamizharasi and Panchanatham (2010) based on the data of 120 entrepreneurs engaged in small and medium enterprises in Cuddalore District of Tamil Nadu noted that the entrepreneurial attitude were influenced by age, income, marital status and type of ownership.

III. THEORITICAL FOUNDATION

The conceptual framework for the current study is built based on the theory of planned behaviour by Ajzen (1991) and entrepreneurial event model proposed by Shapero and Sokol (1982). This framework explains that entrepreneurial behaviour is associated with the entrepreneurial attitude among students. The theory explains the relationship between people's attitude and beliefs. According to the model, people's evaluation of the attitude towards behaviour

is determined by their accessible beliefs about the behaviour and the belief is defined as the subjective probability that the behaviour will produce a certain outcome. In the current study, achievement, innovation, personal control and self-esteem are the four-dimensions considered under entrepreneurial attitude.

IV. RESEARCH BACKGROUND

Since the main function of the entrepreneur is to act as an agent of change in an otherwise repetitive economy, there is a need for favourable attitude towards entrepreneurship (Dana et al., 1999). Wiklund and Shepherd (2003) noted that entrepreneurial attitude has a positive force on the relationship of knowledge based resources and exploitation of opportunities. Jantunen et al., (2005) noted that attitude along with timely capabilities of person has a positive impact on entrepreneurial performance. Entrepreneurial attitude is a precursor of entrepreneurial action and therefore understanding of the attitude and those factors, which may affect them, including the educational background, is a critical step in promoting greater entrepreneurial initiative.

Attitude is defined as beliefs and perceptions regarding the personal desirability of performing the behaviour, which in turn are related to expectation regarding the personal impact of outcomes resulting from that behaviour (Ajzen 1991). Attitude is the tendency to which the individual holds a positive or negative personal valuation (Autio et al., 2001). An attitude is a "complex mental state concerning beliefs, feelings, values and dispositions to act in definite ways". Attitude inclines to change across time and situations through an interactive process with the environment and can offer a prediction about a person's future events (Carlson, 1985). There are several aspects of entrepreneurial attitude orientation. It is assumed that an individual striving for a high degree of autonomy in his life is more likely to act entrepreneurially. Moreover, an individual's attitude towards innovation determines entrepreneurial behaviour and propensity towards risk is likely to affect entrepreneurial orientation.

Despite the importance of entrepreneurship for economic development, the role of students in promoting entrepreneurship predominantly stays unlearned. Thus, a better understanding of the factors that affect students and their entrepreneurial could have theoretical and practical implications to policy makers. There had been little understanding of the factors that affect students' intention of becoming entrepreneurs and the relationship between entrepreneurial education and students' entrepreneurial attitude and intention (Souitaris et al., 2007). Furthermore, the studies showing the differences in entrepreneurial attitude and intention among students belonging to different courses of study are scarce (Wilson et al., 2004). Hence, more detailed research is needed to get a full understanding of the link between education and entrepreneurial attitude (Lepoutre et al., 2010).

V. OBJECTIVE OF THE STUDY

The objective of the study is to examine the entrepreneurial attitude orientation among the male and female students pursuing various streams of study.

VI. RESEARCH QUESTION

Whether male and female students studying in arts, science and commerce streams of study would differ on Entrepreneurial Attitude Orientation?

HYPOTHESES

To find answers for the above research questions, the following hypotheses were formulated. Male and female students belonging to arts, science and commerce streams of study would remain homogenous on all the subscales of entrepreneurial attitude orientation (EAO). There are four subscales of entrepreneurial attitude orientation viz., Achievement, Innovation, Personal Control and Self-esteem. The hypotheses on each of the subscale were formulated for testing. The following are the hypotheses formulated for Achievement sub-scale of entrepreneurial attitude orientation scale.

H₀1.1: Respondents belonging to male and female students would remain homogenous on achievement subscale of entrepreneurial attitude orientation scale.

H₀1.2: Students belonging to arts, science and commerce would remain homogenous on achievement subscale of entrepreneurial attitude orientation scale.

H₀1.3: There is no significant difference between gender and streams of study on the achievement subscale of entrepreneurial attitude orientation scale.

Similar hypotheses were formulated for all subscales of entrepreneurial attitude orientation scale.

MEASUREMENT

Robinson et al., (1991) designed the Entrepreneurial Attitude Orientation (EAO) scale to measure entrepreneurial attitude based on the constructs of achievement, innovation, personal control and self-esteem. Achievement refers to concrete results associated with the starting of a business, innovation relates to acting on business activities, personal control concerns one's perception of control or influence over his or her business and perceived self-esteem relates to self-confidence with regard to one's business affairs. The psychometrics properties of the scale was tested and found to be valid. The Spearman-Brown split-half reliability formula was used to calculate the reliability coefficients of the our dimension. The scores were, achievement – 0.764; Innovation-0.765; Personal Control-0.647 and Self-Esteem – 0.728. The entrepreneurial attitude orientation scale is reported to have high reliability since the Spearman - Brown split-half coefficients for all the subscales were greater than the threshold level of 0.60.

Validity of Entrepreneurial Attitude Orientation Scale

The study tried to test the validity of Entrepreneurial Attitude Orientation Scale by calculating Root Mean Square Error Approximation (RMSEA), Goodness of Fit Index (GFI), Composite Fit Index (CFI), Tucker Lewis Index (TLI) and HOELTER index. Confirmatory factor analysis was performed to verify the factor structure of a set of entrepreneurial attitude orientation constructs. Four constructs including 74 items were employed for confirmatory factor analysis to identify the relationship among the concepts and their measures. The relationship between observed variables and their underlying latent construct - Achievements, Innovation, Personal Control and Self-esteem was analysed by using SPSS 21 and AMOS software version 20.

Fit indices were used to determine the well priori model fit of the sample data. Table1 shows the details of model fit indices of Entrepreneurial Attitude Orientation Scale.

Table 1

Model fit Indices of entrepreneurial attitude orientation scale

Fit Index	Estimated value
Chi-Square/degrees of freedom (CMIN/df)	2.262 0.042
Root Mean Square Error of Approxiamation (RMSEA)	0.942 0.916
Goodness of Fit Index (GFI)	0.908
Comparative Fit Index (CFI)	0.324
Tucker-Lewis Index (TLI)	0.924
HOELTER Index	344

Calculations based on field survey- 2013-2014

In the above model the CMIN/df, RMSEA, GFI, CFI, TLI and HOELTER index satisfy the acceptable threshold level. This indicates that the construct model have sufficient sample size and demonstrates that the model have a good fit to prove the validity of entrepreneurial attitude orientation.

OPERATIONAL DEFINITION

The following are the operational definitions of entrepreneurial attitude orientation and its sub-scales.

Entrepreneurial Attitude Orientation	It refers to the effort taken by individuals to create a favourable image of themselves at their workplace.
Achievement	This refers to concrete results associated with the start-up of a business.
Innovation	This relates to acting on business activities in unique and novel ways.
Personal Control	This refers to one's perception of control or influence over his or her business
Self-Esteem	This relates to self-confidence with regard to one's business affairs.

SAMPLE

Out of the total 1639 prospective survey participants from various disciplines, 817 respondents participated in the survey. On perusal, it was found that a few response sheets were incomplete and few were not marked properly. Hence, those sheets were eliminated. Finally, the sample consisted of 701 respondents. Of the total sample, 178 respondents (26 percent) were belonging to arts, 234 respondents (33 percent) were belonging to science and 289 respondents (41 percent) were belonging to commerce stream of study.

TECHNIQUE

Multistage stratified random sampling method was adopted. In the first stage, the universities were selected. Among the various Universities in Coimbatore, Bharathiar University was selected since it is the only affiliating type of University offering postgraduate programmes in Arts, Science and Commerce streams of study. In the second stage, the colleges were selected. Only colleges admitting both boys and girls, where all the three streams viz., arts, science and commerce are being offered in the colleges and colleges which have successfully completed ten academic years were considered for the study. In the third stage, the respondents were selected. The study was confined to final year postgraduate students of Arts, Science and Commerce in the selected colleges. The graduate students enrol for the post graduate programmes and the students passing out from post graduate programmes have better awareness ability to decide to career option and the professional training necessitated to choose the post graduate students for the present study. From the list of students, every alternate student was selected for the study. Thus, the final sample consists of 701 respondents from three streams of study. The sampling frame adopted in the study is attached in the Appendix 1.

VII. RESULTS AND DISCUSSION

The data collected was analysed using 2*3 ANOVA (Unequal Numbers). The results were analysed for their similarities and differences on all subscales of entrepreneurial attitude orientation scale. The following results are discussed in detail.

Table 1. F – ratios based on the scores of respondents on achievement subscale of Entrepreneurial Attitude Orientation Scale (EAOS)

Achievement				
Source	Sum of Squares	df	Mean Square	F
Between Genders	583.35	1	583.35	5.35*
Among Streams	594.47	2	297.24	2.72#
Gender * Stream	111.85	2	55.93	0.51#
Residual	75838.6	695	109.12	

Total	4641431	701		
-------	---------	-----	--	--

The above table shows that male and female students differ on their scores on the achievement subscale of entrepreneurial attitude orientation scale. The students belonging to various streams of study do not differ on their achievement subscale of EAOS. This shows that the H_0 1.1 is rejected and the alternate hypothesis, stating that there is a significant difference between male and female students is accepted. The mean and SD scores of male and female students belonging to various streams on the achievement subscale are enclosed in Appendix 2.

Table 2. F – ratios based on the scores of respondents on innovation subscale of Entrepreneurial Attitude Orientation Scale (EAOS)

Innovation				
Source	Sum of Squares	df	Mean Square	F
Between Genders	350.45	1	350.45	4.15*
Among Streams	602.90.	2	301.45	3.57*
Gender * Stream	67.91	2	33.96	0.40#
Residual	58760.4	695	84.55	
Total	5224481	701		

The above table shows that male and female students differ on their scores on the innovation subscale of entrepreneurial attitude orientation scale. Similarly, the students belonging to various streams of study also differ on their innovation subscale of EAOS. This shows that the H_0 2.1 is rejected and the alternate hypothesis, stating that there is a significant difference between male and female students on the scores of innovation subscale is accepted. Similarly, H_0 2.2 is rejected and the alternate hypothesis, stating there is a significant difference among various streams of study is accepted. The mean and SD scores of male and female students belonging to various streams on the Innovation subscale are enclosed in Appendix 2.

Table 3. F – ratios based on the scores of respondents on personal control subscale of Entrepreneurial Attitude Orientation Scale (EAOS)

Personal Control				
Source	Sum of Squares	df	Mean Square	F
Between Genders	102.85	1	102.85	3.29#
Among Streams	111.11	2	55.56	1.78#
Gender * Stream	20.67	2	10.33	0.33#
Residual	21754.6	695	31.3	
Total	1257542	701		

The above table shows that male and female students do not differ on their scores on the personal control subscale of entrepreneurial attitude orientation scale. Similarly, the students belonging to various streams of study do not differ on their personal control subscale of EAOS. Therefore the null hypothesis H_0 3.1, H_0 3.2 and H_0 3.3 is accepted. The mean and SD scores of male and female students belonging to various streams on the personal control subscale are enclosed in Appendix 2.

Table 4. F – ratios based on the scores of respondents on self-esteem subscale of Entrepreneurial Attitude Orientation Scale (EAOS)

Self-Esteem				
Source	Sum of Squares	df	Mean Square	F
Between Genders	27.71	1	27.71	1.65#
Among Streams	84.19	2	42.01	2.51#
Gender * Stream	64.23	2	16.77	1.92#
Residual	11654.2	695		
Total	1124219	701		

The above table shows that male and female students do not differ on their scores on the self-esteem subscale of entrepreneurial attitude orientation scale. Also, the students belonging to various streams of study do not differ on their self-esteem subscale of EAOS. This shows that H_0 4.1; H_0 4.2 and H_0 4.3 are accepted and their alternate hypothesis stating that there is a significant difference between male and female students on the subscale of self-esteem; there is a significant difference among various streams of study on the scores on self-esteem and there is an interaction between gender and streams of study on the scores of self-esteem are rejected, respectively. The mean and SD scores of male and female students belonging to various streams on the self-esteem subscale are enclosed in Appendix 2.

VIII. CONCLUSION

Entrepreneurial attitude orientation throws light in the understanding of entrepreneurial performance and behaviour. In that, it is found that all the criterion groups studied have scored higher than the theoretical mean. This may be one of the reasons for the several of the criterion groups fail to differ. However, the scope is that the entrepreneurial attitude has presence among the respondents at the threshold level but fail to reach the higher levels. The scope is wide open in a context that the developing entrepreneurial attitude is no more a difficult proposition. Hence, it may be concluded that the furthering or strengthening the entrepreneurial attitude is feasible. The government's initiative to develop entrepreneurial supply

would augment the economic development and create opportunities for employment.

REFERENCES

- [1] Ajzen, I (1991), "The Theory of Planned Behaviour", *Organizational Behaviour and Human Decision Processes*, 50(2), pp 1-63.
- [2] Akhtar Ali, Keith J. Topping Riaz H. Tariq (2011), "Entrepreneurial attitudes among potential entrepreneurs" *Pakistan journal of Commerce and Social Science*, 5 (1), pp 12-46.
- [3] Autio, E.Keelay, R.H.Klofsten, M.Parker.G and Hay, M(2001), "Entrepreneurial Intent among students in Scandinavia and in the USA", *Enterprise and Innovation Management Studies*, 2(2), pp 145-160.
- [4] Carlson, S.D. (1985), "Consistency of attitude components: A new proposal for an old problem" *Dissertation Abstract International*, 46(09B), 3261 (Microfilm No. AAC8526328
- [5] Dana, L. P., Etemad, H., and Wright, R. W (1999), Theoretical foundations of international entrepreneurship, in 'Research in global strategic management' (eds.) Wright, R, Volume 7, JAI press , Stamford, CT, pp 3 – 22.
- [6] Florin Juan , Ranjan Karri and Nancy Rossiter (2007), "Fostering entrepreneurial drive in business education: An attitudinal approach", *Journal of Management Education*, 31 (1), pp 17-42.
- [7] Francisco Linan, Juan C.Rodriguez –cohard and Jose M. Rueda- Cantuche (2005) "Factors affecting entrepreneurial intention levels "45th Congress of the European Regional Science Association Amsterdam.
- [8] Gary Packham, Paul Jones, Christopher Miller, David Pickernell and Brychan Thomas (2010),"Attitudes towards entrepreneurship education: A comparative analysis" *Education and Training*, 52 (8/9), pp 568-586.
- [9] Isidore Ekpe and Norsiah Mat(2012), "The moderating effect of social environment on the relationship between entrepreneurial orientation and entrepreneurial intentions of female students at Nigeria Universities" *International journal of Management Sciences and Business Research*, 1 (4), pp 1-16
- [10] Jantunen A, Puimalainen, K., Saarenketo, S.and Kyläheiko, K.(2005) "Entrepreneurial orientation, dynamic capabilities and international performance," *Journal of International Entrepreneurship*, 3(3), pp 223-243.
- [11] Jason Fitzsimmons and Douglas, E.J (2005) "Entrepreneurial attitudes and entrepreneurial intentions: A cross –cultural study of potential entrepreneurs in India, China, Thailand and Australia," Paper presented to the Babson- Kauffman Entrepreneurial Research Conference ,Wellesley.M
- [12] Kgagara,M.R.(2011), "An assessment of the attitude towards entrepreneurship among higher education students in Sedibeng District "Doctoral dissertation, North-West University

- [13] Lepoutre, J., Van, D. B., Wouter, T., and Olivier, C. H. (2010), 'A new approach to testing the effects of entrepreneurship education among secondary school pupils', *Velrick leuven gent Working paper series* Leuven, Belgium: Autonomous Management school
- [14] Levent Altinay and Catherine I. Wang (2011), "The influence of an entrepreneur's socio- cultural characteristics on the entrepreneurial orientation of small firms" *Journal of small business and enterprise development* , 18 (4), pp 673-694.
- [15] Nwankwo B.E, Marire M.I, Kanu G.C, Balogun S.K, and Uhiara A.C. (2012), "Gender role orientation and self efficacy as correlates of entrepreneurial intention" *European Journal of Business and Social Sciences*, 1(6), pp 9-26
- [16] Robinson, P.B., Stimpson, D.V., Huefner, J.C. and Hunt, H.K. (1991), "An attitude approach to the prediction of entrepreneurship" *Entrepreneurship Theory and Practice*, 15(4), pp 13-31
- [17] Sandeep Vij and Pooja Sharma (2013), "Does entrepreneurial education enhance the entrepreneurial drive of business students" *The IUP Journal of Entrepreneurship Development*, 10(2), pp 65-82.
- [18] Shanan G. Gibson, Michael I. Harris, Todd D. Mick and Toni M. Burkhalter (2011), "Comparing the entrepreneurial attitudes of University and Community college students" *Journal of Higher Education Theory and Practice*, 11(2), pp 11-18.
- [19] Shapero, A and Sokol, L. (1982), The social dimensions of entrepreneurship in 'Encyclopedia of entrepreneurship' (eds) Kent, C.A., Sexton, D.L. and Vesper, K.H., NJ: Prentice-Hall, Englewood Cliffs, pp 72-90
- [20] Souitaris, V., Zerbinati, S. and Al-Laham, A. (2007), "Do entrepreneurship programmes raise entrepreneurial intention of science and engineering students?", *The effect of learning, inspiration and resources*", *Journal of Business Venturing*, 22(4), pp 566-591.
- [21] Tamilarasi, G. and Panchanathan, D.N. (2010), "An empirical study of demographic variables on entrepreneurial attitudes", *International Journal of Trade, Economics and Finance*, 1(2), pp 215-220
- [22] Urve venesaar, Ene kolbre, Thomas Piliste (2006) "Students attitudes and intentions toward entrepreneurship at Tallinn university of technology" 'Working papers in Economics, School of Economics and Business Administration, Estonia, pp 97-114.
- [23] Wiklund, J and Shepherd, D. (2003), "Knowledge based resources, entrepreneurial orientation and the performance of small and medium sized businesses" *Strategic Management Journal*, 24(13), pp 1307-1314.
- [24] Wilson, F., D. Marlino, and J. Kickul (2004), "Our entrepreneurial future: Examining the diverse attitudes and motivations of teens across gender and ethnic identity" *Journal of Developmental Entrepreneurship* 9(3), pp 177-197.

Influence of Job Task Demand on Role Conflict Dimension of Occupational Stress among the Executives of Bank of Ceylon, Sri Lanka

T. Prabaharan ^{*1}, K. Lakshika ^{*2}

Department of Management, Faculty of Commerce &Management, Eastern University, Sri Lanka

¹p_thambirajah@yahoo.co.in

²klakshika90@gmail.com

Abstract--Occupational stress is any discomfort which is felt and perceived at a personal level and triggered by instances, events or situations that are too intense and frequent in nature so as to exceed a person's coping capabilities and resources to handle them adequately.

Whenever an individual feels that the demand from the job is beyond his/her capacity, he/she is said to be under stress. Stress leads to strain. Stress is felt at the psychological level leading to strain which is felt at the physical level. Irrespective of the professional status, position in the organization or strata of the society to which they belong, people experience stress and strain. This research investigates the Influence of job task demand on role conflict dimension of occupational stress of executives of Bank of Ceylon, Sri Lanka. In this study, The different dimensions of job task demand such as over compensation at work, responsibility, skill under utilization, job demand, job control were used to study the level of influence the role conflict dimension of occupational stress. The strength of survey research is the wide scope to collect detailed information from a sample of a large population. A total of 350 questionnaires were distributed and accepted in executives of Bank of Ceylon. It can be ascertained from this study that Job task demand contribute significant and Negative contribution in the prediction of Role Conflict. Lastly, the regression indicated that 32% of total variance of role conflict was explained by Job task demand. In conclusion, it is observed that Job task demand have low influence on the employees' role conflict.

Keywords: *Job task demand, Role conflict*

I. INTRODUCTION

Occupational stress is a serious and enduring problem in the workplaces. The last few decades have brought about dramatic changes in the nature of work in organizations. The introduction of new technology, particularly the use of computers in the workplace coupled with huge shift towards globalization and privatization with its inherent features of mergers, acquisition, strategic alliances and downsizing,

restructured the functioning of industries. In order to compete successfully in the increasingly competitive global market, many organizations started depending on subcontracting and outsourcing which undermine the requirements of permanent employees.

Work stress can depend on a person's developmental stage of life-with source of stress being different for a beginner in the job compared to an employee in his or her 60's. Demographic and personal factors can also be associated with work stress, and those include age, educational qualification, gender, technical skill, financial problems, family issues such as caring for children or aged parents, dual-career couples, etc. Work stress can result from a poor fit between the employee and the environment. Poor person-environment fit can lead to psychosocial stress that adversely affects the employees. A poor fit between the person and his work environment can be longstanding or brought on by recent changes in the work environment such as requiring workers to learn new forms of technology.

II. RESEARCH PROBLEM

In the Sri Lankan environment, while there are formidable challenges and stiff competitions among the banks both public and private sectors, there are also ingrained and associated problems that are faced by the employees of Bank of Ceylon, Sri Lanka, Sri Lanka in particular.

Those could be stipulated as follows:

1. Difficulties in coping up with high technological skills, competency and knowledge required of BOC's staff
2. Globalization and Information Technology
3. Restructuring contemplated by BOC
4. Future challenges to BOC
5. High competition among banks
6. Risks associated with Cash-handling
7. Banks' staff are compelled to work longer hours.
8. Stresses and strains experienced by the BOC employees

9. Confronting hardships relating to Individual Characteristics
10. Factors intrinsic to their job

There is certain research gap in this study. Most of studies were found that banking sector is a stressful sector when compared with the other numerous sectors and according to the literature review, large numbers of studies were conducted in many countries. However lack of research has been undertaken to study about stress in Sri Lankan banks. To fulfill this gap, this research was conducted to show about Role conflict dimension of occupational stress in the Sri Lankan banks. In Sri Lankan banking history, Bank of Ceylon was found earlier before other banks. It has a long history and many branches all over the island. Hence, researcher has selected the Bank of Ceylon to study about the occupational stress with job related factors.

III. RESEARCH QUESTION

What the influence of job task demand of the bank executives on their role conflict dimension of occupational stress?

IV. RESEARCH OBJECTIVE

To identify the influence of job task demand of the bank executives on their role conflict dimension of occupational stress.

V. LITERATURE REVIEW

A. Occupational Stress

Beehr and Newman (1978) define occupational stress as "a condition arising from the interaction of people and their jobs and characterized by changes within people that force them to deviate from their normal functioning."

Job stress can be defined as the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources or needs of the worker. Job stress can lead to poor health and even injury. When the demands and pressures placed on individual workers do not match the resources which are available either from the organization or within the individual, stress can occur and endanger that person's health and well-being".

Work stress is perceived and interpreted differently by individuals, and their capacity to cope with it and respond to it also differs significantly. Situations that may impose stress on one individual may not be stressful to others. Individual characteristics such as 'personality traits' and 'coping style' can influence how a person responds to work stress. Although these characteristics can be partly responsible for how people respond to stress, working conditions such as workload, demands and pressure, conflicting expectations, or fear of layoffs

or being fired at can influence the amount of stress that one feels.

Role Conflict

Role conflict occurs most frequently when a person is expected to perform in different ways by different groups of people in the organization.

B. Job Task Demands

Job task demands are defined as psychological stressors such as requirements, for working fast and hard, having a great deal to do, not having enough time, and having conflicting demands.

C. Definition of Stress in the Banking Sector

The stress indicator represents a continuum of states which describe the banking sector's condition at a given point in time. The stress level is measured on a scale ranging from tranquil situations where stress is quasi-absent to extreme distress where the banking sector goes through a severe crisis. It is important to distinguish the banking sector's stress from its fragility.

Stress emerges from the combination of exogenous shocks and fragilities in the banking system. A fragile banking sector does not systematically suffer stress if it benefits from a quiet and stable environment. Conversely, a solid banking system can undergo stress if it experiences extreme exogenous shocks. The interaction of the shock's magnitude and the banking system's fragility determines the stress level. For that reason, Bank of Ceylon was selected to study about occupational stress.

VI. CONCEPTUAL FRAMEWORK

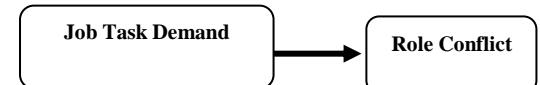


Figure 1: Conceptual Model
(Developed for this Research)

In this study Job task demand considered as an independent variable Role Conflict considered as a dependent variable.

With the help of literature, hypothesis was generated to properly test the relationship between Personality traits and work engagement of employees of financial institutions in Trincomalee. Based on the assumed causal relationship given in the conceptual model, the following research hypotheses formulated for this study are as follows:

Hypothesis: Job task demands of the bank executives do not influence occupational stress

VII. METHODOLOGY

A. Research Design

A research design specifies the methods and procedures for conducting a research work. According to Nargundkar (2006), research design is the plan, structure and strategy of investigation with an objective of obtaining answers or solution for the research question. It provides an overall operational pattern or framework of the investigation that stipulates what information is to be collected from which source and by what procedures.

There are several ways to study and tackle a research problem. This research comes under the category of description study as the researcher is interested in determining the relationship between different variables.

The strength of survey research is the wide scope to collect detailed information from a sample of a large population.

B. Questionnaire

Based on the review of literature, variables have been identified for this research. A structured questionnaire was designed using those variables.

The questionnaire was divided into section A, section B and section C. Section A contained questions to elicit personal details of the respondents. Section B consisted of questions pertaining to Job Task Demand. Section C consisted of questions pertaining to Role Conflict.

C. Measures

Researchers have used different scales, viz., 4 point Likert scale (Bagozzi and Yi, 1988), five point scale (King and Garey, 1997), six point scale (Woondruff et al., 1993), seven and even ten point scale (Choi and Chu, 2001). Findings of Schall (2003) on comparing four, five, six, seven and 10 point Likert scale reveal that five point scale provides best results and recommended its usage especially for Banking Industry. Hence, five point scale has been used in the survey instrument.

D. Sample Size

Van der Lans (2005), suggested that if population is greater than 2000, a minimum of 350 samples to be surveyed to get accurate representation. For the defined population of 4551, according to Uma and Roger (2009) and Van der Lans (2005) the sample size is expected to be 350.

E. Main Study

For the purpose of obtaining the data relating to various aspects, a well structured questionnaire was prepared. Using questionnaire, the relevant data on various aspects have been collected.

The data collected in this study was done by using primary method. The data were collected from the respondents who are working as executives in Bank of Ceylon, Sri Lanka.

In Sri Lanka, there are nine provinces, and each province has certain number of branches. Totally, there are 573 branches

functioning across Sri Lanka. For the purpose of this study, Eastern province is selected as the sample area. The Eastern province selected based on the convenience of the researcher.

F. Method of data analysis

Data has been presented using tables. Meanwhile descriptive analysis was used for data analysis. Regression analysis is used to find out the influence of Job task demand on Role conflict. Hence under the descriptive analysis, mean and standard deviation were derived. Statistical package of SPSS 19.0 has been used for this purpose.

VIII. RESULTS AND DISCUSSION

In this part, the results of the statistical analysis are presented in order to answer the research objectives. A comprehensive profile of the respondents, factors influencing on occupational stress, role conflict and influence of various factors are discussed.

A. Analysis of Reliability

The first step in the measurement of validation involved computing co-efficient alpha for each set of measures to test reliability. Chronbach's alpha is used to test the reliability of a multi item scale. The co-efficient of Chronbach alpha is shown in table I. Since all the values above 0.70, the construct of this questionnaire is reliable. In sum, the evidence suggests that our scale has adequate measurement properties.

TABLE I. RELIABILITY ANALYSES

Dimension	Cronbach's Alpha value
Role Conflict	0.875
Job Task on Demand	0.860

(Source: Survey data)

B. Mean and Standard Deviation of Job Task Demand of the Respondents

TABLE II MEAN AND STANDARD DEVIATION OF JOB TASK DEMAND OF THE RESPONDENTS

Table II shows the mean and standard deviation of different dimensions to measure the organizational stressors. Among the five dimensions that measure organizational stressors, it is observed that the 'safety climate' (mean = 3.4729; SD = 0.71314) has high mean values followed by social support (mean = 3.3519; SD = 0.35742), 'job certainty' (mean = 3.261; SD = 0.8038), and 'training' (mean = 2.9264; SD = 0.74658). However, it is noted that the respondents give poor response to the dimension regarding harassment and discrimination (mean = 2.2093; SD = 0.84456).

JOB TASK DEMAND	Mean	SD
1. I have control over the types of tasks I was assigned to do during a workday	3.04	1.376
2. I have control over getting the superior to provide me with proper personal protective	2.94	1.334
3. I have control over how fast I worked	3.10	1.419
4. In general I have control over work and work related factors	3.02	1.569
5. I work very fast on the job	3.17	1.365
6. I work very hard on the job	3.56	1.305
7. Given a chance that would help me to improve or perfect my skills	3.45	1.375
8. At work, I am also have the responsibility for the safety of others on the jobsite	3.17	1.379
9. In this job I often have to work harder than others to "prove" myself	3.30	1.303
Overall	3.1947	.40657

(Source: Data analysis)

C. Mean and Standard Deviation of Role Conflict of the Respondents in BOC

TABLE III. MEAN AND STANDARD DEVIATION OF ROLE CONFLICT OF THE RESPONDENTS IN BOC

Variable	Mean	Std. Dev
Role Conflict	2.9649	.488

(Source: Data analysis)

Table 4.6 clearly exhibits the mean and standard deviation of the variable used to find the role conflict dimension of occupational stress. However, it is noted that the respondents give low response to the dimensions regarding role conflict (mean=2.9649; SD=0.488).

D. Regression Analysis

TABLE IV REGRESSION ANALYSIS - INFLUENCE OF JOB TASK DEMANDS ON ROLE CONFLICT

	U.Coefficients		S.Coefficients	T	p
	B	Std.E	Beta		
(Constant)	5.436	.212		25.586	.000
Job Control	-.303	.038	-.833	-7.887	.000
Job Demand	-.205	.031	-.492	-6.544	.000
Skill Under Utilization	-.066	.027	-.186	-2.460	.000
Responsibility	-.138	.021	-.389	-6.451	.000
Overcompensation at work	-.061	.027	-.163	-2.267	.024

Dependent Variable: Role Conflict

Model R	R	R.Sq	Ad.R.Sq	Std. E. Es	F	p
1	.571a	.326	.317	.40343	36.857	.000b

(Source: Data analysis)

a. Predictors: (Constant), Overcompensation at work, Responsibility, Skill_Under_Utilization, Job_Demand, Job_Control An examination of t – values of this table shows that, 'Job Control' ($t = -7.887$), 'Job Demand' ($t = -6.544$), 'Responsibility' ($t = -6.451$), 'Skill under Utilization' ($t = -2.460$) and 'Overcompensation at work' ($t = -2.267$) contribute negatively and significantly to the prediction of Role Conflict. Gutek, et al., (1991) already found a negative significant relationship between Job Control, Job Demand, Skill under Utilization, Responsibility, and Overcompensation at work and Role Conflict. Results of this study support the findings reported by Zhang, et al., (2009) where, Job Control, Job Demand, Skill under Utilization, Responsibility, and Overcompensation at work are found to be the significant influencers of Role Conflict. From the results, it is further observed that Job Control is found to be the most significant related factor affecting Role Conflict. Job Demand is the second important factor followed by Responsibility, Skill under Utilization and Overcompensation at work. So Job Control and Job Demand had a notable influence on the Role Conflict.

E. Hypothesis Testing

'Job task Demand' ($t = -14.762$) is negatively and significantly contributed in the prediction of Occupational Stress of bank executives. Results of this study confirm that Training, Social Support, Job Certainty, Job Demand and Responsibility influences Role conflict dimension of Occupational Stress, which is similar to the study of Murphy, L.R, (1984).

Based on the regression analysis, the null hypothesis (H0) is rejected and alternative hypothesis (H1) is accepted, which means that all the study variables significantly influence organizational stress of executives in Bank of Ceylon, Sri Lanka. That is, variable job task demand negatively significantly influence role conflict dimension of organizational stress of the bank executives. Therefore, it is concluded that the variables taken for the study have negative influence on role conflict dimension of occupational stress of bank executives in Bank of Ceylon, Sri Lanka.

IX. CONCLUSIONS

A. Findings

It can be ascertained from this study that Job Control Job Demand, Responsibility, Skill under Utilization and Overcompensation at work contribute significant and Negative contribution in the prediction of Role Conflict.

B. Suggestions

Occupational stress is brought by lack of social network, or unresponsive social network, simply because Bank managers are very interactive people, and they need social dialogue from their superiors, colleagues and to share ideas together to help built the gaps and alleviate occupational stress. As a fact, there is another dispute faced by the respondents such as physical stress whereby they want to be touched in a way that would tell them they are still precious in the society, because they long for intimacy that would be guaranteed for them (Levi et. al, 2014). It has been reported that occupational stress can have unfavourable ramification of the performance of bank managers and clients satisfaction.

Bank officers are in need of exploring the role of positive thinking and direct action in reducing occupational stress and how they operate in effective manner. Along similar lines, particular attention should be devoted by bank organization to understand how respondents select their coping strategies effectively in reducing occupational stress. Bank organization needs to re-examine job-related tensions which is directly related to sound occupational stress. Management should attempt to establish and strengthen the supportive mechanism within the organization. Bank organization might need to implement dependent-care flexible spending account, elder and child care referral services effectively in a holistic fashion.

Bank organization could consider providing a web site designed as a way to let the employees to vent frustrations, post views and opinions. It should be therapeutic in concept and censorship free. Bank organization could design and offer stress reduction program to assist employees to reduce worry and anxiety, and cope with their stress. In addition, a complimentary counselling service should be made available to the respondents that professional advisors confidentially listen and give the employees a chance to vent frustration,

anger and doubt, and may further give them good advice when wanted. This may create a sound psychological well being of the respondents.

C. Scope for Further Research

There is a vast scope for the continuation of this research in future on occupational stress. As occupational stress varies with different sectors of banks, further research should be performed by comparing public sector banks with private sector bank which will be useful for the policy makers to device strategies accordingly.

Since occupational stress is influenced by several variables, the variables considered in this research are only limited and hence, there is a scope in the future to study in detail about different factors that contribute occupational stress.

Future study could be performed on not only bank executives, but also by considering the bank employees as a whole and comparative study can be done, which will be helpful to identify the level of occupational stress among different categories of bank employees.

As the data were collected only from branch level executives, executives from corporate office may also be considered who are more task oriented and have the possibilities of acquiring high level of occupational stress.

D. Conclusions

Research findings suggest that bank officers must identify the effective methods to reduce, eradicate or cope up with occupational stress. Bank management must enhance the best ways to develop the psychological well beings of their officers. Because, bank job is, indeed, complex, continuous, taxing and tiresome where higher proximity and social consensus is always needed. It requires total dedication, full-involvement, devotion to duty and to a very large extent care in the course of duty.

The purpose of the research was to examine through empirical research, the important factors influencing occupational stress. By carefully investigating the variables like personality, self efficacy, organizational stressors factors and coping strategies, the suitable skill development programs can be determined exclusive for banking management.

If the bank managers are stress free, their job performance will be accurate with societal care, which is need of the hour in our society. Because, efficient banking service is very essential for sustaining and improving the economy of the developing nation, Sri Lanka.

REFERENCES

[1] Abrahamian, E. J. (2003). The effect of computer-human interfaces designed for specific personality types on learning. Saint Louis University, St. Louis,

MO. Dissertation Abstracts International, 64 (08).14-17

[2] Ashok Pratap Singh and Kedar Nath, 2 (1991). Effects of Organisational Climate, Role Stress and Locus of Control on Job Involvement of Banking Personnel, Indian Journal of Industrial Relations 27, 63-76

[3] Bagozzi, R. P. and Y. Yi (1989). On the Use of Structural Equational Models in Experimental Designs. Journal of Marketing Research, 26, 271-284.

[4] Barrick, M. R. and Mount, M. K. (1991). "The Big Five Personality Dimensions and Job Performance: A Meta-Analysis", Personnel Psychology, 44, 1-26.

[5] Beehr, T.A., & Newman, J.E. (1978). Job stress, employee health, and organizational effectiveness: A facet analyses, model and literature review, Personal psychology, 31, 665-69.

[6] Button, Lori A (2008). Effect of social support and coping strategies on the relationship between health care- related occupational stress and health. Journal of Research in Nursing, 13, 498-524.

[7] Choi, T. Y. and Chu, R. (2001). "Determinants of Hotel Guests' Satisfaction and Repeat Patronage in the Hong Kong Hotel Industry," International Journal of Hospitality Management, 20 (3), 67 - 82.

[8] Dunseath, J., Beehr, T.A. and King, D. W. (1995). Job Stress-Social Support Buffering Effects Across Gender, Education and Occupational Groups in a Municipal Workforce: Implications for EAP's and Further Research", Review of Public Personnel Administration, 15 (1), 60-83.

[9] Goldenhar, L., Williams, L., & Swanson, N. (2003). Modelling the relationship between job stressors and injury and near-miss outcomes for construction labourers. Work & Stress, 17 (3):218-240.

[10] King Carol A. and Jenene G. Garey (1997). "Relational Quality in Service Encounters," International Journal of Hospitality Management, 16 (1), 39 – 63.

[11] Nargundkar Rajendra (2006). "Marketing Research," Tata McGraw Hill Publications, New Delhi.

[12] Schall Matthew (2003). "Best Practices in the Assessment of Hotel-Guest Attitudes," The Cornell Hotel and Restaurant Administration Quarterly, April, 51 – 65.

[13] Srivastava, A.K. & Singh, A.P. (1981) : Manual of the Occupational stress Index, Department of Psychology, Banaras University, Varanasi.

[14] Umann J, Silva RM, Benetti ERR, Guido LA (2014). Stress and coping among nurses of hematooncologic units. Rev Rene[Internet]. ;14(4) :783-90.

[15] Van Dierendonck, D., Garssen, B.,& Visser, A. (2005). Burnout prevention through personal growth. International Journal of Stress Management, 12, 62-77.

[16] Woondruff, R. B., Cadot, E. R. and Junkins, R. L. (1993). Modelling Consumer Satisfaction Process using Experience Based Norms, Journal of Marketing Research, 20 (3), 296 – 304.

[17] Zhou H, Gong YH (2015). Relationship between occupational stress and coping strategy among operating theatre nurses in China: A questionnaire survey. Nurs Manag, 23(1) 96-106.

The Impact of Domestic Debt on Investment: An Empirical Investigation of Sri Lanka

Selvamalai T

Faculty of Economics, South Asian University, New Delhi India

selvam3088@gmail.com

Abstract— Domestic debt is a major source of public debt in Sri Lanka. Public debt, as well as domestic debt, has a crucial role in an economy where the investment is an element of the economy. The study examines the effect of domestic debt on investment, and also examines the causal relationship between these two variables in Sri Lanka over the period 1960 and 2014. For this purpose, the data was gathered from Annual report of Central Bank of Sri Lanka, 2014. The study applies time series econometric methods, especially cointegration, rational distributed lag model, and Granger causality test. The study was found that there is no long-run equilibrium relationship between domestic debt and investment in Sri Lanka during the study period. And, only previous value (one lag) of change in domestic debt as a percentage of GDP has a negative and significant impact on the change in investment. Further, from the Granger causality test, the study found that, during the above period, domestic debt caused investment but the converse was not acceptable in Sri Lanka.

Keywords— Domestic Debt, Investment, Cointegration, Distributed Lag Model, Granger Causality

I. INTRODUCTION

Sri Lanka has been unable to constrain the growth of its domestic debt. The domestic debt has many impacts on the economy which impact may be either positive or negative or both. In an economy, investment is important and it is determined by many factors, especially domestic debt. The economic policies have changed over a period of time in Sri Lanka with the frequent changes of government since the independence in 1948. In 1960, domestic debt was 29% as a percentage of gross domestic products (GDP) and investment was 14.6% as a percentage of GDP in Sri Lanka. In 2002, domestic debt was increased to 60% as a percentage of GDP and investment was increased to 30% as a percentage of GDP in 2014.

The objective of this study is to find the effect of the domestic debt on investment in Sri Lanka. The study used two variables mentioned above and used its annual series data of fifty-five years from 1960 to 2014. The data was gathered from Annual Report of Central Bank of Sri Lanka,

2014. The paper is organized in the following manner; review of the literature, objective and data, preliminary analysis, methodology, results and discussion, and finally a conclusion.

II. REVIEW OF LITERATURE

There are some narrow definitions of debt that include only currency and deposits, debt securities, and loans and all debt instruments except insurance, pension, and standardized guarantee scheme (IMF, 2011). Decompositions of the public debt are domestic debt and foreign debt. The domestic debt means the liabilities owed by residents to residents of the same economy. The foreign debt is liabilities owed by residents to nonresidents are external debt (IMF, 2011).

The domestic debt has been a major source of public debt in Sri Lanka. For instance, in 2014, the public debt was 75.5 percent as a share of GDP where the domestic debt 43.7 percent as a share of GDP and foreign debt was 31.8 percent as a share of GDP (Annual Report of Central Bank of Sri Lanka, 2014).

The main instruments for the domestic debt of Sri Lanka are treasury bonds, treasury bills, and rupee loans. Among these instruments, the treasury bonds play the major role in domestic debt of Sri Lanka. For instance, in 2012, Share of treasury bonds in total domestic debt was 65 percent whereas it was 35 percent as a percentage of total public debt in Sri Lanka (Annual Report of Central Bank of Sri Lanka, 2014).

The public debt, as well as domestic debt, has many impacts on the economy, as well as national saving. According to “Conventional View of Debt” (Elmendorf and Mankiw, 1999) the public debt (budget deficit) increase the disposable income, aggregate demand, output, and wealth; which increases is high in the short run compared to in the long-run.

Further, theoretically, an increase in government debt reduces the national saving. Suppose that government holds spending constant and reduces tax revenue, thereby an increase in budget deficit (government debt) reduces the public saving. But private saving may rise, the domestic investment may decline, and net foreign investment may decline. In fact, some economists have argued that private saving will fall. But according to ‘conventional view’, private saving rises by less than public saving falls; it has

consequences on the economy (Elmendorf and Mankiw, 1999).

Much empirical evidence shows a non-linear relationship between debt and economic growth in the short-run. In other words, the small size of debt increase the economic growth and high level of debt reduce the economic growth, i.e., there are inverted U relationship between debt and economic growth. (Jernej et al (2014), Baum et al (2012), Mitze and Matz (2015), Egert (2015)).

There is few empirical study about the effect of domestic debt on investment. This study also found an inverse relation between domestic debt and investment.

Damian et al (2014) found that domestic debt has an inverse significant impact on domestic private investment in Nigeria. Results also show that domestic debt has an inverse significant impact on foreign private investment in Nigeria with the exchange rate and debt servicing having a positive effect on foreign private investment in Nigeria. The study concludes that domestic debt if unchecked crowds-out private investment in Nigeria. For these results, the study employed multiple regression models using secondary data from 1970 to 2012.

Maxwell, J.F (1989) estimated a foreign debt model that exploits the balance-of-payments identity (current account=national saving-domestic investment). Foreign debt can affect both saving and investment behavior in this model. He assumed that If an increase in foreign debt reduces investment by more than it reduces saving (or raises investment by less than it raises saving). But the study found that, from 28 developing country sample data, an increase in foreign debt reduces saving by more than it reduces investment.

There are many theoretical and empirical studies on the impact of public debt on economic growth and there are some studies on the effect of domestic debt on investment. However, none of the empirical studies in the existing literature have considered the effect of domestic debt on investment in Sri Lanka; therefore, this study fills the research gap.

III. PRELIMINARY ANALYSIS OF DATA

Before coming to methodology part, a study has to do some preliminary analysis needed for the constructing the methodology. Therefore, following part is the preliminary analysis of data for the study.

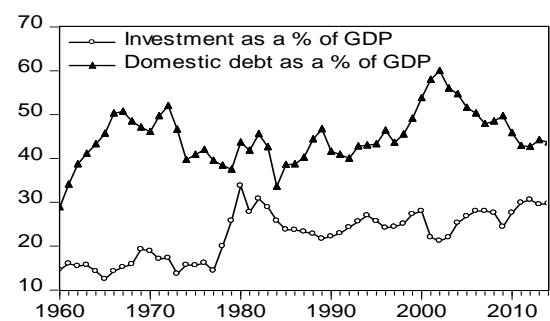
Figure.1 shows the trends of national saving-to-GDP ratio and domestic debt-to-GDP ratio in Sri Lanka between 1960 and 2014. In Figure.1, trends of both series are increasing over the study period; this means that both series were non-stationary. In 1960, domestic debt as a percentage of GDP was 29% but it was increased to 60% in 2002. The

investment as a percentage of GDP was 14.6% in 1960 and it was 30% as a percentage of GDP in 2014.

Figure.2 is a scatter diagram for the both variables, changes of domestic debt and investment. At the first glance, Figure.2 shows that there is no clear relationship between domestic debt and investment.

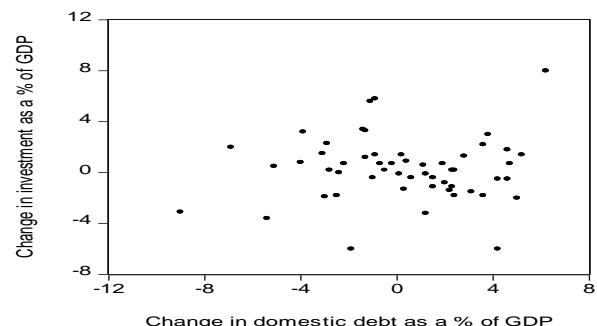
Since the study deals with time series data, a test for stationarity of data is a very important precondition before the analysis. A unit root test is performed to examine the stationarity of time series. The study has tested the stationarity of variables statistically by Augmented Dickey-Fuller (ADF) unit root test.

Figure.1 : Trends of domestic debt and investment in Sri Lanka



Source: Annual Report of Central Bank of Sri Lanka, 2014.

Figure.2 : Correlation between changes in domestic and investment as a percentage of GDP



Source: Annual report of central bank of Sri Lanka, 2014

An Augmented Dickey-Fuller (ADF) unit root test is employed to check the stationarity of data. If there is a unit root, then that particular series is considered to be non-stationary. ADF test has three different specifications. Among these different specifications of ADF test, the study applied the trend with the constant term because both series are trended with time. The Akaike Information Criterion (AIC) was used to decide the optimal lag length.

Table.1 shows the results of ADF unit root test at the level of series of variables. In table.2, critical values which are provided by Mackinnon (1991) are given for the 5% significant level. If calculated $|t\text{-value}|$ is greater than the $|\text{critical value}|$ at the particular significant level, then we can conclude that series is stationary at the particular significant

level. Table.1 shows that series, domestic debt as a % of GDP and investment as a % of GDP, are non-stationary at level. But both series turns to be a stationary at the first differencing level of series (see table.2).

Table.1 : Results of Augmented Dickey-Fuller (ADF) unit root test at level of series

Variables	t-value	Critical Value
Domestic debt as a % of GDP	-2.76	-3.49
Investment as a % of GDP	-2.69	-3.49

Source: Author's Calculation

Table.2 : Results of Augmented Dickey-Fuller (ADF) test at the first differencing level of series

Variables	Calculated t-value	Critical Value
Change in domestic debt as a % of GDP (DDD)	-6.24	-3.49
Change in investment as a % of GDP (DI)	-6.77	-3.49

Source: Author's Calculation

IV. METHODOLOGY

The study applies the times series econometric technique to find the impact of domestic debt on investment. Firstly, the study applies Engel Granger (1987) cointegration. If two or more series are integrated of order one I(1) but a linear combination of them is integrated order zero I(0) and thus stationary, then series is said to be cointegrated. If both series is cointegrated, there exists a long-run equilibrium relationship among the variables.

Let us consider the following relationship,

$$I_t = \beta_0 + \beta_1 DD_t + \varepsilon_t \quad (1)$$

Where, series of investment (I) and domestic debt (DD) are non-stationary at level. Equilibrium error, ε_t , is given by

$$\varepsilon_t = I_t - \beta_0 - \beta_1 DD_t \quad (2)$$

Equilibrium error, ε_t , should be a stationary series to exists a long-run equilibrium relationship between variables investment and domestic debt as a percentage of GDP.

If the variables are cointegrated study applies error correction model (ECM) which allows us to study the short-run dynamics in the relationship between investment (I) and domestic debt (DD). But if they are not cointegrated study applies dynamic model at first differencing level given bellow.

$$DI_t = \alpha_0 + \alpha_1 DI_{t-1} + \delta_0 DDD_t + \delta_1 DDD_{t-1} + \varepsilon_t \quad (3)$$

Where DI_t and DDD_t denote the first difference of investment (I_t) and domestic debt (DD_t) respectively. Where DI_{t-1} is first difference of I_t at lag order one, and similarly for DDD_{t-1} . If study views this as a rational distributed lag model, study can find the long-run propensity and lag distribution for DI_t as a lag distribution in DDD_t . The long-run propensity (LRP) is calculated as $(\delta_0 + \delta_1)/(1 - \alpha_1)$.

Finally, the study applied the Granger causality test between investment and domestic debt as a percentage of GDP. The Granger (1969) causality test for the case of two stationary variables DI_t and DDD_t involves as following VAR model.

$$DI_t = a_1 + \sum_{i=1}^n \rho_i DDD_{t-i} + \sum_{j=1}^m \gamma_j DI_{t-j} + \varepsilon_{1t} \quad (4)$$

$$DDD_t = a_2 + \sum_{i=1}^n \mu_i DDD_{t-i} + \sum_{j=1}^m \delta_j DI_{t-j} + \varepsilon_{2t} \quad (5)$$

Where, DI_t is dependent variable in the model (4) and DDD_t is dependent variable in the model (5). The past values of DI_t , DDD but not the current values are as explanatory variables in the both model (4) and (5). The variable DDD is said to Granger-cause DI_t if DDD is can be predicted with greater accuracy by using past values of DI_t variable rather than not using such past values, all other terms remaining unchanged, similarly for variable DDD .

Now, consider model (4), we set the null and alternative hypothesis as: $H_0: \sum_{i=1}^n \rho_i = 0$ i.e., DDD does not cause DI_t , $H_A: \sum_{i=1}^n \rho_i \neq 0$, i.e., DDD_t does cause DI_t . The H_0 is the null hypothesis and H_A is the alternative hypothesis. Here, if the computed F-value exceeds the F-critical value, then reject the null hypothesis, and conclude that DDD_t does cause DI_t , similarly, for the model (5). All result is estimated with the help of E-Views software.

V. RESULTS AND DISCUSSION

Table 3 : Results of Cointegration Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.13990	5.732161	3.164582	0.0026
DD	0.098268	0.126915	0.774285	0.4422
R-squared	0.011185	Durbin-Watson stat	0.204800	
Adjusted R...	-0.007472	Prob(F-statistic)	0.442200	

Source: Author's Calculation

Table.3 shows the results of cointegration regression. Where dependent variable is an investment as a percentage of GDP and the independent variable is domestic debt as a percentage of GDP. The coefficient of domestic debt is 0.098 which is statistically insignificant. Durbin-Watson statistics is very less from two. This means that there is autocorrelation in cointegration regression. Therefore, these

results are inconsistent or spurious. For cointegration, residuals of cointegration regression should be stationary. Table.4 shows the unit root test of the residuals.

Table 4 : Results of unit root test of residuals of cointegration regression

	t-Statistic	Prob.*
Augmented Dickey-Fuller test...	-1.629921	0.4606
Test critical values:		
1% level	-3.557472	
5% level	-2.916566	
10% level	-2.596116	

*MacKinnon (1996) one-sided p-values.

Source: Author's Calculation

Table.4 shows the results of Augmented Dickey-Fuller (ADF) unit root test of residuals of cointegration regression. The ADF test shows that series of the residual is non-stationary. Therefore, there is no cointegration relationship between domestic debt as a percentage of GDP and investment as a percentage of GDP. So, no need to apply ECM. The study estimated a dynamic model in first differencing. The results are given in table.5.

Table 5 :Results of rational distributed lag model

Variable	Coefficient	t-Statistic	Prob.
C	0.301569	0.887432	0.3792
DI(-1)	0.062397	0.463689	0.6449
DDD	0.071841	0.675136	0.5028
DDD(-1)	-0.255068	-2.446905	0.0180
R-squared		0.11197	
Prob(F-statistic)		0.11775	
Durbin-Watson stat		1.99687	

Source: Author's Calculation

Table.5 shows the results of rational distributed lag model. In table.5, the coefficient of first differencing of domestic debt (DDD) does not have a significant impact on the current value of first differencing of investment but the previous value of first differencing of domestic debt have a negative and significant impact.

The LRP is -0.195 which means that change in domestic debt affected negatively on investment in long-run. Further, in the table.5, Durbin-Watson statistics (DW) is 1.997 which means that there is no autocorrelation in the estimated results of rational distributed lag model because the value DW statistics is nearly two. Table.6 also shows same results.

Table 6

Breusch-Godfrey Serial Correlation LM Test

F-statistic	Prob. F(2,47)	0.9976
Obs*R-squa...	Prob. Chi-Squa...	0.9973

Source: Author's Calculation

Table.6 shows results of Breusch-Godfrey serial correlation LM test for estimated results (see table.5) of rational distributed lag model. The null hypothesis that there is no serial correlation can not be rejected because p-value is 0.9976 (nearly one). Therefore, the estimated results given table.5 are very robust.

Table 7 :Results of Granger causality test

Null hypothesis	p-1	p-2	p-3
DDD does not cause DI	0.02	0.08	0.27
DI does not cause DDD	0.87	0.22	0.31

Source: Author's Calculation

Table.7 shows the results of the Granger Causality test for two variables at the different lags. Where, p-1, p-2, and p-3 denote the probability of F-statistics at lag order 1, 2 and 3 respectively. At one lag, change in domestic debt does cause a change in investment at 5% significant level, and at two lags, change in domestic debt cause a change in investment only at 10 % significant level. But, in all cases, change in investment (DI) does not cause a change in domestic debt because corresponding p-values are greater than 0.05.

VI. CONCLUSIONS

In Sri Lanka, between 1960 and 2014, there was no long-run equilibrium relationship between domestic debt and investment as a percentage of GDP. And, only previous value (at lagged order one year) of domestic debt had a negative and significant impact on investment. Further, from Granger causality test, study concluded that domestic debt caused investment of Sri Lanka but investment did not cause domestic debt in Sri Lanka over the study period.

REFERENCES

- [1] Asteriou, D, & Hall, S.G. (2006). Applied Econometrics. Published by Palgrave Macmillan, UK. Second edition 2011.
- [2] Baum, A., Westphal, C.C., & Rother, P. (2012). Debt and growth: New evidence for the euro area. *Journal of International Money and Finance* , 32, 809–821

- [3] Dickey, D.A., & Fuller, W.A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, 49, pp. 1057-72
- [4] Egert, B. (2015). Public debt, economic growth and nonlinear effects: Myth or reality? *Journal of Macroeconomics* , 226-238
- [5] Elmendorf and Mankiw. (1999). "Government Debt". In (. B. (ed.)), *Handbook of Macroeconomics 1, Part:3* (pp.1615-1669).Harvard,http://nrs.harvard.edu/urn-3:HUL.InstRepos:2643866
- [6] Engle, R.F., & Granger, C.W.J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55, pp.391-467.
- [7] Granger, C.W.J. (1969). Investigating causal relations by econometric models and cross spectral methods. *Econometrica*, 35, pp.424-38.
- [8] IMF. (2011). Public Sector Debt Statistics:Guide for Compilers and Users. Washington: International Monetary Fund.
- .
- [9] Jernej, M., Aleksander, A., Miroslav, V. (2014). The Impact of Growing Public Debt on Economic Growth in the European Union. *Amfiteatru Economic*, 35, 403-414.
- [10] Maxwell, J. F (1989). Foreign debt instability: an analysis of national saving and domestic investment responses to foreign debt accumulation in 28 developing countries. *Journal of international money and Finance*, vol.8, issue 3, September 1989, pages 315-344.
- [11] Mitze and Matz. (2015). "Public debt and growth in German federal state: What can Europe learn?". *Journal of Policy Modeling* , pages 208-228
- [12] Kumara, H., Cooray, N.S. (2013). Public Debt and Economic Growth in Sri Lanka: Is There Any Threshold Level for Public Debt?. *Economics & Management Series*, International University of Japan.

Consumption and Management of Electricity and Water at households in Batticaloa District, Sri Lanka

Tharsinithevy Kirupananthan

Department of Agricultural Economics, Faculty of Agriculture, EUSL
freebirdever04@yahoo.com

Abstract— Electricity and water are two main economic resources marketed at households which should be managed and used properly to value their scarcity. Therefore, this study analyzed the difference in electricity expenditure between the households keeping and not keeping firewood hearth and the effect of income in electricity expenditure. It also analyzed the difference in water charges between the households having and not having water well and effect of income in water expenditure. Data on electricity and water expenditures for the months of April to June in 2014 of 96 households selected by convenience sampling in Batticaloa District was used in this study. One-way ANOVA was used to find the effect of “using firewood hearth on electricity expenditure” and “having water well on water expenditure. Simple regression analysis was used to find the relationship between income and electricity and water charges. The mean electricity expenditure was Rs. 1310.00/month. The mean water expenditure was Rs. 384.91/month. The average monthly income of the sample was Rs. 29,986.98 with the minimum and maximum of Rs. 10,000.00 and Rs. 100,000.00 per month respectively. 74% of the sample showed to use firewood hearth. Firewood hearth keeping and not keeping groups were significantly [$F(1,94) = 11.052, P=.001$] differed by monthly electricity expenditure at 5% level. Mean electricity expenditure of the fire wood hearth keeping and not keeping groups were Rs. 1067.51 and Rs. 1998.67 respectively. 88.5% sample had water well. Groups Having and not having well were not showed any significant [$F(1,82) = .002, P=.967$] difference in monthly water charges. The regression analyses showed average electricity and water expenditure were significantly ($p<0.05$) associated with income of households. One unit increase in income caused 0.044 units increase in electricity expenditure. One unit increase in income level caused 0.008 units increase in water expenditure. Using firewood hearth was found to be the effective management plan to save electricity charges. While owning to well did not affect significantly ($p\leq 0.05$) on water expenditure. When income level increases households try to use more electricity rather than water. At current pricing level for electricity and water, electricity is valued as more than water at households.

Keywords— Electricity expenditure, Water Expenditure, Income, Fire Wood Hearth, Water Well

I. INTRODUCTION

Electricity is a major economic resource that we consume every day. There are many ways to save electricity. One of the electricity consumption at home level is cooking purpose. Fire wood is a traditional bio-energy source used in cooking purpose. Electricity is placed as higher order energy and fire wood as the lower order in the energy ladder hypothesis proposed by Masera et al., 2000. Weerahewa and Rajmohan (2007) found firewood ranking as the second highest used energy rather than electricity in rural, urban and estate sectors in Sri Lanka. If the people substitute bio energy such that firewood could save electricity charges. Since using hearth at home will reduce electricity consumption. While one of the factor which affect energy consumption is income. “Many studies show that the consumption of electricity has some kind of relation with the income concentration in Brazil and many authors tries to characterize the domestic consumption of electricity by means of household’s income variability” (Francisco et al., 2006).

Nowadays water also found to be a marketable resource and use of water supplied by National Water Supply and Drainage Board, Sri Lanka is in common use more than the last two decades. Keeping a water well at home and use that water is found to be a traditional system of water use in Sri Lanka. By owning a water well at home, people can substitute well water and save the money for water charges. Man-induced water management practices such that uncontrolled demand leads to water scarcity (Pereira et al., 2009) and it should be controlled by valuing water or fixing a market price for its use. Therefore, this study explored the group of households having water well are differing in water expenditure with the group of households not having a water well and the effect of income in water expenditure. Even though electricity and water are marketed at home level, they are priced as differently valued market goods.

II. METHODOLOGY

Data collection and Sampling

Data on electricity and water charges for the months of April to June in 2014 of 96 households selected by convenience sampling in Batticaloa District was used in this study.

Analytical methods

One-way ANOVA test was used to find the difference in electricity expenditures by using fire wood hearth and the difference in water charges by having water well.

This method is more suitable to check the mean difference between the two groups using SPSS (Statistical Package for Social Science)version 19. In the analysis of variance, the F statistic is used to test whether the means of two or more groups are significantly different. An ANOVA based on group data that are defined by a single classification is called one-way ANOVA (Cheng et al., 2000). In this method there is no restriction was placed on the relative sizes of the samples that comprised each level of the factor studied (Sharon and Sarah, 2002). Therefore, the following hypotheses were made for this study based on the above test at 5% significant level:

Null hypothesis 1: There is no difference in electricity expenditure between the two groups of using fire wood hearth and not using

Alternative hypothesis 1: There is difference in electricity expenditure between the two groups of using fire wood hearth and not using

Null hypothesis 2: There is no difference in water expenditure between the groups of having water well and not having

Alternative hypothesis 2: There is difference in water expenditure between the groups of having water well and not having

Simple regression analysis

Simple regression analysis is used to find the effect of one independent variable on the dependent variable. The following two different simple regression equations were built to measure the effect of income in electricity and water charges respectively.

$$Y = \alpha + \beta X_1 \quad (1)$$

α =Constant

Y = Electricity charge

X_1 = Average monthly income

To measure the effect of income on water charge the following equation was built.

$$Y_1 = \alpha_1 + \beta_1 X_1 \quad (2)$$

α_1 =Constant

Y_1 = Water charge

X_1 = Average monthly income

III. RESULTS AND DISCUSSION

Descriptive statistics of electricity, water expenditures and household income

Table I shows the descriptive of electricity, water expenditures and income. The mean electricity expenditure was Rs. 1310 per month while the mean water expenditure was Rs. 384.91 per month. The mean income of the studied sample was Rs. 29,986 per month. The range of electricity expenditure was from Rs. 102.33 to 8,274.33. The range of water expenditure was from Rs. 48 to Rs. 2474 per month. The average water expenditure was three times less than the electricity expenditure.

TABLE I. AVERAGE ELECTRICITY, WATER EXPENDITURES AND INCOME IN RS PER MONTH

Expenditures	Mean	Maximum	Minimum	Std.Deviation
Electricity	1,310	8,274.33	102.33	1,266.51
Water	384.91	2474	48	402.46
Income	29,986	100,000	10,000	16,378.43

Electricity expenditure by owning of firewood hearth

An analysis of variance (one-way ANOVA) results showed that using of firewood hearth has significant [$F (1,94) = 11.052, P=.001$] effect on expenditure of electricity (Table II). Therefore, the null hypothesis of there is no difference in electricity expenditure between the two groups using and not using fire wood hearth was rejected. This result was as expected. Normally households make using fire wood hearth consume less electricity. Using fire wood hearth significantly contributed to save electricity. The mean expenditure of group using fire wood hearth was Rs. 1067.511. This value is Rs. 931.15 less than the group not using fire wood hearth (Table III). Therefore, using a firewood hearth is an effective way to save more electricity and reduce the expenditure.

TABLE II. ANOVA ELECTRICITY EXPENDITURE BETWEEN THE GROUPS USING AND NOT USING FIRE WOOD HEARTH

	Sum of squares	df	Mean square	F	Sig.
Between groups	16031384.03	1	16031384.03	11.052	.001
Within groups	1.364E8	94	1450556.087		
Total	1.524E8	95			

TABLE III. ELECTRICITY EXPENDITURE BETWEEN THE GROUPS USING AND NOT USING FIRE WOOD HEARTH

Group	Owning firewood hearth	Not using firewood hearth
Percent of households	74	26
Average electricity expenditure	1067.511	1998.66
Maximum	4663.33	8274.33
Minimum	102.33	533.33
Std. Deviation	1001.53	1660.031

Water charges by having water well

There was no significant [$F (1,82) = .002, P=.967$] difference found in water expenditure between the two groups having and not having a well (Table IV). The null hypothesis of no difference in water charges between the groups having and not having water well was accepted. 88.5% of the studied sample owned to well. The mean water expenditure of this group is Rs. 345.44 (Table V)

Therefore, having well has no significant effect on the use of water supplied by water supply Board Sri Lanka at current (during the study period) charging level. The result was not as expected. The water well at home did not significantly contribute in saving water charges for their needs. It means household owning water well did not consider about water charges and substitute well water. There may be a positive effect by having a well (using the water from the well and reducing water charges) in the future if water price increased. After the basic needs are met water should be priced appropriately to prevent its over use and solve the problem of water scarcity.

TABLE IV. ANOVA WATER EXPENDITURE BETWEEN THE GROUPS HAVING WELL AND NOT HAVING

	Sum of squares	df	Mean square	F	Sig.
Between groups	172.295	1	172.295	.002	.967
Within groups	8444492.597	82	102981.617		
Total	8444664.893	83			

TABLE V. WATER CHARGES BY HAVING WELL AND NOT HAVING

Group	Percent of households	Average water expenses	Maximum	Minimum	Std.Deviation
Having well	88.5	345.44	1450	48	330.21
Not having well	11.5	350.62	557	85	162.14

Simple regression model: effect of income in electricity and water expenditures

Abundant income creates more purchasing power and more consumption. This may be true in case of resource consumption also. Therefore, how the income effect on expenditures of electricity and water was studied using simple regression model. Table VI shows the model is significant ($P<0.05$) as average monthly income as the predictor in both cases (electricity expenditure and water expenditure as the dependent variables separately). One unit increase in income caused 0.044 units increase in electricity expenditure for studied sample. While one unit increase in income caused 0.008 units increase in water expenditure for studied sample. Therefore, income increase caused more consumption units of electricity rather than the water.

TABLE VI. : SIMPLE REGRESSION MODELS: EFFECT OF INCOME IN EXPENDITURES

Model	Dependent variable	Independent variable	Coefficient	Prob> t
1. R Square=0.324 , Probability>F=0.00	Mean electricity expenditure	Average monthly income	0.044*	0.000
		Constant (α)	-9.627	0.966
2. R Square=0.070 , Probability>F=0.00	Mean water expenditure	Average monthly income	0.008*	0.013
		Constant (α_1)	156.857	0.118

*Significant at the 0.05 level.

IV. CONCLUSION AND SUGGESTIONS

The average water expenditure was three times less than the electricity expenditure. Using a firewood hearth is an effective way to save more electricity and reduce the expenditure. Therefore, efficient fire wood hearth should be designed and introduced to households. This will also enhance the bio-wood production and marketing. Having well has no significant effect on the use of water supplied by Water Supply Board Sri Lanka. Households which owned water well should use well water to some extent rather than depend on supplied water. Income increasing caused more consumption units of electricity rather than the water.

REFERENCES

- [1] Cheng, F.L., John, C.L. and Alice, C.L. (2000) Statistics for Business and Financial Economics. World Scientific Publishing Co. Pte. Ltd.
- [2] Francisco, E. D. R., Aranha, F., Zambaldi, F. and Goldszmidt, R. (2006). Electricity Consumption as a Predictor of Household Income: a Spatial Statistics approach. [online] Available at: <http://www.geoinfo.info/geoinfo2006/papers/p67.pdf> [accessed 01 Jun 2016].
- [3] Masera, O.R., Saatkamp, B.D. and Kammen, D.M. (2000). From linear switching to multiple cooking strategies: A critique and alternative to the energy ladder model. World Development, 28(12): 2083-2103.
- [4] Pereira, L.S., Cordery, I. and Iacovides, I (2009). Coping with water scarcity addressing the challenges. Springer Publication.
- [5] Sharon, L.W. and Sarah, K.A. (2002) Data Analysis for the Behavioral Sciences. Cambridge University Press.
- [6] Rajmohan, K. and Weerahewa, J. (2007). Household Energy Consumption Patterns in Sri Lanka Sri Lankan journal of Agricultural Economics. [online] Available at: <http://www.slageconr.net/sjae/sjae91f/sjae09104.pdf> [accessed 01 Jun 2016].

Uses and Perception of Online Social Networks (OSNs) among the Academic Community: Special reference with Eastern University, Sri Lanka

S.Vijayakiruthika*¹, V. R. Ragel*²

Department of Economics, Faculty of Commerce and Management, Eastern University, Sri Lanka.

Department of Management, Faculty of Commerce and Management, Eastern University, Sri Lanka.

¹svijayakiruthika@yahoo.com

²rosanna@esn.ac.lk

Abstract— This research investigates recent Internet developments as seen in the Social Web and specifically investigated the effect of OSN on uses and perception of academics and what some of the consequences would be if users were allowed unrestricted access to these networks. The findings concerning the nature of academics OSN activities, academics attitude or Perceptions with regard to OSN in the workplace and how OSN can contribute or affect the academics are discussed in this article. This study examines what are the uses and perception of online social networking for information gathering among the academic community in Eastern University Sri Lanka. Perception of Online Social Networking (Face book, twitter etc) consists of four dimensions Information, People, Technology, Consequences .The findings of the study indicate that high level of perception through Usefulness, Ease of Use and Subject Norm factor in the OSN that's mean Academics have the potential to high-level influence on their perception regarding the online social networks.

Keywords— Online Social Networks (OSN), perception, uses, perceived ease of use, perceived usefulness, perceived, Subjective norm

I. INTRODUCTION

The Online Social Networking sites have become increasingly popular over the past few years. Major OSN like Face book, Twitter, Myspace, You Tube and LinkedIn have positioned with Millions of users and still growing attracting thousands of new users daily. Broadly, the uses of OSN can be categorized into two categories as personal and professional or business uses. In this 21st century, most of the people are involved with this online social network, while doing activities such as creating community for sharing knowledge, motivation, and encouraging innovation. There are a number of users such as school students, under graduates, teachers as well as parents who are interested in understanding many-to-many communication, video sharing, chat with staffs, online studies, online exams, (get) advanced knowledge, as well as entertainment and hobby. OSNs, as described earlier, offer to write messages, chat and catch up

with friends, upload video, upload photos, watching useful videos, find unknown matters, online studies and, online shopping. Online communities or OSNs may even replace the more traditional communication channels such as emails, phone conversations and Short messaging service.

This study confers Online Social networks of its contribution to the education society. Included in this study an explanation about, amidst of its advantages and disadvantages how the academic population has perceived the online social media networking and its uses especially in the university.

II. PROBLEM STATEMENT AND OBJECTIVES OF THE STUDY

Use of the internet and social media has grown substantially over the last decade, and the use of these new web-based technologies for work related activities has been a major part of OSNs such as Face book, YouTube, Wikipedia, My space, LinkedIn and Twitter. The reason most likely lies in the social nature of online social networking sites (OSN). Andréa Ferreira (2008) did a research at the University of Johannesburg in South Africa and found out that the OSN networks have the potential to positively affect the productivity of employees if a locus of control is inherent to these employees. Another study was conducted at the same University by Ferreira A&DuPlessis T (2009) and they found out that the social networking generally stimulates collaboration and knowledge sharing between individuals, which can lead to increased productivity through the creation.

Based on the above facts, it has become important to validate the impact of online social network uses and perception of it (online social networks) in the higher education sector in Sri Lanka specially Eastern University. This in turn questions about a study of (employees') uses and perception regarding the online social networks. Consequently the research problem has been formulated as follows.

“What are the uses and perception of online social networking for information gathering among the academics?

Research Objectives

- ✓ Examine the uses of (perceptions of usefulness of) Online Social Networks among the academic staff.
- ✓ To examine the level of perceptions among the academic staff with respect to ease of use of OSN.
- ✓ Examine the level of subject norms.
- ✓ To identify the perception of academic staff regarding of OSN. Examine the Behavior and preferences regarding Online Social Networking.

III. LITERATURE REVIEW

Keenan and Shiri conducted an exploratory study on how social networking sites encourage sociability. Four social networking sites (Face book , MySpace, LinkedIn and Twitter) were examined from a user's 'perspective'.

Pempek, Yermolayeva and Calvert studied college students' social networking experiences on Face book. Results of the study revealed that students use Face book approximately 30 minute throughout the day as part of their daily routine.

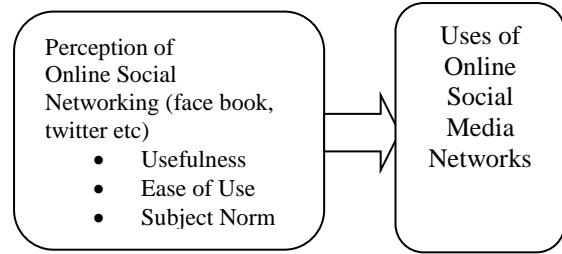
A study by Abu-Shanab and Al-Tarawneh (2013) explored the advantages and disadvantages of Face book utilizing university students.

(Rouis, 2012) Social network is a strong tool for social interaction and connection, where it can improve facilities and friends in a rich social context. A study on 161 Tunisian students concluded that performance was improved because of students' satisfaction with their family and friends relations.

Drury (2008) defines social media as —online resources that people use to share content: video, photos, images, text, ideas, insight, humor, opinion, gossip, news. Emphasizing people's behaviors when engaged in social media, Dykeman (2008) defined social media as —the means for any person to: publish digital, creative content; provide and obtain real-time feedback via online discussions, commentary and evaluations; and incorporate changes or corrections to the original content. Marchese (2007) distinguished social media from traditional media by stating that social media —is not the media itself, but the system of discovery, distribution, consumption and conversation surrounding the media.

IV. CONCEPTUAL FRAMEWORK

Based on literature survey following conceptual framework has been developed. This conceptual framework establishes link between dependent and independent variables.



Source-(Yan Zhang the University of Texas at Austin, School of Information, Austin, TX, 78701, USA)

V. Methods and Materials

This study collected questionnaire from the total population. The data will be collected from the 157 academic staff that represents the total population, that's called census study. Sometimes, the entire population will be sufficiently small, and the researcher can include the entire population in the study.

This type of research is called a census study because data is gathered on every member of the population. This research is limited to the Eastern University. All together there are 08 faculty institutions offices in Eastern University the Questionnaires distributed to whole population of the academic staff.

Data Analysis and Evaluation

Univariate Analysis

Univariate analysis was carried out for evaluating the attributes of variable and dimensions individually based on the responses. Here, the mean values and standard deviation of variable and dimensions are considered. For this purpose, decision criteria shown

VI. RESULTS AND DISCUSSION

6.1. Personnel or Demographic information

The research Information obtained through 103 structured questionnaires. In the first section Demographic information was obtained such as gender, age, designation, and, faculty institution, there are follows.

6.1.1 Gender

Among the total 103 population 47.6% represent male and 52.4% female.

6.1.2 Age

Under the age distribution among the total population the, 43.7% laid under the age distribution between the 20 to29 year, academics perception regarding the OSN mostly use the adults age group

(20to 29) than other age category academics , 27.2% were found under the age distribution between 29to 39 year, 22.3% were found under the age distribution between 39-49 year, 2.9% were found under the age distribution between 50-59 and 3.9% were found under the age distribution

Above 60 however academics regarding the OSN Lesley uses the older age group (50-59 and Above 60) than other age category academics.

Table - 01

Variables		No-of response 103	Percent age 100%
Gender	Male	49	47.6
	Female	54	52.4
Age	20-29	45	43.7
	29-39	28	27.2
	39-49	23	22.3
	50-59	03	2.9
	Above 60	04	3.9
Designation	Professors	02	1.9
	Associated professor	01	1
	Senior lecturer (grade 1)	08	7.8
	Senior lecturer (grade 2)	13	12.6
	Lecturer	10	9.7
	Lecturer (Probationary)	19	18.4
	Temporary Assistant lecturer	36	35
	Temporary Tutor	03	2.9
	Temporary Demonstrator	11	10.7
	Faculty of Commerce & Management	11	10.7
Faculty Institution	Faculty of Arts & Culture	18	17.5
	Faculty of Agriculture	06	5.8
	Faculty of Health-Care sciences	11	10.7
	Faculty of science	20	19.4
	Swami Vipulananda Institute of Aesthetics Studies	19	18.4
	Centre for Information & Communication Technology	07	6.8

6.1.3 Designation

Temporary assistant lecturer mostly responds to the perception regarding the OSN than other Designation category because the Temporary assistant lecturer has the age group laid between (20to 29), reasons the younger academics has more knowledge and experience about online social network. responds to the perception regarding the

OSN than other Designation category, because the professors has the age group laid between (50-59 and above 60), reason compare to adult staffs the late adult hood academics has less knowledge and experience about online social network.

6.1.4 Faculty

Among the 103 population , 10.7% of the total populations were found to be Faculty of Commerce & Management, 17.5% of the total populations were found to be Faculty of Arts & Culture, 5.8% of the total populations were found to be Faculty of Agriculture, 10.7% of the total populations were found to be Faculty of Health-Care sciences and Trincomalea campus, 19.4%of the total populations were found to be Faculty of science , 6.8% of the total populations were found to be Centre for Information & Communication Technology, and 18.4% of the total populations were found to be Swami Vipulananda Institute of Aesthetics Studies.

6.2 Behavior and preferences with regard to Online Social Network information.

Information related to which OSN mostly engage, how often they use, where they access, what the purpose of using there are follow

6.2.1 Frequency recognized online social networks sites distribution

Table02 Frequency recognized online social networks sites distribution

Social networking sites	No. of responses (N=103)	No. of responses (N=103)
Engage	Not engage	
YouTube	87(84.5%)	16(15.5%)
Twitter	19(18.4%)	84(81.6%)
Face book	85(82.5%)	18(17.5%)
LinkedIn	30(29.1%)	73(70.9%)
Other	10 (9.7%)	93 (90.0%)

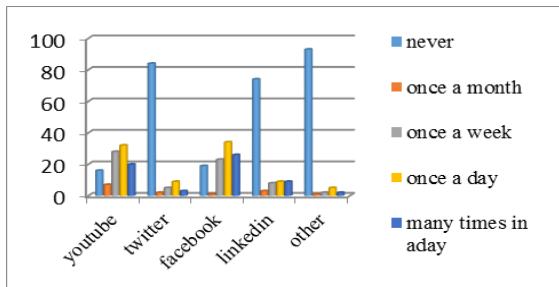
When investigating engage with Online Social Networks sites, results showed that higher level of using OSN sites are YouTube and face book. Those who did Visit these sites 84.5% and 82.5% were whereas 15.5% and 17.5% of the respondents did not visit at YouTube and face book. Engage of other Online Social Network is at very low level (9.7%) and most of the academics staffs have no knowledge about other Online Social Network for an example, what's app, and Skype.

6.2.2 Frequency of Usage academic staffs visit each of the following Online Social Network sites

Regarding the frequency of visits to OSN sites, respondents indicated that Face book, YouTube, twitter, linked in and

other OSN site was the most frequently visited by once a day. It was visited once a day by 33.0%, 31.1%, 8.7%, and 4.9%.

Table03. Frequency of visits to online social networking sites



6.2.3 Where the academics are access the Online Social Networks sites

Table 04. Where they Access to online social networking sites

Where do you accesses	No. of responses (N=103)
From home	90(87.4%)
At the office (PC)	40(38.8%)
At internet cafes	2.0(1.9%)
On cell phone	35(34.0%)

The respondents engaged in OSN more often from their office computer, indicating that these visits were most likely done during office hours; or from home, Internet cafes or via their cell phones. The results showed that 87.4% of the respondents visited OSN sites from the home, while 38.8% of the respondents Visited these OSN sites from office because during the working hours they don't spent time on OSN. The other options proved to be the less popular, with 34.0% of respondents who indicated that they visited OSN sites via their cell phones and of 1.9% respondents who accessed these sites from Internet cafes.

6.2.4 Time spent on online social network sites (in a week)

Table 05. Time spent on social networking sites.

Time spent in a week	No. of responses (N=103)
Less than 2 hours	64(62.1%)
2-4 hours	22(21.4%)
4-6 hours	06(5.8%)

The survey next aimed at establishing respondents Time spent on online social networking sites (in a week). Most of the academics Time spent on OSN sites done less than 2hours (62.1%) and 21.4% of academics Time spent on online social networking sites 2-4 hours. and of 10.7% respondents who Time spent these sites more than 6 hours. The other options proved to be the less popular, with 5.8 % of respondents who indicated that they Time spent on online social networking sites, 4-6 hours.

3. Discussions on research information about perception regarding online social networking.

Usefulness factor is evaluated under two dimensions: Information, People Individual factor have a mean value of 3.83 with the standard deviation of 0.44. The mean value clearly showed that respondents have high level perception about OSN. The perception of Usefulness is high in all factors. Specifically the dimension Information is highly influence the perception of OSN. This defines academics have more concentration about usefulness of OSN. Ease of Use factor is analyzed through the Technology. The Technology dimension includes the Accessibility, Usability, Facility indicators. In order to identify how the variable of Ease of Use influence in the uses and perception of academics in University. Individual factor have a mean value of 3.82with the standard deviation of 0.69.

Table-06: Overall Measures of variable dimension

Descripti on	Independent variable Dimensions			Overall 1 percept
	Perceive d usefulness	Perceive d ease of use	Subject i ve Norm's	
Mean	3.83	3.82	2.96	3.53
Standard Error of Mean	0.37	0.61	0.98	0.54
Std. Deviation	0.44	0.69	0.44	0.34
Variance	0.137	0.371	0.957	0.295
Minimum	3.00	2.00	1.00	3.00
Maximu	5.00	5.00	5.00	5.00
Decision Attribute	High level	High Level	Modera te level	High Level

According to the findings, Ease of Use factor is highly influence the perception of OSN. The academics clearly understand the Ease of Use through the perception of OSN. The conclusion of Ease of Use also draws from a proper sequential order. Subjective Norm's analyzed through the Consequences. The Consequences dimension includes the Security, Privacy, Addictive, Legal consequences. In order to identify how the variable of usefulness influence in the uses and perception of academics in university. Individual factor have a mean value of 2.96with the standard deviation

of 0.44. Perception of Online Social Networking factor is analyzed through the (face book, You Tube etc). The Perception of Online Social Networking includes the Usefulness, Ease of Use, Subject Norm. In order to identify how the variable of usefulness, Ease of Use, Subject Norm influence in the perception among the academics in University.

To know about how the respondents perceive the OSN among the academic community in the Eastern University, from the analysis it has the Mean value 3.53 and SD is 0.34. Therefore finally the perception of Online Social Networks is high level because the mean range is between (3.5<x>5.0).

VII. CONCLUSION

Higher education (HE) lecturers teach academic and vocational subjects to undergraduate and post graduate students aged 20 upwards. They work in universities and in some colleges of further education. Each and every university academics goal is to be excellent in teaching, carrying out Research and dissemination. Now a day's teaching methods include lectures, seminars, tutorials, practical laboratory demonstrations, field work and e-learning. Multimedia technologies are being increasingly used. Therefore the Online Social Networks uses are very important for each academics. However academics feel OSN sites are addictive, there is no privacy for use OSN, and there are some security issues. Uses and perception by individual vary from one to another. Therefore the uses and perception regarding the Online Social Networks among the academics can have a greater influence on their job performance. To measure the uses and perception regarding the online social networks among the academics in Eastern University, hundred and three population were measured. This study included three factors to measure the perception and measure the Purpose of uses of online social network sites.

Overall Perception about OSN has mean value 3.53 and standard deviation 0.34. Study revealed that there is high level perception experience by the academics to access the OSN from anywhere at any time. Especially in term of Usefulness factor and Ease of Use factor has exhibited higher level of perception and Subjective Norm factor comparatively influence moderate level of perception than the other two types of factor.

Finally Objective of this research findings, respondents are perceive that OSN (Twitter, Face book, You Tube, Linked in, etc) as a way to connect with others, share educational resources, create educational content, enhance the classroom experience, while social networking is fun and valuable however there are some risks. Therefore academics keep in their mind when they using these tools and them carefully handle the risk. Online social network have the lot

of advantages as well as risk although academics pick out the OSN values and ignore the risk.

REFERENCE

- [1] An Advisen (2010), legal research corner professional benefits of online social networking (61-64).
- [2] Arumugam Raman, (2011), The usage of technology among education students in University Utara Malaysia: An application of extended Technology Acceptance Model, (1-7).
- [3] Avner Levin, at el, (2008), The Next Digital Divide: Online Social Network Privacy (81-82).
- [4] Connie Varnhagen and Alison Husband, (2011), Social Media: Use and Usefulness at the University of Alberta Report of the TLAT Subcommittee on Social Media, 1-8.
- [5] David C. at el, (2011), Serious social media: On the use of social media for improving student's adjustment to college.
- [6] David m ho , Capt. , usaf, personality and social influence characteristic affects on ease of use and peer influence of new media users over time.
- [7] Ferreira A & du Plessis T, (2009), Effect of online social networking on employee productivity 1-16.
- [8] Ferreira A, (2008), the effect of online social networking on employee productivity with in a tertiary education institution.(114-198).
- [9] Leigh a Clark. Sherry j Roberts, (2010), employers' use of social networking sites: a socially irresponsible practice. (509-515).
- [10] Leigh A. Clark and Sherry J. Roberts (2010), Employer's Use of Social Networking Sites: A Socially Irresponsible Practice, Journal of Business Ethics (2010) 95:507–525 DOI 10.1007/s10551-010-0436-y.
- [11] Madeline kiescher, (2009), legal research corner, professional benefits of online social networking (61-64)
- [12] Robert Allen, (2008) Factors influencing the usage of social networking websites amongst young professional South Africans Gordon institute of business science, (35-36).
- [13] Warnakula W.M.S.S. and Manickam B. ,(2010), Employees' Behaviour in Online Social Networking Websites (SNSs).
- [14] Yan Zhang, (2013), College students' uses and perceptions of social networking sites for health and wellness information IR information research ,(20-23)

‘JATHIKA PASALA’ TELEVISION PROGRAMME FOR ORDINARY LEVEL STUDENTS: A RECIPIENT ANALYSIS

Duwage, H.U.R. ^{*1}, S.Raguram ^{#2}

**Department of Languages and Communication Studies, Trincomalee Campus, Eastern University, Sri Lanka, Trincomalee, Sri Lanka ¹*

Media Studies, Faculty of Arts, University of Jaffna, Jaffna ²

Hiruniudari03@gmail.com¹
ragunadu2003@yahoo.com²

Abstract- Audio – visual medium can be used to provide education for students in a meaningful manner for students who live in rural villages do not have enough resources to achieve their educational goal. Watching television educational programs is one of the ways that they select to get knowledge which they could not get from the school. This study is an audience research and analyzed the audience of the Jathika Pasala educational program telecast in Jathika Rupavahini. The program is telecast to gratify the needs of students who sit for the Ordinary level examination. This study attempted to explore whether students meet their needs from these educational programs. Therefore, according to research findings and discussion researcher found that Jathika Pasala is very effective for students in studies. It helps students to emphasize the subject points and to improve their knowledge. The Jathika Pasala program improved the ability of answering for the questions and it's helpful for preparing for the examinations. But the researcher found that though students are gratified by the Jathika Pasala Program students didn't meet their needs entirely from this Jathika Pasala program. The program needs some improvement. Changing telecasting time of the program to 6.00 pm, Extending the time duration of the Jathika Pasala program, give chance to students' contact with the teachers for clarifying confusions regarding subject matters, inform the topic going to discuss next week at the end of the program are the suggestions came from Jathika Pasala Educational Program audience.

Keywords- Ordinary Level, Educational Television, Non-classroom Atmosphere, Edutainment, Distance Learning

I. INTRODUCTION

Society is influenced by media in so many ways. It is the media for the masses that helps them to get information about a lot of things and also to form opinions and make judgments regarding various issues. It is the media, which keeps the people updated and informed about what is happening around them and the world. Everyone can draw something from it [1].

The media affects people's perspective. Too much intervention of media in everything is a matter of concern. Through the ages, the emphasis of media on news has camouflaged. Media these days, tries to eye the news, which could help them to sell the information that is gathered worldwide, so that they could pave a way of success and fame of their respective channels. FM radios, newspapers, information found on net and television are the mass media

that serve to reduce the communication gap between the audience, viewers and the media world [1].

In currently most of the people watch television to get information on daily. The television program can classify as News bulletin, Documentaries, Education Program, Children Program, Entertainment Program, Religious Program and Political Program. When considering the impact of television, education programs get prominent role among other programs. Schools are not the only institutions that provide educational services. People use the media, both to teach and to learn since media services can often be more efficient and direct in reaching people.

Educational programs: programs intended primarily to educate and in which the educational element is fundamental

- Educational programs related to a specific curriculum (e.g. Schools, university, etc.) excluding programs for rural development purposes
- Educational programs for rural development purposes
- Other educational programs

Most of educational programs that related to a specific curriculum mainly target the school children. In Sri Lanka also there exists a fair amount of educational television programs that were designed to enhance basic literacy skills, including reading, writing, speaking, listening and basic math skills. Most of these programs were targeted to young children. In Sri Lankan television channels they mainly target grade 5, Ordinary Level and Advanced Level students. O/L examination is one of the examinations which majority of the students faces in Sri Lankan school examination system.

Rupavahini is the only channel that covers almost all the areas of the country and it allocates more time for the educational programs. Rupavahini Jathika Pasala is one of the most popular educational programs telecast in Jathika Rupavahini from 4.45 to 5.45 am. This program is telecast to gratify the needs of students who sit for the Ordinary Level Examination. This program provides a bridge to fill gap between rural and urban education in Sri Lanka. It covers five subjects and assigned dates as Monday for History, Tuesday for English, Wednesday for Science, Thursday for Mathematics and Friday for Sinhala.

Most trained, skillful and professional group of teachers teamed up to teach the students in this program series. Most importantly, these programs would use relevant equipment and some practical teaching methods for lessons. This study attempted to explore whether students meet their needs from these educational programs.

A. Problem Statement

There is a particular scarcity of mathematics and Science teachers and necessary educational equipment in rural schools. Hence it is important to examine the usefulness of education programs and identifying the improvements need for these educational programs. This study attempts to explore whether students meet their needs from these educational programs through the recipient analysis. Most of the rural school children are suffering because of the scarcity of teachers in their schools. Not only that, other students also looking for television educational programs for getting additional knowledge and to fresh up their knowledge regarding subject matters. It is questionable about the quality and effectiveness and identifying whether students meet their needs through these educational programs. This problematic study analyzed in this study.

B. Research Questions

1. How far the Jathika Pasala educational program has been utilized by the students?
2. Whether Jathika Pasala program provides additional knowledge to the students than the classroom education in schools or not?

C. Research Objectives

1. To find out how far the Jathika Pasala educational program has been utilized by the students
2. To find out whether the Jathika Pasala program provides additional knowledge to the students than the classroom education in schools or not.

D. Hypothesis

Jathika Pasala educational programs provide additional knowledge to the students and helpful to the students in the preparation of examinations. In other side, the telecasted time of the Jathika Pasala program and the duration are the notable problems.

E. Significance Of The Study

This study tries to understand the effectiveness of education programs and it can help students who need to get an education from the television though the recipient

analysis. Through this study students will get more awareness about educational programs and its usefulness.

And also through this attempt media institutions can get more awareness about educational programs and they can realize what are the weaknesses appear on their programs and how to overcome these problems. Hence this study will help to produce good quality educational programs which can give more support to the students.

F. Theoretical Frame Work

A theoretical framework consists of concepts and, together with their definitions and reference to relevant scholarly literature, existing theory that is used for a particular study.

This study is an audience research and researcher has selected Uses and Gratification theory for this study.

II. LITERATURE REVIEW

As important research work was conducted by Shalom M. Fisch Ph.D. and President of MediaKidz Research & Consulting under the heading of *Children's learning from television* to evaluate effectiveness of educational programs.

The researcher had studied on the effectiveness of educational programs and tried to reveal the positive impact of the educational programs with special reference to Sesame Street. He found the answer to the question what causes some educational programs to be more powerful than others? Through this research study researcher has found that the causes for the Sesame Street program have to become more powerful through the content analysis [2].

An exploratory research on cognitive effects of children's television viewing is an another important study has done by another researcher to find out whether and find out how much amount television viewing influence preschoolers' literacy development. Under the heading of '*The influence of educational television programming on preschoolers' emergent literacy: A review of the literature*' done by Erin A. Schryer PhD, University of New Brunswick. This research study conducted to determine whether and to what extent preschoolers' television viewing influences their literacy development, it was necessary to aggregate literature exploring the cognitive effects of children's television viewing on various emergent literacy skills [3].

The Impact of Broadcast and Streaming Video in Education is an innovative research mainly discussed how new technology threaten to conventional teaching methods. This study was done by Alan D. Greenberg and Jan Zanetis in 2012.

The research indicated that children today are fundamentally different from previous generations in the

way they think and in the way they access, absorb, interpret, process and use information, and above all, in the way they view, interact, and communicate in the modern world [4].

Nasreen Akhter, Assistant professor Education has done this research in the Islamia University of Bahawalpur Pakistan under the topic on *Evaluation of educational television programs for distance learning*. This study was conducted to evaluate the effectiveness of educational television programs in distance learning systems.

The results of the study indicated, ETV programs were very useful for students & majority of students get the benefit of it. Therefore, there were some problems as well. They are the majority of students don't get the broadcast schedule of ETV programs because of which they miss the ETV programs, approximately half of the students who view the program cannot note down the important features of the program because of non-availability of recording facilities [5].

A research study was done by K.M.D.T.Kumarasinghe (2015 March) in Kelaniya University under the topic of Functions and responsibility of Mass media to improve knowledge of school children. In this study researcher try to find out that how Sri Lankan media contribute to provide educational programs for the students.

Through the analyzed data researcher has found that educational programs should select new way to reach students. Traditional and boring way of programs should change as creative and interesting ways.

Another research was conducted by P.B.P.K. Dayasiri (2011 Nov) in Sripali Campus of Colombo University for the B. A Mass Media (Sp), under the heading of "Effectiveness of Sri Lankan educational television". This study attempted to comparatively examine the effectiveness of educational programs in Sri Lankan television [6].

The findings of this study show that television has got prominent place among other media as educational provider for the students. And most students are show tendency to watch edutainment programs than the educational programs.

According to discussed literature, it can identify that most studies done on the effectiveness of educational programs and the impact of television on children's education.

Because of there is no any research yet conducted to evaluate the Jathika Pasala educational program researcher selected Jathika Pasala to evaluate educational programs in Sri Lankan television through the recipient analysis.

III. METHODOLOGY

This study named as 'Jathika Pasala' Television programme for ordinary level students: A recipient analysis. This study attempts to explore whether students meet their

needs of the educational programs through the audience point of view.

In this study researcher has used both primary and secondary data. Researcher has used structured questionnaires that are included 15 numbers of questions to collect primary data from the ordinary level students, unstructured focus group discussion used to collect data from the school teachers who teach for ordinary level students and interviews were used to collect data from the producers of Jathika Pasala program.

Through the Books and journals, Magazines and newspapers, Research reports of Rupavahini Corporation, Annual reports of Rupavahini Corporation, Statistics, Department of Examinations and the Internet researcher collected secondary data.

In sampling method the researcher selected 50 numbers of Ordinary Level students as sample from Kaluthara District. The researcher has used non probability sample for this study. Then researcher selected 5 numbers of teachers for focus group discussion to get the information. For that researcher used a convenience sample for select teachers in the focus group discussion. After researcher interviewed all the five producers who produce the each programs according to the subjects in Jathika Pasala program.

In data analyzing method collected primary data were analyzed quantitatively and qualitatively.

Researcher quantitatively analyzed the data collected through the close ended questions in the questionnaire. Coding is the process of converting verbal responses to numerical codes. To presented data researcher used Diagrams, Charts and Percentages. To get a final analysis, Excel 2010 was used for this study.

In this study researcher used focus group discussion to collect data from the school teachers and focus group discussion to collect data from producers of program. The qualitative data came in an interview transcript analyzed by using the content analysis method. And also open ended questions in the questionnaire analyzed through the content analysis method.

IV. RESULTS AND FINDINGS

The researcher has found following findings with paying primary attention to analyzed data that collected from the questionnaire.

According to the analyzed data regarding the willingness of watching the program, 80% students watch the program because of their own desire and other 20% students watch it due to guidance of parents and teachers. This does not mean this 20% watch the program entirely based on force of others. Hence researcher could find that

the students watch the Jathika Pasala program with a positive attitude.

TABLE I. WILLINGNESS OF WATCHING THE PROGRAM

Willingness	Frequency	Percentage
Own desire	24	80
Guidance by parents	05	17
Guidance by teachers	01	3
Total	30	100

Students' awareness about the Jathika Pasala program covers by the advertisements. 43% got awareness about the programs through the advertisement telecast in Jathika Rupavahini as well as 27% from parents, 20 from friends and 10% from teachers. Through that it would appear not only students' mind, but in parents and teacher's mind also has positive comments regarding the Jathika Pasala program.

When analyzing the subjects which are watching by the students results shows that the majority of the students watch English, Science and Mathematics subject. Statistics display that English 63%, Science, 70% and Mathematics 77%. Through that it can identify students want to get more knowledge, additionally regarding complicated subjects than what they learn in school classrooms.

The majority of the students are not satisfied on teaching aids related to the content of the program. 60% students claim that the program not included additional subject information than the textbook. Here the researcher's hypothesis was not proved. The researcher assumed that the Jathika Pasala Program provide the additional knowledge to the students, but researcher unable to prove that one in the study.

When comparatively study on the responses concerning with the students willingness and opinion regarding the content of the program researcher found that though students are gratified by the Jathika Pasala Program students didn't meet their needs entirely from this Jathika Pasala program.

The presentation and teaching methods of teachers who deliver the lessons get the attraction of the majority students. 57% students have a positive comment on presentation style and regarding the teaching process students responses take several aspects. 50% students say teaching method is interesting, 30% very clear and another 20% have no comment about the teaching process.

Considering the responses regarding the usefulness of the program for 60% students it helps to emphasize the

subject points and for another 40% program help to improve their knowledge. According to the above data, there is no doubt Jathika Pasala is very effective for students in studies.

TABLE II. USE OF TEACHING METHOD

Uses	Frequency	Percentage
Emphasize the subject points	18	60
Improve the knowledge	12	40
Total	30	100

11th and 12th questions on the survey are about telecasting time. 67% are not happy with telecasting time and 33% happy with telecasting time. But when researcher asks in 12th question if they are thinking it should be change the time of the program what is the preferable time for that all students comment on that with different preference time.

TABLE III. TELECASTING TIME

Response	Frequency	Percentage
Satisfied	10	33
Not Satisfied	20	67
Total	30	100

As per the hypothesis researcher assumed that it is better to change the telecasted time of the Jathika Pasala program at night time. According to findings that hypothesis is partially correct. 23% students mentioned night time as preference time. But the majority's desire was evening time. 17% mentioned 5.00 – 5.30 pm and another 60% mentioned 6.00 pm as preference time. According to that it would give the idea that 6.00 pm is a most appropriate time for telecasting Jathika Pasala educational program. Because evening time students, stay at home with a relaxed mind. When they give suggestions for the program some students say the morning session should repeat at evening.

Then for 67% students allocated time not enough. That finding is proof according to the researcher's hypothesis mentioned as the duration of program is not enough to cover the topics and it should be rectified.

In the final question on the survey as their suggestions the main suggestion given by the respondents was extending the time duration of the program.

This study found that the ways students getting benefits from the Jathika Pasala education program in learning process.

- The Jathika Pasala program helps students to remember subject points

- The Jathiqa Pasala program helps to emphasize the subject points
- The Jathiqa Pasala program improved the ability of answering for the questions
- It helps to deviate from the boring educational system in the classroom
- It helps to the self-study.
- It helps to get a solution to the complicated subject points.
- It gives a clear understanding about subject points.

Another hypothesis of the study was Jathiqa Pasala educational program is helpful to students in preparation of examinations. Above all responses proved the researcher's hypothesis.

For question number 15 in survey researcher attempted to find out the ways to improve the Jathiqa Pasala educational program through the audience response analysis

- Extending the time duration of the Jathiqa Pasala program
- Teaching the subject points according to the respective of text book
- Changing the telecasting time of the program
- The Jathiqa Pasala program should discuss additional subject matters beyond the textbook.
- The Jathiqa Pasala program should give practical knowledge.
- It should give chance to students to contact with the teachers for clarifying confusions regarding subject matters.
- It will be better inform the topic which is going to be discussed next week at the end of the program.
- If the Jathiqa Pasala program considerate about other subjects, students can get benefits from it.

Focus group discussion held with school teachers help to do an in-depth study about the Jathiqa Pasala educational program.

According to the teachers' opinion regarding the presenting and teaching style researcher found that teaching and presenting style help to students who has considerable knowledge regarding discussing topics. The majority of the teachers accepted that opinion.

Then researchers found that through the majority teachers' idea of the content of the program help to students only to upgrade or fresh their knowledge because of limited time duration. That finding found from students' responses were also same idea came out.

The overall idea of teachers is Jathiqa Pasala educational program should target and help students living in remote areas.

V. CONCLUSION

This study attempted to explore whether students meet their needs from these educational programs. Therefore, according to research findings and discussion researcher found that Jathiqa Pasala is very effective for students in studies. It helps students to emphasize the subject points and to improve their knowledge. The Jathiqa Pasala program improved the ability of answering for the questions and it helps in preparation for the examinations. But the researcher found that though students are gratified by the Jathiqa Pasala Program students didn't meet their needs entirely from this Jathiqa Pasala program. The program needs some improvement.

Changing telecasting time of the program to 6.00 pm, Extending the time duration of the Jathiqa Pasala program, give chances to students to contact with the teachers to clarify confusions on subject matters, inform the topic which is going to be discussed in next week at the end of the program are the suggestions came from Jathiqa Pasala educational program audience.

VI. RECOMMENDATIONS FOR FUTURE RESEARCHERS

- Future researchers can select both students who are watching the program and who are not watching the program. It will help to compare the reasons for why students watch and not.
- If future researchers analyze this audience comparatively with another educational program, it will help to find more results regarding educational programs.
- For the further studied the researcher suggests that to conduct focus group discussions with teachers as well as parents to get more information.

REFERENCES

- [1] Shakeel, M 2010, The Role of Media in Today's World <http://www.hamariweb.com>
- [2] Fisch, SM 2005, Children's Learning From Television, http://www.br_online.de/jugend/izi/english/publication/television/d
- [3] Erin, AS 2014, The Influence of Educational Television Programming on Preschoolers' Emergent literacy: A review of the literature, Canadian Journal for New Scholars in Education, Volume 5, Issue 2
- [4] Greenberg, J, Zanetis, J 2012, The Impact of Broadcast and Streaming Video in Education, Wainhouse Research, <https://www.cisco.com>
- [5] Akhter, N 2011, Evaluation of Educational Television Programs for Distance Learning, The Turkish Online Journal of Educational Technology, volume 10, Issue 4, <http://www.tojet.net>

- [6] Kumarasinghe, KMDT 2015, Functions and responsibility of Mass media to improve knowledge of school children, University of Kelaniya
- [7] Babbie, E, (2007), 'The Practice of Social Research', 11th edition, United States of America: Wadsworth Publication
- [8] Briggs, M, (2010), 'Television, Audience and Everyday Life', 1st edition, New York: Tata McGraw Hill
- [9] Akhter, N. (2011) 'Evaluation of Educational Television Programs for Distance Learning', The Turkish Online Journal of Educational Technology, October 2011, volume 10 Issue 4, pp. 188-194
- [10] Fisch, S.M. (2005), 'Children's Learning from Television', German TelevIZion 18/2005 E, pp. 10-14
- [11] Dayasiri, P.B.P.K. (2011), 'Effectiveness of Sri Lankan educational television', (2011), in Sripali Campus of Colombo University
- [12] Kumarasinghe, K.M.D.T. (2015), 'Functions and responsibility of Mass media to improve knowledge of school children', in Kelaniya University

Ethnobotanical survey of medicinal plant species at Trincomalee Campus

R.T.S.Bamini*1, V. Paheerathan*2

*Unit of siddha medicine, Trincomalee campus, Eastern University Sri Lanka.

¹rtsbamini911@gmail.com

²geethan1978@live.com

Abstract — The Konesapuri area which comes under Trincomalee district has a valuable birthright of Medicinal plants and historical and Traditional evidence for people depend to a great extent on the spiritual Siddha medical practices. The Siddha practitioners as well as peoples collected the Medicinal plants from that surrounding area. A plant survey was conducted with the aim of document the Medicinal plants in the area of Trincomalee Campus, Konesapuri, Eastern University Sri Lanka during May and June 2016 to develop the herbal garden. There are 110 plants was identified and Categorised taxonomically with medicinal uses. Thus 16.5 % of plants coming under Fabaceae Family, 9.17 % is contributed by Euphorbiaceae family plants, 5.5 % by Asclepiadaceae family plants, 4.58 % by Cucurbitaceae Family plants, Next to that Malvaceae, Verbenaceae, Solanaceae, Rubiaceae plants contributed 3.66% separately and Amaranthaceae, Acanthaceae, Compositae, Aizoaceae family plants are presented 2.75 % each. Liliaceae, Sapindaceae Boraginaceae, Gramineae, Loganiaceae, Convolvulaceae, Rhamnaceae family plants contributed 1.8% each finally Anacardiaceae, Aristolochiaceae, Meliaceae, Nyctaginaceae, Palmae, Apocynaceae, Vitaceae, Rutaceae, Cyperaceae, Ebenaceae, Myrtaceae, Violaceae, Lamiaceae Capparidaceae, Oleaceae, Lythraceae, Labiatae, Loranthaceae, Aizoaceae, Labiata, Hippocrateaceae, Arecaceae, Araceae, Salvadoraceae, Menispermaceae, Zygophyllaceae each family plant are contributed 0.91% separately. Most of plant under fabaceae family those plants commonly posses the Anti inflammatory, Laxative, analgesic and diuretic action. Those plants commonly use for Respiratory tract disease, Skin disease and diseases in the digestive system. There for further plant survey need in more than two year period to get septs to obtain the complete plant distribution in Trincomalee Campus area.

Keywords— Plant survey, Family, Siddha Medicine, Medicinal plants.

I. INTRODUCTION

The acceptance and use of herbal medicine is increase globally. Plants form an important part of health care especially for the rural poor in Sri Lanka. Sri Lanka has been identified by the environment activist group Conservation International (CI) as one of 25 biodiversity hot spots in the world. Trincomalee has a valuable heritage of Medicinal

plants and also Konesapuri areas Has historical and Traditional evidence for people depend to a great extent on the spiritual Siddha medical practices. Now also Medicinal plants collected by Siddha medical students for their educational purpose as well as medical purpose plants from the Trincomalee campus area.

The increased preference of herbal medicine has consequently propelled the search for pharmaceutical remedies against different ailments from plants. As a Siddha Students plant survey, documentation, sustainable utilization as well as conservation are essential because of study and research purpose. due to lack of knowledge regarding documentation, overharvesting of medicinal materials from their natural habitat has been one of the major threats of Siddha medicine. The documentation of indigenous knowledge through ethnobotanical studies is important in conservation and utilization of biological resources in the Trincomalee campus area. The identification of local names, scientific name, pharmacological action, parts use and medicinal uses of plants not only preserves indigenous knowledge but also facilitates future research on safety and efficacy of medicinal plants in treatment of various ailments.

Under the urbanization relevant to the higher educational development, 310 archer of land allocated for Establishment of Trincomalee campus, Eastern University, Sri Lanka. Among the area of Trincomalee Campus 25 archer allocated for Establishment of herbal Garden.

This allocation and establishment give one of new era to Trincomalee campus Siddha Medical system, current researchers and herbal medical practitioner. The area is give vast idea about the distribution of medicinal plants. The variety of trees, shrubs, herbs, bushes and Climbers and also different characteristic like perennial or annual plants easily identified.

Objective of Study

The general objective is documented the Medicinal plants which are available in Trincomalee Campus.

The specific objectives are

- To identify the plants , family and its medicinal uses during the summer season (May & June)

II. METHODOLOGY

A. Study area

Trincomalee Campus situated 10 Km away from Trincomalee town. This is Historical as well as more tourist place in Sri Lanka. Now the time to develop the Herbal Garden and produce valuable crude drug and herbal medicine to the society, practitioner and Scientific Siddha researchers.



The survey proceeds had done four consecutive visits around the Trincomalee campus area during May and July 2016. According to the direct observation the data of identified plants was list out with their Botanical name, Tamil name, and respective families. Manually calculated the percentage of plants relevant to the family.

Among the plant select the Fabaceae family plants which are distributed in 16.5% around the Trincomalee campus area. Manually analysis the fabaceae family plants with medicinal uses, pharmacological action and part uses.

According to the master plan of Trincomalee campus, the number 25 is indicated for the area of herbal garden. The place is very suitable for herbal Garden to educational sector as well as research activity

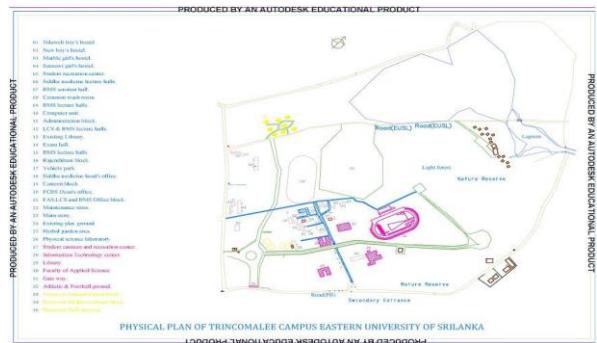


Figure I

III. RESULTS AND DISCUSSION

TABLE 01:- DISTRIBUTION OF PLANTS WITH THE BOTANICAL NAME, TAMIL NAME AND FAMILY

No	Plants		
	Botanical name of plant	Tamil Name	Family
1.	<i>Abutilon indicum.</i>	Vaddaththuthi	Malvaceae
2.	<i>Abrus precatorius.</i>	Kuntrimani	Fabaceae
3.	<i>Acalypha indica.</i>	Kuppaimeni	Euphorbiaceae
4.	<i>Achyranthes aspera</i>	Nayuruvi	Amaranthaceae
5.	<i>Adathoda tranquebariensis</i>	Thavasumurungai	Acanthaceae
6.	<i>Adhatoda vasica</i>	Adathodai	Acanthaceae
7.	<i>Aerva lanata</i>	Thengai Poo Keerai	Amaranthaceae
8.	<i>Alternanthera sessilis</i>	Ponnangani	Amaranthaceae
9.	<i>Alysicarpus vaginalis</i>	Pulladi	Fabaceae

No	Plants		
	Botanical name of plant	Tamil Name	Family
10.	<i>Anacardium occidentale</i>	Munthiri	Anacardiaceae
11.	<i>Andrographis paniculata</i>	Siriyal Nangai	Acanthaceae
12.	<i>Aristolochia indica</i>	Kattoddi/ Isuramulli	Aristolochiaceae
13.	<i>Asparagus racemosus</i>	Saththavaari	Liliaceae
14.	<i>Asparagus falcatus</i>	Saththawari	Liliaceae
15.	<i>Azadiracta indica</i>	Vembu	Meliaceae
16.	<i>Bauhinia racemosa</i>	Aaththi	Fabaceae
17.	<i>Boerhavia diffusa</i>	Mookkarattai	Nyctaginaceae
18.	<i>Broyonia laciniosa</i>	Ivirali	Cucurbitaceae
19.	<i>Caesalpinia bonduc</i>	Kalarchchi	Fabaceae
20.	<i>Calamus rotang</i>	Pirappan Kilangu	Palmae
21.	<i>Calotropis gigantea</i>	Erukku	Asclepiadaceae
22.	<i>Cardiospermum halicacabum</i>	Mudakkoththan	Sapindaceae
23.	<i>Carrissa carandas</i>	Kala	Apocynaceae
24.	<i>Cassia angustifolia</i>	Kattu Nilawakai	Fabaceae
25.	<i>Cassia auriculata</i>	Awarai	Fabaceae
26.	<i>Cassia tora</i>	Thakarai	Fabaceae
27.	<i>Cassia fistula</i>	Kontrai	Fabaceae
28.	<i>Cissus quadrangularis</i>	Pirandai	Vitaceae
29.	<i>Clausena indica</i>	Purangai Naari	Rutaceae
30.	<i>Clerodendron inerme</i>	Sangan Kuppi	Verbenaceae
31.	<i>Clitoria ternatea</i>	Kakkanavan	Fabaceae
32.	<i>Coccinia grandis</i>	Kovvai	Cucurbitaceae
33.	<i>Cordia dichotoma</i>	Naruvili	Boraginaceae
34.	<i>Corollo cartus</i>	Akasakarudan	Cucurbitaceae
35.	<i>Cymbopogon nardus</i>	Kawaddam Pull	Gramineae
36.	<i>Cynodon dactylon</i>	Arukam Pul	Gramineae
37.	<i>Cyperus rotundus</i>	Korai Pul	Cyperaceae
38.	<i>Datura metel</i>	Oomaththai	Solanaceae
39.	<i>Desmodium triflorum</i>	Siru Pulladi	Fabaceae
40.	<i>Diaspyros malabarica</i>	Panichchai	Ebenaceae
41.	<i>Dichrostachys cinerea</i>	Vidaththal	Fabaceae
42.	<i>Dregea volubilis</i>	Kurinsa	Asclepiadaceae
43.	<i>Eclipta prostrata roxb.</i>	Karisalan Kanni	Compositae
44.	<i>Eugenia jambolana</i>	Nawal	Myrtaceae
45.	<i>Euphorbia hirta</i>	Ammanpachcharisi	Euphorbiaceae
46.	<i>Euphorbia tirucalli</i>	Kommbukalli	Euphorbiaceae
47.	<i>Evolvulus alsinoides</i>	Vishnukiranthi	Convolvulaceae
48.	<i>Feronia limonia</i>	Vila	Rutaceae
49.	<i>Gisekia pharnacioides</i>	Manalikeerai	Aizoaceae
50.	<i>Glinus oppositifolius</i>	Kachantaraj/ Thirai	Aizoaceae
51.	<i>Gmelina asiatica</i>	Nilakkumil	Lamiaceae

No	Plants		
	Botanical name of plant	Tamil Name	Family
52.	<i>Gynandropsis gynandra</i>	Nai Welai	Capparidaceae
53.	<i>Jasminum angustifolium</i>	Kaddu Mallikai	Oleaceae
54.	<i>Jatropha curcas</i>	Kattamanakku	Euphorbiaceae
55.	<i>Jatropha podagrica</i>	Kaddamanakku/kadal amanaku	Euphorbiaceae
56.	<i>Heliotropium indicum</i>	Thelkodukku	Boraginaceae
57.	<i>Hemidesmus indicus</i>	Nannari	Asclepiadaceae
58.	<i>Hybanthus enneaspermus</i>	Orithalthamarai	Violaceae
59.	<i>Ipomea obscura</i>	Siruthalikeerai	Convolvulaceae
60.	<i>Indigofera enneaphylla</i>	Seppunerunchil	Fabaceae
61.	<i>Indigofera tinctoria</i>	Avuri	Fabaceae
62.	<i>Kiraganelia reticulata</i>	Pullanthi	Euphorbiaceae
63.	<i>Lantana camara</i>	Nai Unnisedi	Verbenaceae
64.	<i>Lawsonia inermis</i>	Maruthani	Lythraceae
65.	<i>Leucas zeylanica</i>	Mudithummbai	Labiatae
66.	<i>Loranthus longifolius</i>	Pulluruvi	Loranthaceae
67.	<i>Melothria heterophylla</i>	Peipudol	Cucurbitaceae
68.	<i>Morinda tinctoria</i>	Manchvuna	Rubiaceae
69.	<i>Mollugo pentaphylla</i>	Kaadu Pattpadalkam	Aizoaceae
70.	<i>Melothria maderaspatana</i> -	Mosumosukkai	Cucurbitaceae
71.	<i>Metragyna paviflora</i>	Neerkadambu	Rubiaceae
72.	<i>Mimosa pudica</i>	Thoddatsurungi	Fabaceae
73.	<i>Murraya koenigii</i> -	Kariveppilai	Rutaceae
74.	<i>Ocimum sanctum</i>	Thulasi	Labiatae
75.	<i>Ocimum americanum</i>	Ganjankorai	Labiatae
76.	<i>Oldenlandia corymbosa</i>	Kaddupattpadakanm	Rubiaceae
77.	<i>Oldenlandia umbellata</i>	Imbooral	Rubiaceae
78.	<i>Pergularia daemia</i>	Veliparuththi	Asclepiadaceae
79.	<i>Phoenix loureirii</i>	Siru Eachchi	Arecaceae
80.	<i>Phylanthus reticulatus</i>	Kaddukeelkainelli	Euphorbiaceae
81.	<i>Phylanthus debilis</i>	Keelkai Nelli	Euphorbiaceae
82.	<i>Phylanthus urinaria</i>	Sivappu Nelli	Euphorbiaceae
83.	<i>Phyla nodiflora</i>	Poduthalai	Verbenaceae
84.	<i>Ponga pinniata</i>	Pungu	Fabaceae
85.	<i>Pothos scandens</i>	Pota Wel	Araceae
86.	<i>Salacia reticulata</i>	Kadlranji	Hippocrateaceae
87.	<i>Salvadora persica</i>	Uhai	Salvadoraceae
88.	<i>Sarcostemma brunonianum</i>	Kodikalli	Asclepiadaceae
89.	<i>Schleichera oleosa</i>	Koolan	Sapindaceae
90.	<i>Sida acuta</i>	Arrival Mookupachchilai	Malvaceae
91.	<i>Sida cordifolia</i>	Waddaththuthi	Malvaceae
92.	<i>Sida veronicaefolia</i>	Palampasi	Malvaceae
93.	<i>Solanum indicum</i>	Waddukaththri	Solanaceae

No	Plants		
	Botanical name of plant	Tamil Name	Family
94.	<i>Solanum nigrum</i>	Manithakkali	Solanaceae
95.	<i>Solanum torvum</i>	Sunndai Kai	Solanaceae
96.	<i>Solanum trilobatum</i> -	Thoothuwalai	Solanaceae
97.	<i>Strychnos nux vomica</i>	Eddi	Loganiaceae
98.	<i>Strychnos potatorum</i>	Tettan	Loganiaceae
99.	<i>Tamarindus indica</i>	Puli	Fabaceae
100.	<i>Tephrosia purpurea</i>	Kavilai	Fabaceae
101.	<i>Tinospora cardifolia</i>	Seenthil	Menispermaceae
102.	<i>Tragia plukenetti</i>	Kansondri	Euphorbiaceae
103.	<i>Tribullus terrestris</i>	Nerunchi	Zygophyllaceae
104.	<i>Tylophora indica</i>	Nancharuppan	Asclepiadaceae
105.	<i>Vernonia cinerea</i>	Seetheviyar Sengaluneer	Compositae
106.	<i>Vernonia zeylanica</i>	Kuppilai	Compositae
107.	<i>Vachellia nilotica</i>	Veel(White)	Fabaceae
108.	<i>Vitex negundo</i>	Ntchi	Verbenaceae
109.	<i>Ziziphus jujuba</i>	Elanthai	Rhamnaceae
110.	<i>Ziziphus oenoplia</i>	Soorai	Rhamnaceae

A. Discussion

The Trincomalee campus area is commonly dry zone and near to the sea therefore it contained dry zone plants with some variation. Within the Trincomalee campus area identified one hundred and ten plants during the month of May and June 2016, but the plant growth depends on the seasonal variation and climatic changes. Plants distribution is endemic to specific area and the specific character of plants may change with the quality and quantity of water, mineral and soil ect.

Here the identified plants categories under the family. Among the 110 plants 45 families was identified in the area.

According to the Table 01, the 16.5 % of plants coming under fabaceae Family (around 18 plants) commonly available plant around the area, 9.17 % is Euphorbiaceae family, 5.5 % is Asclepiadaceae family plants, 4.58 % is Cucurbitaceae Family plants, Next to that Malvaceae , Verbenaceae, Solanaceae, Rubiaceae plants 3.66% in each, Amaranthaceae, Acanthaceae , Compositae , Aizoaceae family plants 2.75 % each. Liliaceae , Sapindaceae Boraginaceae, Gramineae, Loganiaceae, Convolvulaceae, Rhamnaceae family palnts 1.8 % each .finally Anacardiaceae, Aristolochiaceae, Meliaceae, Nyctaginaceae, Palmae ,Apocynaceae ,Vitaceae, Rutaceae, Cyperaceae, Ebenaceae, Myrtaceae, Violaceae, Lamiaceae Capparidaceae , Oleaceae, Lythraceae , Labiatae, Loranthaceae, Aizoaceae, Labiata, Arecaceae ,

Hippocrateaceae, Araceae, Salvadoraceae, Menispermaceae, Zygophyllaceae each family plants are present in 0.91%.

The Fabaceae family plants contributed 16.5% and it is commonly distributed in the Trincomalee campus area dry as well as wet zone, in previous days the family of fabaceae called as Leguminosae or Papilionaceae, commonly known as the legume, pea, or bean family, is a large and economically important family of flowering plants. It includes trees, shrubs, and perennial or annual herbaceous plants, which are easily recognized by their fruit (legume) and their compound, stipulated leaves.

Here fabaceae family plants tabulated under the heading of Parts uses, Pharmacological action and Medicinal uses.

TABLE 02:- FABACEAE FAMILY PLANTS WITH PART USES, PHARMACOLOGICAL ACTION AND MEDICINAL USES

Plant	Fabaceae Family		
	Parts used	Action	Medicinal value
<i>Abrus precatorius</i>	Leaves Seed(toxin)	Anti-inflammatory	Fever, cough
<i>Alysicarpus vaginalis</i>	Whole plant	Laxative Diuretic	Constipation Odema
<i>Bauhinia racemosa</i>	Leaves Root seeds	Antiasthmatic Antimicrobial	Cough Skin diseases Fever
<i>Caesalpinia bonduc</i>	Seeds	Anti-inflammatory Antihistamine Analgesic	Cough Asthma Hydrosol, tumors
<i>Cassia auriculata</i>	Seeds Flower, leaves, unripe fruit	Anti-inflammatory Hypoglycemic	Diabetes Conjunctivitis Constipation
<i>Cassia angustifolia</i>	Leaves Flower.	Laxative , Purgative Antipyretic, Diuretic	Constipation Fever , Hemorrhoids, Skin disease
<i>Cassia tora</i>	Leaves Seeds root	Laxative Stimulant Tonic	Skin disease(ringworm) Fever cough
<i>Cassia fistula</i>	Leaves Flower Bark	Febrifuge Purgative Diuretic Anti-inflammatory	Fever Cough Bronchitis leprosy
<i>Clitoria ternatea</i>	Roots Seeds	Laxative Anti Depression Antipyretic	Constipation Depression Anxiety
<i>Desmodium triflorum</i>	Leaves Whole plants.	Laxative Tonic Diuretic	Eye diseases Menorrhagia Asthma Cough
<i>Dichrostachys cinerea</i>	Leaves Bark Pods	Anti inflammatory Laxative Anthelmintic	Gonorrhoea Menorrhagia Eczema cough
<i>Indigofera enneaphylla</i>	Whole plant Leaves	Diuretic Anti diarrheal	Skin diseases Burns

Plant	Fabaceae Family		
	Parts used	Action	Medicinal value
		Analgesic	Venereal diseases
<i>Mimosa pudica</i>	Whole plants root	Hypoglycemic Anti asthmatic Aphrodisiac Anti depression	Diabetes Asthma Leucoderma Bleeding piles
<i>Pongamia pinniata</i>	Leaves Oil Seeds Flower	Anti plasmodial Anti inflammatory Anti Hyperglycemic	Malaria Diabetes Hemorrhoids Gonorrhea
<i>Tamarindus indica</i>	Root Fruit seed	Anti diabetes Antivenom Cardioprotective laxative Anti inflammatory	Diabetes Skin disease Wound Cough
<i>Tephrosia purpurea</i>	Seeds Leaves	Anthelmintic Antipyretic Alternative	Leprosy Asthma Rheumatism Liver disease
<i>Vachellia nilotica</i>	Pods Leaves Stem Gum	Anti diabetes Antiseptic Expectorent	Diabetes Anemia Cough Leucorrhoea

These plants seeds, leaves and commonly used for medicinal purpose. 44% of plants posses the Anti inflammatory and Laxative action, in addition to that there are some pharmacological action used for medicinal purpose such as diuretic, anti diabetic, Antiasthmatic Antimicrobial, Antihistamine, Analgesic, Hypoglycemic, Anti asthmatic and Anti depression

According to the medicinal Value 61.1% of plants used for Respiratory tract Diseases, 38.8 % plants used for skin diseases and these plants used for constipation, liver disease, leucorrhoea, Diabetes, eye diseases and piles.

Next to that 9.17 % Euphorbiaceae family plants and other family plants also have the character of distribution around the dry zone.

Salacia reticulata plant was identified. The plant comes under Hippocrateaceae family, it called as "kadalranji" in tamil "othalakimbutu" in Sinhala, the plant endemic to Sri Lanka and its stem, leaves are more effective treatment to diabetes mellitus as well as high economic plant.

The diversity of medicinal plant species used and the associated indigenous knowledge are of great value to the local community and their conservation and preservation is paramount. The therapeutic uses of the documented plants provides basic data for further research focused on pharmacological studies and conservation of the most important species.

The plant distribution may change with season as well as Cofactor of plant growth, thus if the plant survey process in deferent season that will give the different results regarding

Plants.

IV. CONCLUSION

According to the survey during month of May and June at Trincomalee campus, 110 plats were identified under 45 families, the Trincomalee campus area show valuable, variable, endemic and economic rich plant distribution. Soil mineral, climatic changes, water type are gave more support to grow different type of plants. The area is more suitable to develop as a Herbal garden. Among the plants 16.5 % fabaceae Family and it posses the Anti inflammatory, Laxative, analgesic and diuretic action. Those plants commonly use for Respiratory tract disease, Skin disease and diseases in the digestive system.

V. RECOMMENDATION AND SUGGESTION

The plant survey should need to carry more than two year and following that give the full knowledge of plants and its distribution in Trincomalee campus area.

Follow to the distributaries study should give the results relevant to part uses, pharmacological action and medicinal uses.

Need to develop soil and water studies which were contribute to plant growth and its chemical constitution.

Further need to develop the scientific study relevant to agriculture, concentration of chemical composition and medicinal value.

In future studies the data will need to analysis with statistical package.

REFERENCES

- [1] Jayaweera.D.M.A.(2006), Medicinal plants (indigenous and exotic) used in ceylone, The National science foundation, srilanka, part 1, 2, 3, 4 and 5
- [2] Sivasanmugaraja.S,2008, *Moolikaith thiravukol* dictionary of medicinal plants,Siddha Medical Development Society 199/1 kilner lane Jaffna.
- [3] Ragone, Diane/Lorence, David H.2003. Botanical and ethnobotanical inventories of the national park of American Samoa. National tropical Botanical Garden, Kalaheo, Hawaii and pacific cooperative studies unit, Department of Botany,University of Hawaii.
- [4] Jigna. P, Nehal.K,Sumitra.C, (2006)Evaluation of antibacterial activity and phytochemical analysis of *Bauhinia variegata.l* bark, African Journal of Biomedical Research, vol.9(2006);53-56.ISSN 1119-5096 Ibadan Biomedical Communications group.
- [5] Dayanand M. Kannur, Mukta P.Paranjipe Evaluation of *Caesalpinia bonduc* seed coat extract for anti inflammatory and analgesic activity, Jurnal of advanced pharmaceutical technology & research2012 Jul-Sep;3(3):171-175.
- [6] Jain NNet al (2003)Clitoria ternate and the CNS. Pharmacol Biochem Behav.
- [7] Pinar k,(2014), Tamaridus indica and its health related effects, Asian pacific journal of Tropical Biomedicine Vol.4.
- [8] VogtK,(1995), A field guide to the identification, propagation and uses of common trees and shrubs of dryland Sudan, Sos sahel international(uk), retrieved on June 22, 2008
- [9] <https://en.wikipedia.org/wiki/Fabaceae> , 26.05.1026
- [10]<https://www.herbpathy.com/> *Alysicarpus vaginalis* , 10.06.1026
- [11]<https://www.mahaushadhi.com/> Medicinal Value of *Cassia angustifolia* 10.06.1026
- [12]<https://www.iloveindia.com/Cassiatora>, 11.06.1026

Prevalence and risk factors of overweight and obesity among adults in rural areas in Batticaloa district

M. Laavanya^{*1}, K.Karthijekan², K. Kartheepan^{#3}, J.Josepha⁴, S.D.H. Sadeera^{*5}, W.M.C.M. Premachandra⁶, T.R.A. Priyangani⁷, D.R.N.S. Dahanaka⁸

^{*}Department of Supplementary Health Sciences, Faculty of Health-Care Sciences, Eastern University, SriLanka

[#]Department of Primary Health Care, Faculty of Health- Care Sciences, Eastern University, SriLanka

¹mohan.laavanya@gmail.com

⁸sadeera.89wi@gmail.com

Abstract— Obesity is a chronic condition and the prevalence of adult obesity is increasing rapidly worldwide due to environmental and behavioural changes. Data on prevalence and determinants of obesity in developing countries are needed for primary prevention. This study was undertaken to assess the prevalence of overweight and obesity among adults (above 18 years) in rural areas in Batticaloa district and to examine the associations of overweight and obesity with socio-economic, nutritional and lifestyle factors. A Cross-sectional survey was conducted among 320 adults aged above 18 years. Multistage sampling method was used. Data on socio-economic, nutritional and lifestyle factors were collected with structured, interviewer administered questionnaire and anthropometric measurements of weight, height and waist circumference were measured by using appropriate measuring scales. Obesity was defined as Body Mass Index (BMI) $> 27.5 \text{ kg/m}^2$ and overweight as BMI $> 23 \text{ kg/m}^2$; waist circumference $> 90 \text{ cm}$ for men and $> 80 \text{ cm}$ for women considered as not-normal. Prevalence of overweight and obesity and distribution of BMI by socio-demographic and lifestyle characteristics was assessed. Prevalence of overweight and obesity were 17.0% and 8.8% . Prevalence was high in females as well as in the age group of 35-44 years. Family history of overweight and obesity, sleeping habit after the meal in the evening, following weight reduction methods were the significant factors ($p<0.05$) associated with overweight and obesity. Conclusions from the findings were the prevalence of overweight was higher than obesity. Females were more obese and overweight than males. Awareness programs should be carried out regarding weight reduction measures and primary prevention of overweight and obesity; Health education programs have to be done regarding the consequences of overweight and obesity, especially for women and adults between 35-44 years.

Keywords— Obesity, Overweight, Prevalence, Rural

I. INTRODUCTION

Obesity is a chronic condition which is caused by physiological, social, cultural, psychological, genetic, metabolic and behavioural factors (Kelly et al 2008). The prevalence of overweight and obese people is increasing

worldwide and the prevalence of adult obesity is increasing rapidly due to environmental and behavioural changes (Ramachandran & Snehalatha 2010). Obesity is simply defined as a condition of abnormal or excessive fat accumulation in adipose tissues and it will impair the health (Rathnayaka, Rupasingham & Dibley 2014). Body Mass Index (BMI) is the indicator to identify whether a person has normal weight or overweight or obesity. According to the Asian cut-offs BMI >23.0 is overweight and BMI >27.5 is obesity and waist circumference $>90 \text{ cm}$ and $>80 \text{ cm}$ are not normal and risk for men and women respectively (Katulanda et al 2010). Physical inactivity, dietary habit, smoking, alcohol use and high socio-economic status are some of the risk factors of overweight and obesity (Janssen, Katzmarzyk & Ross 2002). Overweight and obesity leads to serious health problems mainly for non-communicable diseases (Janus et al 2007). There were many studies regarding overweight and obesity conducted in Sri Lanka; however there were no studies on prevalence of overweight and obesity in the North and East provinces. Batticaloa has high prevalence of overweight and obesity among adult women (DCS and MOH 2009) especially in rural areas. Therefore it was essential to conduct the study to provide enough awareness and education to control overweight and obesity and its complications.

II. METHODOLOGY

A cross-Sectional study was conducted among 320 adults (above 18 years old) including 177 females and 143 males from four Divisional Secretariat divisions in rural areas with high population. From Eravur Pattu, Porativu Pattu, Munmunai South and Eruvil Pattu and Koralai Pattu South administrative divisions 40 Grama Niladhari divisions were selected from above administrative areas according to the population. Families from each Grama Niladhari divisions were selected by systematic random sampling method. One adult from each family was selected by the tossing method as a respondent. Data were collected from those willing to participate in the study; respondents who were not present at the time of study, who refused to participate in the study, who were physically disabled, adults who were mentally disabled, pregnant mothers and adults who were not a permanent resident of study areas were excluded from the study. The respondents were thoroughly explained about the study and written consent was obtained before the data collection. Anonymity was ensured throughout the study.

Data were collected by investigators through a structured interviewer administered questionnaire and anthropometric measurements of weight, height and waist circumference of adults were measured by investigators. All anthropometric measurements were performed by standard procedures; weight was measured with a mechanical personal scale (model- CAMRY, model number -BS 2014); weighing scale was calibrated by taking an average of more than one measurements for a known weight and the difference was adjusted nearest to 100g. Height was measured in a standing position, without shoes and waist circumference was measured at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest with the nearest 1cm using a non-stretchable steel measuring tape and the BMI was computed as Weight (Kg) / Height² (m²). Collected data were transferred to SPSS 19 statistical software and analysed based on the research problem, objectives and variables. Gender and age related prevalence and overall prevalence were estimated for rural areas of Batticaloa district

III. RESULTS

A. Description of the socio-demographic details of study samples

The study was conducted among 320 adults who were above 18 years old in rural areas of Batticaloa district. Females were 54.1 % (n=173). Tamils were 95.6% (n=306) and 23.4% (n=75) of adults come under the age group of 35-44 years, 45.9% (n=147) had senior secondary education, 43.8 % (n= 140) adults had family income of less than 15 000, 3.4% (n=11) had more than 50 000 and others had middle income (Table 1). Among the 320 adults 29.1% (n=93) were overweight and 42.8 % (n=48) were obese (Figure 1).

B. Description of the socio-demographic details of overweight and obesity

Out of the overweight individuals 61.3% (n=57) were females, 32.3% (n=30) were in the age group of 35-44 years, 83.9 % (n=78) were married; Tamils were 94.6% (n=88) and 91.4 % (n=85) were Hindus, 41.9 % (n=39) had senior secondary education, 46.2% (n=43) had the monthly family income between 15000-30000. Out of the obese individuals 64.6% (n=31) were females, 43.8% (n=21) were in the age group of 35-44 years, 93.8 % (n=45) were married, Tamils were 93.7% (n=45), 89.6% (n=43) were Hindus, 47.9% (n=23) had senior secondary education, 39.6% (n=19) had the monthly family income less than fifteen thousands (Table 2). Fig 2 describes the distribution of waist circumference among overweight and obese adults.

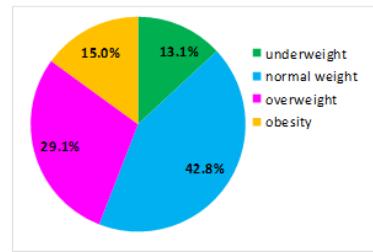


Figure 1: Weight distribution of study samples.

TABLE 1 DESCRIPTION OF SOCIO-DEMOGRAPHIC DETAILS OF STUDY SAMPLE

Variables	No.	%
Gender		
Male	147	45.9
Female	173	54.1
Age		
19-24	42	13.1
25-34	71	22.2
35-44	75	23.4
45-54	59	18.4
55-64	46	14.4
>64	27	8.4
Marital status		
Unmarried	54	16.9
Married	266	83.1
Ethnicity		
Tamil	306	95.6
Muslim	14	4.4
Sinhalese	-	-
Religion		
Hindu	293	91.6
Christian	13	4.0
Islam	14	4.4
Buddhist	-	-
Education		
No education	9	2.8
Primary (1-5)	64	20.0
Junior secondary (6-9)	68	21.3
Senior secondary (10-13)	147	45.9
Tertiary/Collegiate	32	10.0
Employment		
Unemployment	163	50.9
Self-employment	100	31.3
Government	39	12.2
Non-Government	18	5.6
Monthly income		
<15000	140	43.8
15000-30000	128	40.0
30001-50000	41	12.8
>50000	11	3.4

TABLE 2 DESCRIPTION OF SOCIO-DEMOGRAPHIC VARIABLES

Variables	Overweight (n=93)		Obesity (n=48)	
	No.	%	No.	%
Gender				
Male	36	(38.7)	17	(35.4)
Female	57	(61.3)	31	(64.6)
Age				
19-24	10	(10.8)	2	(4.2)
25-34	24	(25.8)	9	(18.8)
35-44	30	(32.3)	21	(43.8)
45-54	15	(16.1)	10	(20.8)
55-64	11	(11.8)	5	(10.4)
>64	3	(3.2)	1	(2.1)
Marital status				
Unmarried	15	(16.1)	3	(6.2)
Married	78	(83.9)	45	(93.8)
Ethnicity				
Tamil	88	(94.6)	45	(93.7)
Muslim	5	(5.4)	3	(6.3)
Sinhalese	-	-	-	-
Religion				
Hindu	85	(91.4)	43	(89.6)
Christian	3	(3.2)	2	(4.2)
Islam	5	(5.4)	3	(6.2)
Buddhist	-	-	-	-
Education				
No education	1	(1.1)	-	-
Primary(1-5)	19	(20.4)	8	(16.7)
Junior secondary(6-9)	20	(21.5)	10	(20.8)
Senior secondary(10-13)	39	(41.9)	23	(47.9)
Tertiary/ Collegiate	14	(15)	7	(14.6)
Employment				
Unemployment	51	(54.8)	28	(58.3)
Self-employment	24	(25.8)	8	(16.7)
Government	12	(12.9)	9	(18.8)
Non-government	6	(6.5)	3	(6.3)
Monthly income				
<15000	34	(36.6)	19	(39.6)
15000-30000	43	(46.2)	1	(2.1)
30000-50000	14	(15.1)	12	(25)
>50000	2	(2.2)	2	(4.2)

OF OVERWEIGHT AND OBESITY SAMPLES

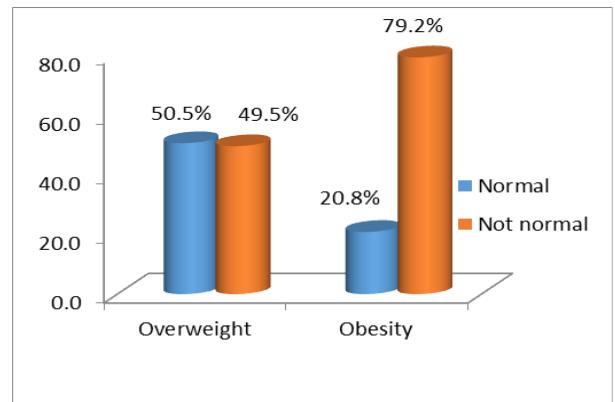


Figure 2: Distribution of waist circumference among overweight and obese adults

C. Prevalence of overweight and obesity

The prevalence of overweight (17.0%) was higher than obesity (8.8%). Prevalence of overweight (16.9%) and obese (9.2%) was high in females. Prevalence of overweight (8.71%) and obesity (6.1%) was high in the age group of 35-44 years than other age groups. (Table 3)

D. Lifestyle factors

Among the overweight and obesity adults 7.1% (n=10) have the habit of smoking, 12.1% (n=17) have the habit of consuming alcohol, 9.9% (n= 14) take alcohol less than three times per week, 28.4% (n=40) adults have the family history of overweight and obesity, 26.2% (n=37) adults are following weight reduction methods, 74.5% (n=105) spend less than three hours to watch television, 57.4% (n=81) adults have the habit of sleeping in the evening after the meal and 33.3% (n=47) adults sleep for 30 to 60 minutes, 99.3% (n=140) adults were non vegetarian, 64.5% (n=91) are taking meal three times in a day, 61% (n=86) were eating homemade foods. Family history of overweight and obesity ($p=0.045$), sleeping habit in evening after meal ($p=0.000$), involving in weight reduction activities ($p=0.000$) are significantly associated with overweight and obesity.

TABLE 3 : PREVALENCE OF OVERWEIGHT AND OBESITY

Variables	Overweight		Obesity	
	No	%	No	%
Gender				
Male	36	(11.9)	17	(5.6)
Female	57	(16.9)	31	(9.2)
Age				
19-24	10	(3.7)	2	(0.8)
25-34	23	(8.0)	9	(3.1)
35-44	30	(8.7)	21	(6.1)
45-54	15	(4.6)	10	(3.0)
55-64	11	(3.4)	5	(1.5)
>64	4	(1.2)	1	(0.3)
Over all prevalence	93	(17.0)	48	(8.8)

E. Awareness regarding the consequences of overweight and obesity

Fig 3 and Fig 4 describe the awareness among adults regarding the consequences of overweight and obesity. Among the overweight and obese adults 79.4% (n=112) were aware about the consequences and complications of overweight and obesity. Most of them (68.1%) know about the occurrence of Hypertension (HTN) and only few of them (6.4%) know about the occurrence of Psychological Disorders(PD) and 38.3%, 31.2%, 24.8% adults aware about Diabetes Mellitus(DM), Cardio Vascular Diseases (CVD) and Musculo-Skeletal Disorders(MSD) respectively.

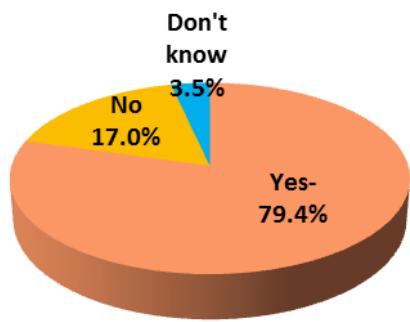


Figure 3 Awareness regarding the consequences of overweight and obesity.

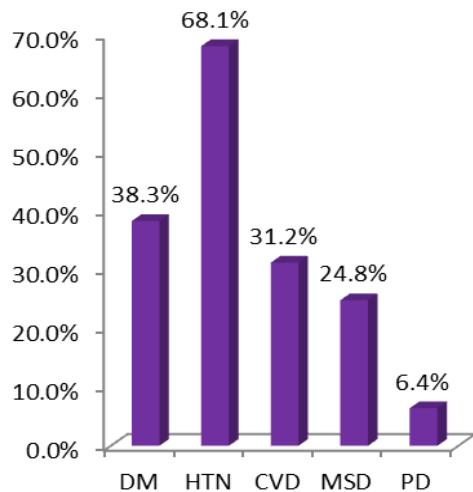


Figure 4 Awareness about the occurrence of NCDs among overweight and obese adults.

IV. DISCUSSION

The prevalence of overweight and obesity is increasing worldwide due to environmental and behavioural changes (Ramachandran & Snehalatha 2010). Overweight and obesity have reached epidemic proportions in many countries. The prevalence of adult obesity is increasing rapidly worldwide (Renuka et al 2012). In this study, prevalence of overweight and obesity and the associated risk factors were assessed for rural areas of Batticaloa district. There were no data available for Batticaloa district on prevalence of adult obesity; but according to the statistic,

SriLankan adult obesity prevalence rate was 5.1 % (CIA world fact book 2015)

This study reveals that the over-all prevalence of overweight was higher than obesity and the prevalence of both overweight and obesity were high in females. Similar association was seen in other studies done in Vietnamese adults (Trinh et al 2009) and in young adults in Uganda (Balwaa et al 2010). Prevalence of overweight and obesity was high among both males and females between the age of 35-54 years and less in the age group of 19-24 years and above 64 years, a similar study done among Shanghai adults in china reveals that BMI was significantly high in age group of 35-44 years and low above 65 years (Hou et al 2008); another study done in Indian women shows the higher prevalence in the age group of 40-49 years(Garg et al 2010) and a study done in province of Vojvodina, Serbia shows the higher prevalence in both males and females of 60-69 years(Grujic et al 2009). Another study done in SriLankan adults shows that the prevalence of overweight was higher than obesity and female sex, urban living, higher education, higher income and being in the middle age had a association with overweight and obesity (Katulanda et al 2010).

Prevalence of both overweight and obesity were high in rural women; a study done in Thailand rural areas shows that prevalence was low in women (Aekplakorn et al 2007) and family history of obesity, activities for weight reduction, sleeping habit after the meal in evening and the duration had significant association with overweight and obesity in rural areas. A study done in Chinese adults in Shanghai shows that, overweight and obesity had positive association with alcoholism and having family history of overweight and obesity (Hou al 2008); another study done in Netherland regarding prevalence of overweight and obesity shows similar association with significant variables of sleeping habit and weight reduction activities (Deurenberg & Hautvast 1998).

According to the findings of this study increased waist circumference more than the recommended range for both men and women was common among the adults those who were overweight and obesity. The similar association was there in a study done in rural population from north-east part of Roma (Mihalache , Popescu & Graur 2010). A study done in Swedish adult women shows, the risk of overweight and obesity was low in vegetarians than omnivorous (Newby, Tucker & Wolk 2005); and another study done among adults in United Kingdom reveals the significant association of dietary habit (Spencer et al 2003); and a study done in adult population of United States indicates that frequency of food intake and taking meals from outsides were significantly associated with overweight and obesity (Yunsheng et al 2003).

V. CONCLUSION

Prevalence of overweight and obesity was high in females than males. Abdominal obesity was common among overweight and obese adults. Middle aged (35-54 years) adults had a high prevalence of overweight and obesity. Family history, sleeping habit and the duration of sleeping in evening after meal were more significant risk factors than others for being overweight and obese. Awareness programs should be carried out in the community regarding weight reduction measures and primary prevention of overweight and obesity by eliminating risk factors. Health education programs have to be done for public regarding the consequences of overweight and obesity, especially for women and adults of 35-44 years age group, who were more vulnerable. Awareness programs and health education programs should be carried out by investigators with the support of community health workers.

REFERENCES

- [1] Aekplakorn, W, Hogan, MC, Chongsuvivatwong, V & et al 2007, 'Trends in obesity and associations with education and urban or rural residence in Thailand' *Obesity (Silvnlmer Spring)* , vol. 15, no. 12, pp.3113-21.
- [2] Balwaa, J, Byarugaba, BB, Kabagambe, EK & et al 2010, 'Prevalence of overweight and obesity in young adults in Uganda' , *Afr Health Sci* , vol.10, no.4, pp. 367-73.
- [3] CIA world fact book 2015, *Obesity- adult prevalence rate of SriLanka* . Available from : http://www.indexmundi.com/sri_lanka/obesity_adult_prevale_nce_rate.html.updated [Accessed on 30 june 2015]
- [4] Department of Census and Statistics (DCS) and Ministry of Healthcare and Nutrition (MOH) 2009, 'Sri Lanka Demographic and Health Survey 2006-07', *DCS and MOH*. Colombo, Sri Lanka.<http://www.statistics.gov.lk>
- [5] Deurenberg, P & Hautvast, JG 1998, 'Prevalence of overweight and obesity in The Netherlands in relation to socio demographic variables, lifestyle and eating behavior: starting points for the prevention and treatment of obesity', *BiblNutrDieta* , vol. 44, no. 8, pp. 21.
- [6] Garg, C, Khan, SA, Ansari, SH & et al 2010, 'Prevalence of obesity in Indian women' , *Obes Rev* , vol. 11, no. 2, pp. 105-8. doi: 10.1111/j.1467-789X.2009.00666.x.
- [7] Grujic, V, Cvejin, MM, Nikolic, EA & et al 2009 , 'Association between obesity and socioeconomic factors and lifestyle' , *Vojnosanit Pregl* , vol. 66, no. 9, pp. 705-10.
- [8] Hou, X, Jia, W, Bao, Y & et al 2008, 'Risk factors for overweight and obesity, and changes in body mass index of Chinese adults in Shanghai' , *BMC Public Health* , vol. 21, no. 8 , pp. 389.
- [9] Janssen, I, Katzmarzyk, A, & Ross, R 2002, 'Body mass index, waist circumference, and health risk: evidence in support of current National Institutes of Health guidelines', *Arch Intern Med* , vol. 162, no.18, pp.2074-9.
- [10] Janus, ED, Laatikainen, T, Dunbar, JA & et al 2007, 'Overweight, obesity and metabolic syndrome in rural southeastern Australia' *MJA* , vol.187, pp.147–152.
- [11] Katulanda, P, Jayewardene, MAR, Sheriff, MHR & et al 2010, 'National Prevalence of Obesity: Prevalence of overweight and obesity in Sri Lankan adults' , *Obesity reviews* , vol. 11, pp. 751-756.
- [12] Kelly,T, Yang,W, Chen, CS & et al 2008, ' Global burden of obesity in 2005 and projections to 2030', *Int J Obe* , vol. 32, no.9, pp.1431-7.
- [13] Mihalache, L, Popescu, D & Graur M 2010, 'Prevalence of overweight and obesity in a rural population' , *Rev Med Chir Soc Med Nat Iasi* , vol. 114, no. 3, pp.715-20.
- [14] Newby, PK, Tucker, KL & Wolk, A 2005, 'Risk of overweight and obesity among semi-vegetarian, lacto-vegetarian, and vegan women' *Am J ClinNutr* , vol. 81 , no. 6 , pp. 1267-1274.
- [15] Ramachandran, A & Snehalatha, C. 2010, ' Rising Burden of Obesity in Asia', *Journal of Obesity*, revised on 1 June 2010, <http://dx.doi.org/10.1155/2010/868573>.
- [16] Rathnayake, KM, Roopasingam, T & Dibley, MJ 2014, 'High carbohydrate diet and physical inactivity associated with central obesity among premenopausal housewives in Sri Lanka, *BMC Res Notes* , vol. 7, pp. 564.
- [17] Renuka, J, Moazzem-Hossain, SM, Sandya, G & et al 2012, 'Prevalence and associations of overweight among adult women in Sri Lanka: a national survey', *Sri Lanka Journal of Diabetes, Endocrinology and Metabolism*, vol. 2, pp. 61-68.
- [18] Spencer, EA, Appleby, PN, Davey, GK & et al 2003, 'Diet and body mass index in 38 000 EPIC-Oxford meat-eaters, fish-eaters, vegetarians and vegans', *International Journal of Obesity* , vol. 27, pp. 728-734.
- [19] Trinh, OTH, Nguyen, ND ,Phongsavan, P & et al 2009, 'Prevalence and risk factors with overweight and obesity among Vietnamese adults: Caucasian and Asian cut-offs' , *Asia Pac J ClinNutr* , vol. 18, no. 2, pp. 226-233.
- [20] Yunsheng, Ma, Bertone, ER, Stanek, EJ & et al. 2003, 'Association between Eating Patterns and Obesity in a Free-living US Adult Population' , *Am. J. Epidemiol* 2003, vol. 158 , no.1, pp. 85-92.

Evaluation of the therapeutic effectiveness of *Rungia parviflora* leaf on Iraippu noai

S. Laavanyah^{*1}, Dr. N. Varnakulendran^{*2}, Prof. R. Sivakanesan^{#3}

^{*}Unit of Siddha Medicine, Trincomalee campus, EUSL, Konesapuri, Nilaveli, Sri Lanka

[#]Dept. of Biochemistry, Faculty of Medicine, University of Peradeniya, Sri Lanka

¹lavisathyandren@gmail.com

³sivaskanda@gmail.com

Abstract - *Rungia parviflora* is well known remedy belongs to Acanthaceae family and it is also known as Thavasi murungai in Sri Lanka. The aim of the present study was planned to assess the role of the plant *Rungia parviflora* leaves in a management of iraippu noi which quoted by our ancient Siddhars. This single case study was taken to give the scientific validation of anti-asthmatic action of *Rungia parviflora* in the treatment of iraippu noi. The leave powder was prepared. Patients were selected with inclusion criteria and the clinical study was conducted in Teaching hospital of Siddha medicine at Trincomalee. The patient was treated with 1g leave choornam two times per day. The duration of treatment one month with follow up of first three visit for every 3 days and other four visits for every five days. The clinical manifestations were evaluated and recorded. The improvement of the treatment was assessed by the reduction in severity of tightness of the chest, wheezing, cough and increasing the peak flow rate after the treatment. The leaves choornam shows reduction in major clinical features of iraippu noi as well as the analysis of this recordings resulted that the thavasi murungai choornam good respond in the management of iraippu noi since the test drug showed the degree of decreasing symptoms of iraippu noi, and improvement in the peak flow rate. Improvement in peak flow rate indicates the increased level of vital capacity of lung. From this study, it is proved that the remedy of *Rungia parviflora* leaf choornam shows a better anti-asthmatic action. The choornam of thavasi murungai leaves will be an easily available, highly effective, scientifically valid, pure natural herbal drug without any other chemicals fortified.

Keywords— *Rungia parviflora*, Anti-asthmatic, iraippu noi

I. INTRODUCTION

Iraippu is characterized by tightness of the chest, difficult to breathing and producing abnormal sound during breathing. Iraippu is compare with bronchial asthma nowadays. Bronchial asthma is a common chronic inflammatory condition of the airways. It is characterized by reversible

airway obstruction, produce by a combination of mucosal edema, constriction of the bronchial musculature and excessive secretion of viscid mucus, causing mucous plugs. Symptoms include wheeze, chest tightness, cough and shortness of breath, often worse at night. Thavasimurungai (*Rungia parviflora*) is applicable for Bronchial Asthma patients.

A. Problem Statement

According to Gunapadam part 1 (Author:- K.S. Murugesamuthaliyar)

“Thavasumurung ithazhikuthaiyalea keazhai

Avasiyam peenisa munaakum-ouvasakka

Iyamsuvaasakapam andaathukuthirumal

Viyamviduthoodum vazhuthul”

It was stated that the plant is applicable for Bronchial asthma.

B. Objective

To evaluate the anti-asthmatic activity on leaves of *Rungia parviflora*

I. SELECTION OF THE PATIENTS

Patients were selected with Iraippu noai in either sex between 18-60 years of age exclusion of pregnant mothers, elders, patients with hypertension and diabetes. Sole consents were taken prior to the work.

II. MATERIAL AND METHOD

Rungia parviflora leave were collected from Kallady, Batticaloa. Leave were cleaned using distilled water, dried in shade, ground well to make fine powder and sieved. Each 500 mg of dose was given to the patients two times per day. The patients were selected from Siddha Teaching Hospital, Konesapuri, Trincomalee with the advice of Medical Officer In Charge of the hospital. Continuous observations were carried out for 30 days in the conditions of difficult of breathing, Rhonchi, Bouts of cough and peak flow rate. The data were collected according to Likert scale as 1 – 5 from problem stage to better stage.

RESULTS

A. Difficult to breathing

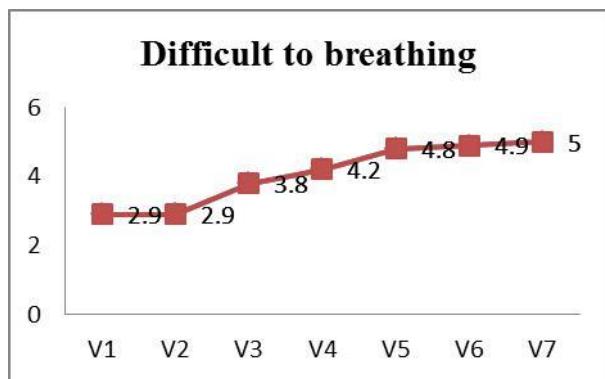


Fig 1: Graph plotted for difficult to breathing

B. Rhonchi

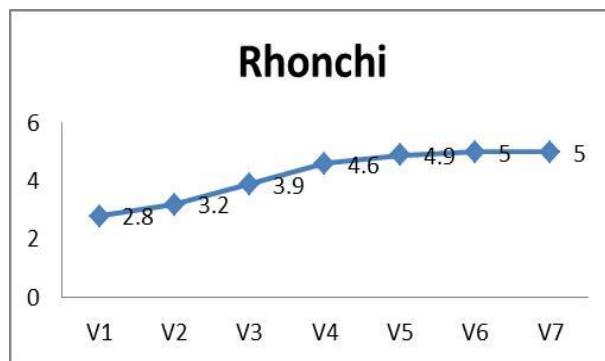


Fig 2: Graph plotted for Ronchi

C. Bouts of cough

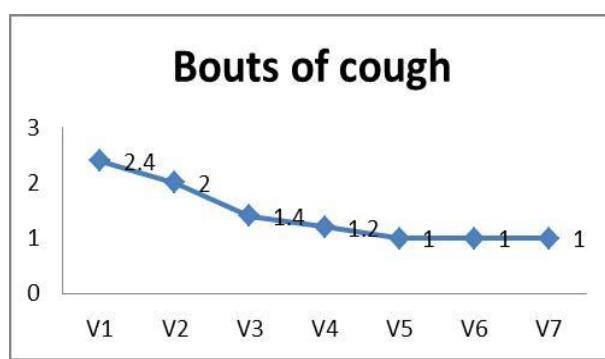
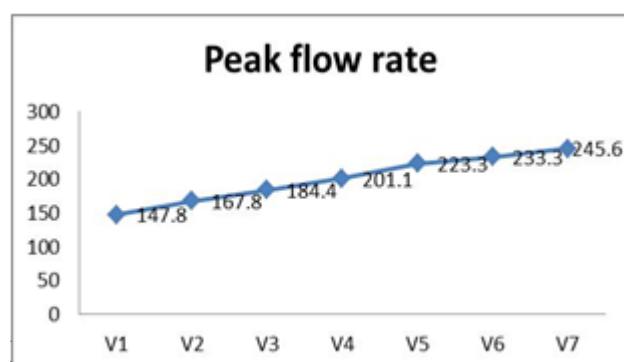


Fig 3: Graph plotted for Bouts of cough

D. Figures and Tables



III. DISCUSSION

Patient those who selected for the clinical studies were in adverse condition. The graph shows the clinical improvements of patients for difficult to breathing after the medication of leaves choornam of *Rungia parviflora*. In every visits difficult to breathing gradually reduce. At the 7th visit all patients are completely cure from the difficult to breathing. The experiment were carried out to the patient whom rhonchi sound had been listened.in every visits auscultated the rhonchi. Every patient gradually decreases the rhonchi with visits. Mostly from the 6th visits patient completely cure and not heard the rhonchi due to auscultation. At first visits every patient affected by cough. All patients are completely cure from the cough From the 5th visits. In addition to this the Peak Expiratory flow rate which is used to measure the vital capacity of the lungs. Peak expiratory flow rate of apparently healthy individual is usually above 250-300 l/S and little high in males than female.at the 1st visits every patient has minimum rate of peak flow rate gradually increase the rate according with visits. Finally all patients are come under the normal range. As per the above result, clinical trial has been done to test the research hypothesis that the administration of leaf choornam of *Rungia parviflora* will reduce the severity of selected clinical parameters of Bronchial asthma. At the end of the 30 days, the breathing become very easy, the patients was free of coughs, the patients got no wheezing attacks and lung fields become clear and peak flow rate also increased.in addition to this peak flow rate which is used to measure the vital capacity of the lungs.

There is no adverse effect found either by the researcher or the clinical supervisor thus the leaves of *Rungia parviflora* has no toxic effect. The researcher has found the answer for the research question that *Rungia parviflora* has the curable ability for iraippu noi and the research hypothesis also accepted through the finding.

IV. CONCLUSION

Result of clinical trial on *Rungia parviflora* decrease the degree of sign and symptoms of bronchial asthma. The present study also exhibit significant improvement in the peak flow rate which indicates increasing level of vital capacity of the lungs.

Hence it can concluded that the 1g of *Rungia parviflora* leaf choornam twice a day for one month, can be one of the best, side effects less medicine in the treatment of bronchial asthma. The present study also exhibits the scientific validation for the siddha quotation for general character of thavasi murungai.

REFERENCES

- [1] Murugesamuthaliyar, KS 2008, *Kunapadam porutpanpunool*; ,moolihai vahuppu,part-1
- [2] Sastry, JLN, Chunekar, KC 2010, *Dravyaguna vingnana*, Vol-2
- [3] Sharma, PC Yelne MB & Dennis TJ 2000,*Databased on medicinal plants*; Vol-4
- [4] Arya Vaidya sala Vaidhyaratnam PS. Varier 1995, *Indian medicinal plants*; Vol-04
- [5] Robert Bently, Hendry Trimen 2006 ,*Medicinal plants* ; Vol-2
- [6] Orient Longmean 1996 , *Indian medicinal plants* ; Vol-4

- [7] Kritikar & Basu KR 2008, *Indian medicinal plants*, vol -1
- [8] Vaidyaratnam, *Indian Medicinal Plant*, Vol II (45).
- [9] Praveenkumar, Michel clerk Kumar & Clerk 2009, *Clinical medicine 7th edition*
- [10] Oxford medical dictionary, fifth edition, 2010. P-43.
- [11] Jayaweera DMA with Taxonomic updating by Senaratna LK, *Medicinal plant used in Sri Lanka, part – 3*, The National Science Foundation (89).
- [12] Mozelle Isaacs. M. A, M. Sc. The commoner flowering plant of Western India.Pp-341.
- [13] Kritikar KR & Basu BD, *Indian Medicinal Plant, Volume IV*. (2689).

Preliminary study of Free radical scavenging activity of aqueous extracts of parts of *Cassia auriculata* under different storage conditions

S.Pancharajah*¹, R. Sivakanesan^{#2}

¹Postgraduate Institute of Science, Peradeniya, SriLanka.

²Department of Biochemistry, Faculty of Medicine, University of Peradeniya, SriLanka.

drpancharajas@gmail.com

sivaskanda@gmail.com

Abstract - Antioxidants can terminate or retard the oxidation process by scavenging free radicals. It helps to reduce cellular oxidation in the body. A study was conducted to evaluate the Antioxidant Capacity(AC) in water extracts of air dried and powdered bark, root, flower, leaves and unripe fruit of *Cassia auriculata* (CA) stored at room temperature($26^{\circ}\text{C} \pm 2$) and in a freezer (- 4°C) for three months. Cold and hot aqueous extracts of different parts of CA were assessed for their antioxidant activity by measuring the DPPH radical scavenging activity. Bark showed highest free radical scavenging activity in cold as well as hot extract with IC 50 ($\mu\text{g}/\text{ml}$) values being 278.60 and 271.32 followed by root 319.40 and 284.62, leaf 372.40 and 287.17, flower 399.53 and 306.92 and unripe fruits 428.65 and 427.82 on the 1st day after the preparation of the powder before storage. Highest increase of IC50 was observed in cold extract of bark kept in room temperature 83.37% and 97.67% after the 1st and 3rd month respectively. In hot extract, IC50 of all the parts were increased after the 3rd month. Highest increase of IC50 was observed in hot extract (78.05%) as well as in cold extract (93.70%) of bark powder kept in freezer (- 4°C).for two months. IC50 value was increased in hot extract of flower by 70.94% and 74.94% on 1st and 3rd months respectively. IC50 value of all the parts of *Cassia auriculata* kept in room temperature and freezer showed increasing trend during storage. Bark showed the highest AC in cold as well as hot extracts, followed by root, leaves, flower and unripe fruit in descending order when stored at room temperature as well as under - 4°C . Hence the prepared chooranum(powder) of *C. auriculata* should be used before 3 months in order to get the maximum benefit from their antioxidant property.

Key words- Antioxidant capacity, *Cassia auriculata*, DPPH, Lifespan of chooranum

I. INTRODUCTION

Antioxidant counteract various oxidative reactions naturally occurring in tissues. They can terminate or retard the oxidation process by scavenging free radicals, chelating free catalytic metals and also by acting as electron donors. It helps to reduce cellular oxidation in the body and to provide an important defense against degenerative diseases caused by oxidative stress. Medicinal plants are important therapeutic

aids for alleviating human diseases. Many of these medicinal plants are also excellent sources of phytochemical, of which many have potent antioxidant activities. Worldwide trend towards the use of natural phytochemicals present in herbs has increased. Antioxidant capacity is widely used as a parameter for medicinal bioactive components. Evaluation of the antioxidant properties of plants used in Traditional Medicine is necessary and important. Recently importance has been given for in vitro antioxidant study to understand the pharmacological role of medicinal plant and their isolates. All antioxidant compounds can act as substances that delay or prevent the oxidation of cellular oxidisable substrates caused by reactive oxygen species.

Cassia auriculata L. (CA) commonly known as tanners cassia, also known as "Avaram" in Tamil language and "Ranawara" in Sinhala is a branched shrub with 1-3 meters height which belongs to the Leguminaceae (Sub family Caesalpiniaceae) family. It is used as a tonic, astringent and as a remedy for diabetes, conjunctivitis and ophthalmia (Murugesa Muthaliyar, 1936). All the parts of *Cassia auriculata* are valuable in traditional medicine for the treatment of ulcer, leprosy, liver diseases, chronic fever, gout and skin disorders (Kumar et al., 2002). The leaves are used as anthelmintic, in ulcers, leprosy and skin disorders (Kirthikar and Basu, 1987). The flowers are used in the treatment of skin disorders, body odour, urinary discharges diabetes and throat problems (Joy et al., 2012). Seeds are used in diabetes and ophthalmia (Kirthikar and Basu, 1965; Nadkarni, 2002).The roots are used in urinary discharges, skin tumours, skin diseases, asthma and diabetes. Its bark is used as an astringent. Bark contains tannin - 25% & ash - 5% (Kirthikar and Basu, 1965; Nadkarni, 2002).

The survey of literature reveals that flower, root, leaves, bark and unripe fruit posses antioxidant activity. Kumaran and Karunakaran (2007) reported that the CA flowers showed antioxidant activity. Sabu and Subburaju, (2002) reported that the aqueous extract of CA leaves posses antioxidant activity. Leaves of CA posses antibacterial and antioxidant activity (Anushia et al., 2009; Thulasi and Amsaveni, 2011). Flowers and seed of CA have been shown to have antidiabetic activity (Jain and Sharma, 1967).

In traditional system, the plants are used in different forms as internal medicine to treat diseases. The chooranum (powder) is the one of the form of internal medicine and its period of efficacy is three months. Hence this study was initiated to evaluate the antioxidant capacity of root, bark,

flower, leaves and unripe fruits of *Cassia auriculata* at different storage for three months.

II MATERIALS AND METHODS

A. Plant materials

The root, leaves, bark, flowers and unripe fruit of *Cassia auriculata* (CA) were collected at Kaithady. Herbarium sheet for CA was prepared and voucher specimens are preserved in the Unit of Siddha Medicine, University of Jaffna, Kaithady.

B. Preparation of plant extract

The root, leaves, bark, flower and unripe fruit were cleaned and washed well with water. Then plant parts were dried under shade at room temperature for 7 days. The individual parts were powdered and sieved. The finely powdered parts were packed (10mg each) in air tight polythene. These packets stored in air tight bottle at room temperature ($26^{\circ}\text{C} \pm 2$) and in the freezer (-4°C) separately. The plant extract was prepared on the same day and every month for four months after powdering the plant parts.

Ten milligrams of the dried and powdered root, leaves, bark, flowers and unripe fruit which were kept in room temperature and freezer were taken separately in 2 test tubes for each 10ml of distilled water added and vortexed for 5 minutes. One test tube of each plant parts powder was boiled in water bath for 5 minutes to obtain hot extract. The hot aqueous extracts were cooled and again vortexed for one minute. The cold and hot aqueous extracts were transferred into the eppendorf tubes and centrifuged at 10,000 rpm for 10 minutes at room temperature (26°C). The supernatant was used for analyzing antioxidant activity of the plant parts.

C. Antioxidant assay

The DPPH free radical scavenging activity of each part of the *Cassia auriculata* plant extracts was measured using a modified method described by Khamsah et al. (2006). Cold and hot aqueous extracts prepared from the powders kept in room temperature ($26^{\circ}\text{C} \pm 2$) and freezer (-4°C) were used for the assay. The assay was carried out on samples aliquots, once a month for 4 months. Each sample was prepared in a series of dilution (100mg/ml, 200 mg/ml, 300 mg/ml, 400mg/ml, and 500mg/ml) with final volume of 1 ml. Each solution was mixed with 250 μl of DPPH reagent and mixed thoroughly. After 30 minutes of incubation the absorbance of the mixture was measured at 517 nm.

III RESULT AND DISCUSSION

An easy, rapid and sensitive method for the antioxidant screening of plant extracts is the free radical scavenging assay of 2,2 – diphenyl 1 – picryl hydrazyl (DPPH) to stable radical. In the presence of an antioxidant, DPPH radical obtains one more electron and the absorbance decreases. DPPH is a stable free radical which produces a violet solution in methanol. It is reduced and decolorized in the presence of an antioxidant molecule.

The results of DPPH assay were presented in IC50 values. The calculated IC50 values for each part were calculated from the graph. Radical scavenging activity of the different parts of the extracts increased with concentration of the extract. The significant decrease in the concentration of DPPH radical is due to the scavenging ability of the part of

Cassia auriculata. The higher IC50 value indicates a weaker capability to scavenge DPPH radical and vice-versa. Among the parts of the plant, bark showed highest radical scavenging activity in cold as well as hot extract with IC 50 ($\mu\text{g /ml}$) value being 271.32 and 278.60 followed by root 284.62 and 319.40, leaf 287.17 and 372.40, flower 306.92 and 399.53 and unripe fruits 427.82 and 428.65 on the 1st day after the preparation of the powder before storage.

Generally bark extract showed the highest antioxidant activity compared to leaf, flower, root and unripe fruit extracts. However, antioxidant activity of root extract (IC50 value 284.62 $\mu\text{g /ml}$) was slightly better than the leaf extract (IC50 value 287.17 $\mu\text{g /ml}$) with lower IC50 value.

The IC50 value of aqueous extracts (the inhibitory concentration of which there is 50% reduction of free radical) prepared from the powder of *Cassia auriculata* leaves, flower, bark, root and unripe fruit kept in room temperature ($26^{\circ}\text{C} \pm 2$) is summarized in Table 1.

Highest increase of IC50 was observed in cold extract of bark kept in room temperature 83.37% and 97.67% after the 1st and 3rd month respectively. In hot extract, IC50 of all the parts were increased after the 3rd month.

Highest increase of IC50 was observed in hot extract of flower 67.33% and 94.11.8% and bark 64.32% and 70.75% after the 1st and 3rd months respectively

TABLE 1. THE IC 50 VALUE OF AQUEOUS EXTRACTS OF CASSIA AURICULATA LEAVES, FLOWER, BARK, ROOT AND UNRIPE FRUIT IN ROOM TEMPERATURE ($26^{\circ}\text{C} \pm 2$).

Parts of CA	IC 50 Value ($\mu\text{g /ml}$)					
	Hot			Cold		
	1st day	After 1st month	After 3rd month	1st day	After 1st month	After 3rd month
Bark	271.32	445.83 64.32%	463.27 70.75%	278.60	510.88 83.37%	550.70 97.67%
Root	284.62	446.82 59.99%	474.29 66.64%	319.40	518.57 62.36%	561.07 75.66%
leaves	287.17	458.06 59.51%	493.06 71.70%	372.40	524.19 40.76%	595.00 59.77%
Flower	306.92	513.57 67.33%	595.76 94.11%	399.53	582.75 45.86%	600.00 50.18%
Unripe Fruit	427.82	622.41 45.48%	648.10 51.49%	428.65	627.67 46.43%	668.41 55.93%

In hot extract of leaf 71.7% increase of the IC50 was observed after the 3rd month. Highest increase of IC50 was observed in cold extract of the Bark 83.37% and 97.67% after the 1st and 3rd month and root 62.36% and 75.66% after the 1st and 3rd months respectively.

The IC 50 value of aqueous extracts prepared from the powder of *Cassia auriculata* leaves, flower, bark, root and unripe fruit kept in freezer (-40°C) is summarized in Table 2. Highest increase of IC50 was observed in hot extract (78.05%) as well as in cold extract (93.70%) of bark powder kept in freezer (-40°C) for two months. IC50 value was increased in hot extract of flower by 70.94% and 74.94% on 1st and 3rd months respectively. IC50 value of all the parts of *Cassia auriculata* kept in room temperature and freezer showed a trend for increasing IC50 during storage.

The antioxidant activity of phenolic compound is due to hydroxyl functional group which is responsible for the radical scavenging effect mainly due to redox properties (Rice Evans et al., 1997).

Previous study shows that the hot extracts of all the parts of *C.auriculata* possess higher Total phenolic content (TPC)

than cold extracts. Among the parts of the plant, bark showed the highest TPC in cold as well as hot extracts, followed by root, leaves, flower and unripe fruit in room temperature as well as in freezer.

TABLE 2. THE IC 50 VALUE OF AQUEOUS EXTRACTS OF CASSIA AURICULATA LEAVES, FLOWER, BARK, ROOT AND UNRIPE FRUIT AT IN FREEZER (- 4°C).

Parts of CA	IC 50 Value (µg /ml)					
	Hot			Cold		
	1st day	After 1st month	After 3rd month	1st day	After 1st month	After 3rd month
Bark	271.32	448.72 65.38%	483.08 78.05%	278.60	484.23 73.81%	539.66 93.70%
Root	284.62	452.25 58.90%	488.10 71.49%	319.40	524.65 64.26%	549.46 72.03%
Leave	287.17	475.76 65.67%	492.76 71.59%	372.40	549.36 47.52%	559.30 50.19%
Flower	306.92	524.65 70.94%	536.94 74.94%	399.53	581.15 45.46%	600.50 50.30%
Unripe Fruit	427.82	535.24 25.11%	560.95 31.12%	428.65	628.06 46.52%	650.33 51.72%

IV. CONCLUSION

From the results of the study it could be concluded that there was no significant difference in the TPC between room temperature and freezer storage. Among the parts of the plant, bark showed the highest AC in cold as well as hot extracts, followed by root, leaves, flower and unripe fruit in descending order when stored at room temperature as well as under - 4°C. Hence the prepared chooranum should be used before 3 months or dosage of the chooranum should be increased in order to get the maximum benefit from their antioxidant property.

REFERENCES

- [1] Anushia, C., P. Sampathkumar and L. Ramkumar, 2009. Antibacterial and antioxidant activities in *Cassia auriculata*. Global J.Pharmacol.,3: 127 – 130
- [2] Doshi, G.M, D.K.Sandhya, M.D.Shahare, G.V.Agarwal and P.G.Pillai, 2011. Comparative antioxidant studies of Cassia auriculata plant parts. Int.J. Applied Biol. Pharma Nanotechnol,2: 327 - 331
- [3] Finkel, T and N.J.Holbrook, 2000. Oxidants oxidative stress and the biology of ageing. Nature, 408: 239 – 247.
- [4] Gupta S, Sharma SB, Bansal SK, Prabhu KM. Antihyperglycemic and hypolipidemic activity of aqueous extract of Cassia auriculata L. leaves in experimental diabetes. J Ethnopharmacol. 2009;123:499–503. [PubMed: 19473793]
- [5] Halliwell B. Free radicals, antioxidant and human disease, curiosity, cause or consequence Lancet. 1994; 344: 721 – 724. Doi: 10.1016/S0140-6736(94)92211-X.
- [6] Halliwell, B and J.M. Gutteridge, 2000. Free radicals and antioxidants in the year 2000 a historical look to the future. Ann.N.Y.Acad. Sci., 899: 136 – 147.
- [7] Halliwell, B., J.Rafter and A. Jenner, 2005. Health promotion by flavonoids, tocopherols and other phenols; direct or indirect effects? Antioxidant or not?. Am.J.Clin.Nutr., 81: 268 – 276.
- [8] Jain,S.R and S.N.Sharma, 1967. Hypoglycemic effect of Musa Sapientum L.flowers. planta Media, 4:439-442.
- [9] Joy, V, M.Paul John Peter, J. Yesu Raj, and Ramesh, 2012. Medicinal Values of Avaram (Cassia auriculata Linn.): A Review. *International Journal of Current Pharmaceutical Research*, Vol. 4, Issue 3.
- [10] Kirtikar, K.R., & Basu, B.D. Medicinal Plants of India. Vol.I, 1965. CSIR, New Delhi, India, 518 – 520.
- [11] Kirtikar, K.R., & Basu, B.D. Indian Medicinal plants, Vol III, 2nd ed. 1987. International book distributors: Dehradun. 867 – 868
- [12] Kumar,R.S., M. Ponmozh, P. Viswanathan and N.Nalini,2002. Effect of Cassia auriculata leaf extract on lipids in rats with alcoholic liver injury. Asia Pac.J.Clin.Nutr., 11: 157 – 163.
- [13] Kumaran.A and R.J.Karunakaran, 2007. Anti oxidant activity of Cassia auriculata flowers. Fitoterapia, 78:46-47.
- [14] Murugesa Muthaliyar, K.S; Gunapadam (Materia medica); Government press; 1936; 56 – 58.
- [15] Nadkani,K.M. Indian Materia medica; Bombay popular prakasan; 2002; 284 – 285.
- [16] Pari.L and m.Latha. Effect of *Cassia auriculata* flowers on blood sugar levels, serum and tissue lipids in streptozotocin diabetic rats. Singapore Medical J. 2002. 43(12): 617-621.
- [17] Purushotham, K.N., H.V.Annegowda, N.k.Sathish,B.Ramesh and S.M.Mansor; Evaluation of Phenolic Content and Antioxidant potency in various parts of Cassia auriculata L: A Traditionally Valued Plant;Pakistan Journal of Biological Sciences,2013.
- [18] Rice Evans C.A, Miller N.J, Paganga G. (1997). Antioxidant properties of phenolic compounds. *Trend plant Science* 4, 152 – 159.
- [19] Sabu,M.C and T.Subburaju,2002. Effect of Cassia auriculata Linn. On serum glucose utilization of isolated rat hemidiaphragm J. Ethnopharmacol, 80:203-206.
- [20] Shrotri,D.S., Kelkar, M., Deshmukh V.K. and Aiman R., Indian J Med R es, 1963, 51, 464 – 467.
- [21] Shimada K., Fujikawa K., Yahata K. and Nakamura T. Antioxidative properties of Xanthan on auto oxidation of soyabean oil incyclodextrin emulsion.J. Agric and Food Chem 1992; 40: 945 - 948
- [22] Singleton V. I., Rossi J.A. 1965.Colorimetry of total phenolics with phosphomolytic – phosphotungstic acid reagent. American Journal of Enology and viticulture 16: 144 - 158
- [23] Skinner,M. Encyclopedia Article about *Cassia* (genus) 2005: 1 - 3.
- [24] Subramanian D. P. and Venugopal S. Comparative study of Antioxidant Activities of Cassia auriculata and Casia siamea flowers. International research Journal of pharmacy: 2(12), 208 – 212.
- [25] Thulasi, G. and V. Amsaveni, 2011. Antibacterial activity of *Cassia auriculata* against ESBL producing E.Coli from UTI patients. Int.J.Micr.Res., 2: 267 – 272.
- [26] www.doaj.org/doai?func=abstract&id=598793
- [27] Yildirim A, Oktay M.,and Bilaoglu V. The Antioxidant activity of the leaves of Cyclonia vulgaris. Turkish Journal of Medical Science 2001; 31: 23 - 27

Total antioxidant capacity of leaf, stem, root and flower of *Datura metel*

R.Piratheepkumar^{1, 2}, R.Sivakanesan²

¹*Unit of Siddha Medicine, Trincomalee Campus, Eastern University*

²*Postgraduate Institute of Science, University of Jaffna*

piratheepkumar@yahoo.com

Abstract - In Srilanka *Datura metel* is used in Ayurveda and Siddha treatment systems for treating bronchial asthma and chronic wound healing respectively. It is also used to maintain heath as a rejuvenating herb. The purpose of the study was to investigate the Total antioxidant capacity of the different parts of *Datura metel* plant. The plant was obtained from Government herbal garden, and taxonomically authenticated by officer In charge of medicinal plants division, Unit of Siddha Medicine, University of Jaffna. The collected plants were washed thoroughly with running tap water and separated into leaf, flower, stem, and root immediately. Separated parts were dried in sun shade. The dried parts were powdered and stored in air tight containers. Cold and hot water extract were prepared. Total antioxidant capacity (TAC) was measured by the ferric reducing antioxidant power and expressed as $\mu\text{mol/g}$ dry weight (DW). TAC values of cold water extract were 450.3 ± 31.99 to 647.2 ± 32.93 and values of hot water extracts were 499.1 ± 42.49 to $702.7 \pm 45.15 \mu\text{mol/g}$ DW. *Datura metel* leaf contained the highest amount of TAC in both hot and cold water extracts. TAC values were higher in hot water extract than cold water extract. Flower sample showed the lowest TAC. However all plant parts showed moderate level of Anti-oxidant capacity.

Keywords - *Datura metel*, Antioxidant

I. INTRODUCTION & LITERATURE REVIEW

Plants are the source of medication for preventive, curative, protective or promotive purposes (Sidhu et al., 2007). Several constituents in plants have been identified as potentially health promoting in animal studies including cholesterol lowering factors, antioxidants, enzyme inducers and others. Many of these herbal medicines are finding their way into the world market as alternatives to prescribed allopathic drugs currently available to treat various disorders and ailments. The rapid increase in the consumption of traditional herbal remedies worldwide has been stimulated by several observations, which have shown their use as an alternative medicine. In particular cancer patients are reported to benefit from treatment with herbal medicine and survivability in many cases is significantly increased. These observations show herbal product to be safe, harmless, effective, and free from side effect. (Jeyachithra Krithiga, 2012)

Herbal medicine is frequently a part of a larger therapeutic system such as traditional and folk medicine. It is necessary to evaluate in a scientific base the potential use of folk medicine for the treatment of various diseases. The search and use of drugs and dietary supplements derived from plants have been accelerated in recent years.

Several medicinal plants have been extensively studied in order to find more effective and less toxic compounds. Pure extract of herbs active component are more reliable and safer than administration of the herb itself. Many herbs are now in use whose therapeutic properties and active principle are as yet not well understood.

Antioxidants are chemicals that interact with and neutralize free radicals, thus preventing them from causing damage. The body makes some of the antioxidants to neutralize free radicals. These antioxidants are called endogenous antioxidants. However the body relies on external (exogenous) sources, primarily the diet, to obtain the rest of the antioxidants it needs. These exogenous antioxidants are commonly called dietary antioxidants. Fruits, vegetables, and grains are rich sources of dietary antioxidants. Some dietary antioxidants are also available as dietary supplements.

Antioxidants have been shown to play an important role in preventing many diseases like cancer, inflammation and brain dysfunction. Apart from their role of health benefactors, antioxidants are added in foods to prevent or delay oxidation of food initiated by free radicals formed during their exposure to environmental factors such as air, light, and temperature. At present most of the antioxidants are manufactured synthetically. They belong to the class of synthetic antioxidants. The main disadvantage with the synthetic antioxidant is the side effects when taken in vivo. Strict governmental rules regarding the safety of the food has necessitated the search for alternatives as food preservatives.

Plants are the potential source of natural antioxidants. Natural antioxidants or phytochemical antioxidants are the secondary metabolites of plants. Carotenoids, flavonoids, cinnamic acids, benzoic acids, ascorbic acids, tocopherol, tocotrieols etc., are some of the antioxidants produced by the plant for their sustenance. Beta-carotene, ascorbic acid and alpha tocopherol are the widely used antioxidants. Plant derived natural products such as flavonoids, terpenoids and steroids have received considerable attention in recent years due to their diverse pharmacological properties including antioxidant and antitumor activity.

Datura metel is a primarily annual herbaceous plant, though it is occasionally biannual. It grows more than twelve feet in height and develops numerous branches. The soft leaves are a light, matte green colour with slightly serrated edges. The plant has smooth, violet or dark purple branches and the funnel-shaped, fragrant flowers are either white, yellow, or violet, depending on variety, and jut upward at an angle (Ratsch 1998,203).

Datura metel is mentioned as rejuvenating herb and which is used by Siddhas for maintain their health. Mean time *Datura metel* can identify in any part of Srilanka. Hence collection of *Datura metel* will not so difficult. The objective of the study was to estimate the antioxidant activity, total phenolic and Flavanoid content in different parts of *Datura metel*.

II. MATERIALS AND METHOD

Collection of Sample

The plant *Datura metel* was obtained from Government herbal garden, Navakkiri, Jaffna, and taxonomically authenticated by Officer In charge of medicinal plants division, Unit of Siddha Medicine, University of Jaffna. The collected plants were washed thoroughly in running tap water and separated into leaf, flower, stem, and root immediately. Separated parts were dried in sun shade for two weeks. The dried parts were powdered by multi – fine grinder, mess number 20. Then powders were stored in labeled air tight dry plastic containers

Preparation of cold water extract

Ten mg of dried sample was crushed with 10 ml of distilled water using a motor and pestle. Crushed sample was centrifuged for ten minutes at 10000 rpm. After centrifugation the supernatant was transferred carefully to a test tube.

Preparation of hot water extract

Ten mg of dried sample was crushed with 10 ml of distilled water using a motor and pestle. The crushed sample was kept in a water bath at 100°C for 10 minutes. Then it was centrifuged for ten minutes at 10000 rpm. The supernatant was carefully transferred to a test tube.

Assay methods

The FRAP assay will be done according to the procedure described by Benzie and Strain (1996). FRAP reagent was prepared by mixing 1 mL of (10mmol/L) TPTZ solution in 40 mmol/L HCl, 1 mL of FeCl₃ (20mmol/L) and 10 mL of acetate buffer, (0.3 mol/L, pH=3.6). Twenty microliters of 1g/L sample was mixed with 1 ml FRAP reagent and the absorbance at 593 nm measured spectrophotometrically after incubating at room temperature for 4 minutes, against the FRAP reagent as the blank. FeSO₄ (1000 µM) was used as the standard. The ferric reducing antioxidant power was expressed in µmol/g dry weight (DW).

III. RESULTS AND DISCUSSION

TABLE I Total Anti-oxidant capacity of both cold and hot water extract of different parts of *Datura metel*

Sample	FRAP Cold extract (µmol/g DW)	FRAP Hot extract (µmol/g DW)
Stem	455.7 ± 37.90	499.1 ± 42.49
Leaf	647.2 ± 32.93	702.7 ± 45.15
Root	465.81 ± 36.91	511.2 ± 53.29
Flower	450.3 ± 31.99	500 ± 43.26

The assay was done with six different samples. The TAC (µmol/g DW) values of cold water extract ranged from 450.3 ± 31.99 to 647.2 ± 32.93 and in hot water extracts from 499.1 ± 42.49 to 702.7 ± 45.15 µmol/g DW. *Datura metel* leaf contained the highest amount of rich TAC in both hot and cold water extracts. TAC values were higher in hot water extract than cold water extract. Flower sample showed the lowest TAC.

IV. CONCLUSIONS

Datura metel possess moderate level of anti – oxidant capacity.

REFERENCE

- [1] Abdul – LateefMolan, Abbas MohamadFaraj, AbdulkhaliqSalehMahdy. Antioxidant activity and phenolic content of some medicinal plants traditionally used in Northern Iraq. Phytopharmacology 2012,2(2)224-233
- [2] Ali khoddami, Meredith. A. Wilkes, Thomas H. Roberts. Techniques for analysis of plant phenolic compounds. Molecules 2013, 18 2328-2375; doi: 10.3390, molecules 18022328.
- [3] AugustinScalbert, Ian T Johnson, Mike Saltmarsh. Polyphenols: antioxidants and beyond. The American journal of Clinical nutrition. January 2005, Vol.81, no 1, 215S – 217S
- [4] Avani Patel, Amitpatel, Dr.N.M.Patel. Estimation of flavonoid, polyphenolic content ad In-vitro antioxidant capacity of leaves of Tephrosiapurpurea. Avani Patel al/ International journal of pharma sciences and research (IJPSR). Vol. 1(1),2010,66-77.
- [5] Antimicrobial activity of aqueous extract of Terminaliachebula. International journal of pharmaceutical and clinical research. Vol 1, Issue 1, 2009.
- [6] Audd.B., Ferreir.M., Blasina.F, Lafo.L, Arredond.F, Dajas.F, Tripathi.P.C, Seal.TMukherjee.B, Screening of antioxidant activity of the Indian medicinal plants traditionally used for the management of neurodegenerative disease. Journal of Ethno pharmacology 84(2003)131-138
- [7] Farrukh AQIL, Iqbal AHMAD, Zafar MEHMOOD. Antioxidant and free radicals scavenging properties of twelve traditionally used Indian medicinal plants. Turk J Biol 30(2006)177-183
- [8] Farooq Anwar1, Amer Jamil1, ShahidIqbal, Munir A. Sheikh. Antioxidant activity of various plant extracts under ambient and accelerated storage of

sunflower oil. GRASAS Y ACEITES, 57 (2), April - June, 189-197, 2006, ISSN: 0017-3495.

[9] Karthikumar. S, Vigneswaran. K, Jegatheesan. K. Screening of antibacterial and antioxidant activities of leaves of *Eclipta prostrata*. Vol 2(4), pp 101-104, April 2007

[10] Longo.G, Karan.M, Sharma.P.D, Rakesh.D.D, Vyas.S, Vasisht.K. Quantitative analysis of green tea polyphenols in Indian cultivars.

[11] Praveen. K, Ramamoorthy, Awang bono. Antioxidant activity, total phenolic and flavonoid content of *Morindacitrifolia* fruit extracts from various extraction processes. Journal of Engineering science and technology. Vol 2, No 1 (2007)70-80. Sathiyaseelan.V Material medica II (Gunapadam II) 2008.

The study of mal identification of *Munronia pinnata* (Wall) Theob. as *Nilavembu* (T)- Review

Saranya U^{*1}, Mohommadu Hasan MG^{*2}, Paheerathan V^{*3}

¹*Intern Medical Officer, Department Of Ayurvedha Sri Lanka*

²*Intern Medical Officer, Department Of Ayurvedha Sri Lanka*

³*Senior lecturer, Unit of Siddha Medicine, Trincomalee Campus EUSL*

¹kganga28@gmail.com

²hn0272242219@yahoo.com

³geethan1978@live.com

Abstract— This is a literature review study to identify the *Munronia pinnata* as *Nilavembu*(T). *Nilavembu* is one of the unique herb has been using from ancient time to treat fever. There is no any botanical description were mentioned by siddhars to proper identification of *Nilavembu*. Due to this reason, number of plants have been using as *Nilavembu* by practitioners, among these *Munronia pinnata* is one of the herb that has been identifying as *Nilavembu* by practitioners as well as many literatures. But misidentification of species and the subsequent substitution with unsuitable material could lead to a real danger in the preparation and administration of herbal medicine. Therefore scientific approach is needed to use *Munronia pinnata* as *Nilavembu*. In this study all sorts of references about *M. pinnata* and *Nilavembu* have been collected and relevant material is compiled from various available classics texts and research papers to compare with *Nilavembu* (T). and identified the *M. pinnata* is not as a *Nilavembu* (T) which is mentioned in ancient Siddha texts. According to this study, *Nilavembu* were stated for the treatment of *Vatha sura*, *Neerettam*, *sura thosham* and *piththa Mayakkam*. The plant used as *Nilavembu*; should passify the *Vatha* as well as *piththa*. Plant *M. pinnata* is, Bitter taste, pungent *vipakam* and cold potency. There for it has property of pacifying *kapha* and *piththa* and aggravating *vatha*. There for using *M. pinnata* in the treatment of *Vatha suram*, further aggravates *Vatha* and may leads to danger condition. Even though, *M. pinnata* has Bitter tonic and Antipyretic actions, therefore it can used to treat other type of *sura thosham* and *piththa* aggravating conditions.

Keywords; *Munronia pinnata*, *Nilavembu*, *Vatha suram*, *suram*.

I. INTRODUCTION

Nilavembu is one of the unique herbal drug has been using from ancient time for the treatment of fever. There is no any botanical description were mentioned by siddhars to proper identification of plant *Nilavembu*. Due to this reason, there are number of plants such as *Andrographis paniculata*, *Swertia chirata* (Murugesa muthaliyar, 2008), *Gentiana kurroo* (Kannusami pillai, 2006), *Munronia pinnata* (Department of ayurvedha, 2002).

The reason may be unintentional adulteration or need of substitution because uncertain identity or cost of original drug.

Among these plants *M. pinnata* belongs to original *Nilavembu* by practitioners' mostly traditional practitioners (observational study). In Srilanka however no any other literature evidence of Tamil name to *Munronia pinnata* except Department of ayurvedha, 2002. But Srilankan standard medicinal botany text books such as Jeyaveera M.A, 1982 and Dassanayake M.D, 1995 mentioning that *M. pinnata* often used as substitute for *Chirata* (*Swertia chirata*).

But misidentification of species and the subsequent substitution with unsuitable material could lead to a real danger in the preparation and administration of herbal medicine.

The herb or drug using for medicine preparation must be procured and identified properly. Lack of standard drug of course is a serious drawback (Narayananappa et al, 1983). But at present the adulteration and Substitution of the herbal drugs is the burning problem in herbal industry (Om Prakash et al, 2013). It may be intentional practice or, unintentional. Unintentional adulteration may be due to following reasons; Confusion in vernacular names between indigenous systems of medicine and local dialects, Lack of knowledge about the authentic plant, Non-availability of the authentic plant, Similarity in morphology and or aroma, Careless collection etc (Mitra et al, 2007).

However in some conditions substitution is essential, because of Non-availability of the drug, Uncertain identity of the, Cost of the drug, Geographical distribution of the drug, The adverse reaction of the drug (Sarin , 1996) (Mishra et al, 2002) (Mukherjee et al , 2005).

Therefore A drug to be considered as a substitute should fulfil the following criteria – Similarity in Rasa-panchakas, Exhibit similar therapeutic effects, In a formulation the pradhana Dravya I,e, the Major ingredient should never be substituted. When considering substitution with totally different drug, the most essential criteria for substitution is the Pharmacological activity rather than Morphology or Phyto constituents (Poornima, 2010).

Therefore present study deals with a comparative review of *M. pinnata* vs Tamil traditional herb *Nilavembu* mentioned by Siddhars. This is a literature review type of study. In this study detail study of *Nilavembu* and *M. Pinnata* were made to prove *M. Pinnata* is not *Nilavembu* which is mentioned in ancient Siddha text.

1.1 Objective

To determine the *Munronia pinnata* is not a *Nilavembu* which is mentioned in ancient Siddha texts.

II. LITERATURE REVIEW

Present study deals with this section outlines detail review of Tamil traditional herb *Nilavembu* and *M. pinnata*.and arrived conclusion that the plant *M. pinnata* is not a *Nilavembu*.

2.1 *Nilavembu*

Botanical name: There are number of botanical names were used in different texts and research papers such as:-

- *Andrographis paniculata* (Murugesu muthaliyar, 2008), (lavekar et al,2009) (Thillaivanan et al 2015) (Anbarasu et al, 2011) (jayaprasad et al, 2012) etc.
- *Swertia chirata*, (Joshi et al, 2005) (Alka et al, 2006).
- *Gentiana kurroo*, (Kannusami pillai, 2006)
- *Munronia pinnata* ((Department of ayurvedha, 2002)

Part use: leave and stem

Organoleptic character:

Suvai : Bitter

Veeryam : Heat

Vipakam : Pungent (Kannusami pillai, 2006) (Murugesu muthaliyar, 2008).

Actions:

Stomachic, Alterative, Tonic and Stimulant

Medicinal use

*"vathasuram neerettam maatrum surathodam
Kaathamena ooda kadiyum kaan- maatharase
Piththa mayakkarakkum pinpu thelivai kodukkum
Suththa nilavembin tholil"*

Abstract:-

The pure *Nilavembu* cures *vaatha suram* (fever due to aggravation of vatha dhosha) , *Neerettam* (sinusitis), *Suram* (fever) *piththa mayakkam* (Kannusami pillai, 2006) (Murugesu muthaliyar, 2008).

2.2 *Munronia pinnata*



Fig. 1 - *Munronia pinnata*

Synonym :- *Melia pumila* (Jeyaveera M.A, 1982) (Dassanayake M.D, 1995), *Munronia pumila*, *Munronia hainanensis* (Department of ayurvedha, 2002)

- a. Family: Meliaceae
- b. Tamil name: *Nilavembu* (Department of ayurvedha, 2002)
- c. English name: King Bitter,Ground Bitter, Ground Neem (SL flora, 2014)
- d. Sinhala name: *Binkohomba* (Jeyaveera, 1982)
- e. Sanskrit Name: *Bhūnimba* (Department of ayurvedha, 2002)
- f. Morphology

Very small hardly shrub, 5-15 cm long, Unbranched stems, a whitish bark and long woody root; bark finely fissured. Leaves rather crowded, pinnate, petioles, 1-4.5 cm long, hairy; leaflets 1-3 pairs and a large terminal one, stalked, oval, oval, entire or coarsely lobed, the terminal leaflet 2-5cm long, 1.5- 3 cm broad, lateral leaflets 0.8-2.7cm long, 1.5-3 cm broad, scantily pubescent above, densely hairy below;

Flowers regular, bisexual, white, scented, 2.5cm long and as much across when open, bracts linear, 2.5mm long, hairy inside and outside, lobes broadly lanceolate, 1.5-1.6cm long, 0.6-0.75 cm broad, sub acute, hairy outside specially along the midrib, glabrous inside, stamens 10, filaments connate into a tube which adheres to corolla tube at the base and terminating in 10 filiform teeth at the mouth, hairy on both surface, base recurved in to a glabrous inside; stamens 10, filaments connate into a tube which adheres to corolla tube at the base and terminating in 10 filiform teeth at mouth; hairy on both surface, base recurved into a glabrous sheath round the ovary and part of the style, anthers almost sessile, erect, alternating with the teeth, 2mm long, narrow sterile at the top and hairy outside; ovary superior, pyramidal, 1.2mm long, 5-locular with 2 superposed ovules in each loculus, style 2 cm long, hairy 3/4 way up from base, stigma capitates; Flowers during July, august and April; Fruit a depressed globose 5-lobed capsule, 1.2cm diam, and hairy. Seeds pyriform, narrowly winged, smooth, brown. (Jeyaveera M.A, 1982)

- g. Part use: Whole herb (Department of ayurvedha, 2002)

- h. Organoleptic characters:

Guna:	Lahu and Ruksha
Taste:	Bitter
Vipakam:	pungent
Veeryam:	cold potency (Department of ayurvedha, 2002)

- i. Chemical compositions

Liminoids, triterpinoids (Darmadhesa et al, 2012), phytosterols, fatty acids, sesquiterpenes (Napagoda et al, 2014),

j. Actions

Bitter tonic (Jeyaveera M.A, 1982) (Dassanayake M.D, 1995)
Antipyretic (Darmadhesa et al, 2012).

Antimalarial, Anti Bacterial, Anti Fungal, Anti Viral, Anticancer, Cytotoxic (Darmadhesa et, al 2012), Anti-inflammatory (Napagoda et al, 2014)

k. Medicinal usage

A decoction of this plant is an excellent bitter tonic often used as a substitute for Chirata (Swertia chirata)

It is given for fever, dysentery and purification of blood (Jeyaveera M.A, 1982) (Dassanayake M.D, 1995).

III. METHODOLOGY

This is a review.

In this study all sorts of references about *M. pinnata* and *Nilavembu* have been collected and relevant material is compiled from various available classics texts and research papers to compare with *Nilavembu* (T). and identified the *M. pinnata* is not as a *Nilavembu* (T) which is mentioned in ancient Siddha texts.

Findings of *M. Pinnata* and *Nilavembu* were compared to identify *M. Pinnata* as not *Nilavembu*.

Comparison were made based on organoleptic characters, pharmacological action and medicinal properties of both plants.

All complied matter is reorganized and critically analysed for the discussion and attempt has been made to draw some fruitful conclusions.

IV. RESULTS AND DISCUSSION

According to Siddha medicine imbalance of tridhosa is main factor for disease condition. It was stated in following stanza (shanmugavelu M, 2009).

“மிகினும் குறைந்தும் நோய் செய்யும் நாலோர் வழிமுதலாய் எண்ணிய முன்று”

Therefore treatment of any condition should be focused on pacifying the imbalanced *Doshas*.

According to stanza of *Nilavembu*, the pure plant *Nilavembu* cures *Vatha Suram*, sinusitis (*Neerettam*), “*Sura thodam*” *Piththa Mayakkam* (Giddiness due to aggravation of *Piththam*). Table one indicates medicines which is prepared using *Nilavembu*

TABLE I - MEDICINES THAT CONTAIN *NILAVEMBU* AS A INGREDIENTS

Medicine	Indication	Reference
<i>Thontha sura kiyalam</i>	<i>Thontha suram</i>	(Prema S, 1996)
<i>Thapasura kiyalam</i>	<i>Thapasuram</i>	(Prema S, 1996)
<i>Vidasura kiyalam</i>	<i>Vida suram</i>	(Prema S, 1996)
<i>Orunaal maatal sura kiyalam</i>	<i>Orunaal maatal suram</i>	(Prema S, 1996)
<i>Sarvamaaalar sura kiyalam</i>	<i>Orunaal maral suram, irunaal maatal suram, 3m maral suram, 4m maral suram, iravu suram.</i>	(Prema S, 1996)
<i>Seethe sura kiyalam</i>	<i>Seethe suram</i>	(Prema S, 1996)
<i>Maalai sura kiyalam</i>	<i>Maalai suram (evening raise of temperature)</i>	(Prema S, 1996)
<i>Sarva sura kiyalam</i>	<i>Sarva suram</i>	(Prema S, 1996)
<i>Pirasaviththa pen sura kiyalam</i>	Fever on puperial period	(Prema S, 1996)
<i>Patpadathi kashayam</i>	All type of fever	(Venkadrajan S, 1991)
<i>Nilavembu kashayam</i>	Fever with body pain	(Venkadrajan S, 1991)
<i>Hareethakyathi kashayam</i>	All type of fever	(Venkadrajan S, 1991)
<i>Sapthanathi kashayam</i>	Excess vomiting, <i>thontha suram</i> , chronic fever, <i>uzhalai</i> .	(Venkadrajan S, 1991)
<i>Sirukanchontri kashayam</i>	All type of fever	(Venkadrajan S, 1991)
<i>Ureerathi kashayam</i>	<i>Thapa suram</i>	(Venkadrajan S, 1991)
<i>koththamalli kashayam</i>	<i>Aama suram</i>	(Venkadrajan S, 1991)
<i>Kuruvichcham ver kashayam</i>	<i>Samnipatha suram</i>	(Venkadrajan S, 1991)
<i>Musthakasi kashayam</i>	<i>Samnipatha suram</i>	(Venkadrajan S, 1991)
<i>Sura kiyalam</i>	All type of fever	(Kannusamiyam pillai, 1998)
<i>Pancha moola kiyalam</i>	Chronic fever, hepatitis	(Kannusamiyam pillai, 1998)

Based on this, the plant used as Nilavembu; should passify the Vatha as well as piththa. The plant Nilavembu is Bitter taste. Bitter taste aggravates Vatha and pacifies piththa. At the same time Nilavembu has the hot potency which helps to pacify aggravated vatham. “Ama” is the main factor in pathogenesis of suram (fever) and which is produce by indigestion or any other abnormalities in GI system (shanmugavelu M, 2010). Pungent vipakam increase the function of pitta and helps to proper digestion and also the plant is stated for stomachic action. These helps to eliminate Ama. Bitter taste and pungent vipakam and hot potency helps to normalize aggravated kapham. This helps to treat Neerettam mentioned in stanza. There for the pure Nilavembu can cure Vatha sura(feaver with body aching pain) , Neerettam(sinusitis) ,sura thodam(Fever) piththa Mayakkam (fainting due to piththa aggregation).

Alterative and bitter tonic properties of nilavembu are treat fever condition as well as help to regain body strength. Therefore the plant identifying as Nilavembu should fulfil above mentioned properties.

The names Nilavembu, Binkohomba and Bhu-nimba give the meaning of “Ground Neem”. When considering these vernacular name, the plant should be categorize under Neem family (meliaceae), based on this M. pinnata can identify as Nilavembu. But when we considering the treatment using Nilavembu the selected plant should fulfill the medicinal use stated by Siddhars.

According to Ayurvedha the plant M. pinnata has Bitter taste, pungent Vipakam and cold potency. Bitter taste aggravates Vatha and pasify Pitta and Kapha. Pungent Vipakam, aggravate Vatha and Pitta and passify Kapha. Cold potency aggravate Vatha and Kapha and passify Pitta. There for altogether M. pinnata is Kapha Pitta Shamakai (Passify kapha and piththa). Therefore M. Pinnata can use as Nilavembu to treat Piththa mayakkam and Neerettam .

Due to cold potency of Munronia pinnata is fails to treat Vatha Sura. Instead of that, it will further aggravate Vatha. At the same time, M. pinnata takes action of Bitter tonic and Antipyretic therefore this plant lowers the elevated temperature as well as regains the body strength. Anti microbial and anti malarial properties of M. Pinnata also exhibit as it can use to treat fever due to infections. Based on this findings M. Pinnata can used as Nilavembu to treat any other type of fever condition except vatha sura.

V. CONCLUSION

Based on these findings following conclusion can drown down,

M. pinnata is failure to identify as *Nilavembu*(T) because of *vatha* aggravating property. Therefore *M. Pinnata* should not use to treat *vata* aggravating conditions such as *vatha suram*. Though it can use as substitute for *Nilavembu* in Siddha formula which is going to treat *piththa* and *kapha* disorders such as *Neerettam*, “*Sura thodam*” *Piththa Mayakkam*.

Any one of other species such as *Swertia chirita*, *Andrographis panniculata* or *Gentiana kurroo* should be pure *Nilavembu*(T) which is stated by siddhars.

VI. SUGGESTION

Further study should be made to identify pure *Nilavembu* stated by siddhars and most related substitute for pure *Nilavembu*.

REFERENCE

- [1] Alka rani rishiraj and Chhipa. (2006). Phytochemical investigation and pharmacological study of swertia chirata . 50-62.
- [2] Anbarasu K, Manisenthil Kumar KT, Ramachand. (2011). Antipyretic, anti-inflammatory and analgesic properties of nilavembu kudineer choornam: a classical preparation used in the treatment of chikungunya fever . Asian Pacific Journal of Tropical Medicine , 819-823.
- [3] Darmadhesa RM, Premakumara GAS, Hettiarachi PL and Ratnasoorya WD. (2012). cytotoxicity and in vivo antimalarial activity of aqueous whole plant extraction of Munronia pinnata(Wall) Theob.(meliaceae) in mice. research jurnal of medicinal plant , 6 (3), 267-273.
- [4] Dassanayake M.D. (1995). A revised hand book of Flora of Ceylon (Vol. IX). Newdelhi: Oxford & IBH publishing co. pvt. Ltd.
- [5] Department of ayurvedha. (2002). A compendium of medicinal plant- A Srilankan study . Srilanka: Department of ayurvedha.
- [6] Jayaprasad B, Thamayandhi d and sharavanan p.s. (2012). Traditionally using antidiabetic medicinal plants in tamil nadu. International journal of research in pharmaceutical and biosciences , 2 (1), 1-8.
- [7] Jeyaveera M.A. (1982). Medicinal plant (indeginous and exotic) used in ceylon (Vol. IV). colombo: A publication of national sceince council of sri lanka.
- [8] Joshi p, Dhawan V. (2005). swertia chirayita – an overview. Current science , 635-640.
- [9] Kannusami pillai. (2006). siddha materia medica (vegetable kingdom). chennai: Rathna nayakkar and sons.
- [10] Kannusamiyam pillai. (1998). kannusamiyam ennum vaithhiya sekaram. chennai: rathna nayakkar and sons, chennai 1.
- [11] Lavekar G. S. Padhi m. M. (2009). Management of chikungunya through ayurveda and siddha a technical report. New delhi – 110 058: central council for research in ayurveda and siddha, department of ayush, ministry of health and family welfare, government of india.
- [12] Mishra B, Shankar and Vaishya.R (editor). (2002). “Bhava Mishra’s Bhavaprakasha Choukamba Sanskrit sansthan (10th Edition ed.). Varanasi.
- [13] Mitra S K ; R.Kannan. (2007). A Note on Unintentional Adulterations in Ayurvedic Herbs. India.: R&D Center, The Himalaya Drug Company, Bangalore-562123.

- [14] Mukherjee K Pulok . (2005). “Quality Control of Herbal drugs” (1Edition ed.). New Delhi: Business Horizons.
- [15] Murugesa muthaliyar, K. (2008). siddha material medica, medicinal plants division (2 ed.). india maruthuvam homeopathy Chennai 600106.
- [16] Napagoda M, Gerstmeier J, Koeberle A, Wesely S, Popella S, Lorenz S, Scheubert K, Böcker S, Svatoš A, Werz O. (2014). *Munronia pinnata* (Wall.) Theob.: unveiling phytochemistry and dual inhibition of 5-lipoxygenase and microsomal prostaglandin E2 synthase (mPGES)-1. *J Ethnopharmacol.*, 882-90.
- [17] Narayananappa.D, Veluchchamy. (1983). Collection and Identification of Mooligai (Medicinal Plant) in siddha system of Medicine. In Subramanian.S.V, Heritage of the tamils Siddha Medicine (pp. 154-170). Madras: International Institute of Tamil Studies, Madras-113.
- [18] Om Prakash , Jyoti , Amit Kumar , Pavan Kumar , Niranjan Kumar Manna. (2013). Adulteration and Substitution in Indian Medicinal Plants: An Overview. *Journal of Medicinal Plants Studies* , I (4), 127-132.
- [19] Ponnaiyapillai I. (2000). Amirthasahara pathartha soodamaniyum vaithiya thelivum. provincial department of indegenous medicine, ministry of health N.E.P.
- [20] Poornima b. (2010). Adultration and substitution in herbal drugs a critical anaysis. *Ijrap* , 8-12.
- [21] Prema S. (1996). Agasthiyar vaithhiya sinthamani venpa 4000, 1st part. chennai: thamarai noolakam sennai 26.
- [22] Ruckshanthy J.P.D. , Pushpakumara D.K.N.G. ,Perera A.L.T. and Muhunthan R. (2002). Morphological and Genetic (RAPDs) Characterization of *Munronia pinnata* (Meliaceae). *Tropical Agricultural Research* , Vol. 14, 11-21.
- [23] Sarin YK. (1996). “Illustrated Manual of Herbal drugs used in Ayurveda” . New Delhi: joint Publication of C.S.I.R and I.C.M.R.
- [24] Shanmugavelu M. (2009). *Noi nadal Noi muthal nadal thiraddu* (1 ed., Vol. part 1). india maruthuvam homeopathy Chennai 600106.
- [25] Shanmugavelu M. (2010). *Noi nadal Noi muthal nadal thiraddu* (2nd Edition ed., Vol. part 2). india maruthuvam homeopathy Chennai 600106.
- [26] SL flora. (2014). Ground Neem or king Bitter - Bin Kohomba. Sri lanka: <http://slflora.blogspot.com/2014/10/ground-neem-or-king-bitter-bin-kohomba.html>.
- [27] Thillaivanan. S, Parthiban. P, Kanakavalli. K, Sathiyarajeshwaran. (2015). A Review on “Kapa Sura Kudineer”-A Siddha Formulary Prediction for Swine Flu. *International Journal of Pharmaceutical Sciences and Drug Research* , 7 (5), 376-383.
- [28] University of Wisconsin Writing Center’s online guide to Literature Reviews: <http://www.wisc.edu/writing/Handbook/ReviewofLiterature.html> M S Sridhar Literature Review 30
- [29] Venkadrajan S. (1991). sarapenthira vaithhiya murai(jvara roga sikitchai). thanchavoor: saraswathi mahaal noolakam.

Evaluation of haemopoietic activity of the rhizome of *Corallocarpus epigaeus* benth. Ex hook

Saranya U^{*1}, Sivaganeshan S², Varnakulendran N^{*3}

¹Intern Medical Officer, Department Of Ayurvedha Sri Lanka

²Senior professor, Department Of Biochemistry, University of Peradeniya

³Senior lecturer, Unit of Siddha Medicine, Trincomalee Campus EUSL

¹kganga28@gmail.com

²sivaskanda@gmail.com

Abstract— *Corallocarpus epigaeus* is indigenously known as *Aagasakiarudan*. Rhizomes are having many traditional claims including *Paandu Rogam*. This study is a quasi experimental study. In this study, ten volunteers with iron deficiency anemia were selected and treated with root of *C. epigaeus Choornam* in the capsular form for eight weeks. Evaluation visit were made at every weeks and signs and symptoms were recorded using 5 point likert scoring pattern. Serum hemoglobin was recorded before treatment, end of 4th and 8th weeks after treatment using sahli method. Clinical study showed, at the end of 8th week average hemoglobin was increased from hemoglobin concentration 103 g/l to 129.89g/l and also significant reduction in degree of sign and symptoms. Based on this study *C. epigaeus* rhizome provided significant improvement on hemoglobin concentration and the *Choornam* is effective to relieve the signs and symptoms of *Pandu Rogam* like Exretional tiredness, Palpitation, Paleness and Tachycardia.

Keywords; *Corallocarpus epigaeus*, *Paandu Rogam*, haemopoietic activity, quasi experimental study

I. INTRODUCTION

This is a quasi experimental study to determine the internal administration of “*kollan kovai kizhangu*” (*Corallocarpus epigaeus*) Choornam in the management of iron deficiency anaemia patients.

Anaemia is defined as low hemoglobin concentration <135g/l for men and <115g/l for women (Murray longmore, 2014). Iron deficiency anaemia develops when there is inadequate iron for hemoglobin synthesis (Murray longmore, et al 2014). Iron deficiency is a very common nutritional disorder worldwide and is known to affect approximately one third of the global population (WHO). It has affected 24.8% of the world’s population. When anemia prevalence is 20–39.9% of the general population, it is considered as a moderate public health problem by WHO (The World Bank, 2007). In Sri Lanka, anemia has become a moderate public health problem among preschool, non-pregnant, and pregnant populations as the prevalence is 15.1% (Renuka Jayatissa, 2014), 39%, and 34%, respectively (Vidaratne, 2011).

Clinical features of *Paandu Rogam* can compare with the clinical features of iron deficiency anemia. The sign and symptoms of anemia are similar to the symptoms describe in *Paandu* in *Siddha* such as Paleness, Giddiness, Exertional

Tiredness, Dyspnea, Palpitation etc. With the aim that herbo-mineral medicines may be effective to manage iron deficiency anemia without any side effects, the plant has been chosen.

Corallocarpus epigaeus Benth ex Hook (Cucurbitaceae) is a prostrate or climbing monoecious plant found in tropical countries like Sri Lanka India, Deccan and South Maratha (Jayaweera, 2006). The plant is indigenously known as *Aagasakiarudan* (Murugesa muthaliyar, 2008). The plant contains chemicals like alkaloids, flavonoids, phenols, tannins, steroids, saponins, glycosides, terpenoids (Priyavardhini et al, 2012) carbohydrates, mucilages, proteins and amino acids (Nisha Shr et al, 2010). *C. epigaeus* has several medical claims such as analgesic, anti-inflammatory, adaptogenic (Gupta, 1994) anti-allergic, antimicrobial and anticancer activity (Aiyelaagbe & Osamudiamen, 2009), hypotensive effects (Matsubara et al, 1985) and antioxidant (Jayaseelan et al, 2014) properties.

Even though the plant has good therapeutic use and traditional claims for *Paandu rogam*, till now no scientific study was available to prove activity of *C. Epigaeus* on *Paandu rogam*. Hence, the present study deals Evaluation of haemopoietic activity of the *Corallocarpus epigaeus* Benth. ex Hook rhizome.

II. OBJECTIVE

A. General objective

To determine the haemopoietic activity of the *Corallocarpus epigaeus* Benth ex Hook rhizome

B. Specific objective

To find out the effectiveness of the tested drug in the management of *Paandu*

III. METHODOLOGY

A. Patient selection

Sample size of this study was ten volunteers. Volunteers between 20 to 50 years of age, both sexes presenting with the signs and symptoms of anemia were selected on randomization schedule from “*Konesapuri*” area. Full blood count report and blood picture were obtained from authenticated medical laboratory at Trincomalee to conform the diagnosis, out of selected volunteers, ten volunteers were selected based on inclusion and exclusion criteria.

a) Inclusion criteria

Iron deficiency anemia

Age group 20-50y

Sex- both sexes

Any of following clinical features given below with reduced hemoglobin

- Pale
- Tachycardia
- Exertional tiredness
- Palpitation
- Dyspnea

Hb level <13.5 g/dl (<135 g/L) in men, and <11.5g/dl (<115 g/L) in women.

Hb level above 8g/dl in both men and women

Blood picture- microcytic hypochromic RBC

Patient those who willing

b) Exclusion criteria

Pregnant mothers

Feeding mothers

Patients with other drug treatment

Age below 20y and above 60y

Patients with severe anemia (Hb concentration below 8g/dl)

Other type anemia

c) Preparation of volunteers

The selected volunteers were interviewed on their first visit. They were assurance that all information obtain from them and Drug, dose, duration about study and proper diet and regiments according to the study, which were explained to the volunteers and written concern was obtained from them.

B. Plant collection and Preparation of medicine

Fresh and healthy plant root of *C. epigaeus* were collected from Trincomalee district and plant was authenticated by Gunapadam, pharmacognacy division. The sand and external particles were removed from the root. Then it was washed thoroughly, outer covering was removed and purified in milk.

General rule of method of preparation of *Choornam* were adapted(Narayanaswami, 1995). The purified root was cut into small pieces and dried out under sunshade then it was bruised well & stained through fine meshes of sieve. The *Choornam* was filled in 500mg capsule.



Fig-1 *C. epigaeus* Choornam



fig-2 capsule

C. Clinical assessment

Selected volunteers were examined based on standard clinical case sheet. Symptoms specific for iron deficiency anemia were recorded in data sheet using likert scale mentioned below. This scale measures the level of symptoms that is relative just to the individual sufferer.

TABLE 1

Symptoms	scoring	
	Always	5
Exertional tiredness	Often	4
Palpitation	Some time	3
Giddiness	Rare	2
Breathlessness	Never	1
Chest pain		
Sleepiness		

The volunteers were subjected to a detailed clinical examination. Observed objective parameters which are closely related to iron deficiency anemia were analyzed using following scoring pattern.

TABLE -2

Sign	Scoring	
	Never	0
Pale	Mild	1
Angular stomatitis	Moderate	2
Bold tongue	Sever	3
Brittle nail		
Heart rate	<80 bpm	0
	80-90 bpm	1
	90-100 bpm	2
	>100 bpm	3

A total volume of 2 ml of venous blood was obtained from each participant into EDTA (Ethylene Diamine Tetra Aceticacid) containers for hemoglobin measurement. Universal precautions were followed during blood collection, transportation, storage, and disposal to protect the participants as well as the researchers.

Blood hemoglobin concentrations of the participants were measured using sahli method in authenticated medical laboratory at Trincomalee to conform the diagnosis.

D. Intervention

Selected patients were treated with capsulized *choornam* of *kokollan kovai kizhangu* in dose of 1g (2 capsule) 6 hourly orally.

E. Study period

Study was conducted for 8 weeks

F. Method of data analysis

Evaluation visit were made at end of 1st, 2nd, 3rd, 4th, 5th, 6th, 7th & 8th weeks from the registration. The patient's signs and symptoms were recorded before treatment and at every visit after the treatment with likert scoring pattern depending upon their severities.

Serum hemoglobin Changes was evaluated by calculation of serum Hb before treatment, 4th and 8th week after treatment. Improvement of Hb was determined by following manner to this study mild improvement determined by the range of 1-15g/l increased Hb, moderate significant improvement determined by the range of 16 - 30g/l increased Hb and marked significant improvement determined by increased Hb >30g/l.

Effect of drug was evaluated based on changes in the subjective and objective parameters mainly based on clinical observation by grading methods and hemoglobin value before treatment & after treatment using Microsoft excel 2007.

IV. RESULT

Results of clinical trials were considered in 9 volunteer, one was dropped.

A. Effect of drug on haemopoietic activity

Figure-3 shows Hemoglobin concentration of each volunteer over subsequent visit. Figure-4 shows mean hemoglobin concentration before treatment and after 4th and 8th weeks of treatment and Table-3 shows Summary finding of haemopoietic activity



Fig-3 Hemoglobin concentration of volunteers over subsequent visit

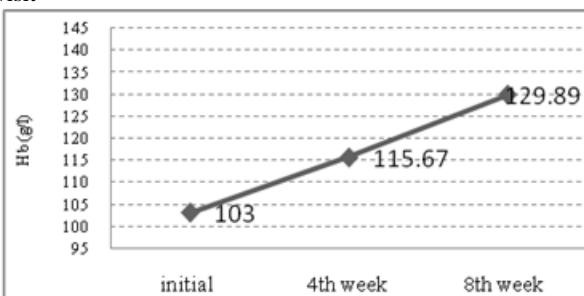


Fig- 4 Mean Hb value over subsequent visit

TABLE -3 SUMMARY FINDING OF HAEMOPOIETIC ACTIVITY

		improvement		
		No	Mild (increased Hb by 1-15g/l)	Moderate (increased Hb by 16-30g/l)
BT- 4 th week AT	Pt No	0	6	3
	% of total	0%	66.66%	33.33%
BT- 8 th week AT	Pt No	0	1	5
	% of total	0%	11.11%	55.55%

(pt No:- number of patients)

Based on these results, at end of 8th week average hemoglobin was increased from hemoglobin concentration 103 g/l to 129.89g/l scilicet at end of 8th week mean increased Hb was 26.88. Summary finding of haemopoietic activity revealed that After 8 weeks treatment 1 volunteer (11.11%) shown mild improvement, 5 volunteers (55.55%) shown moderate significant improvement and 3 volunteers (33.33%) were shown marked significant improvement.

B. Effect of drug on sign and symptoms

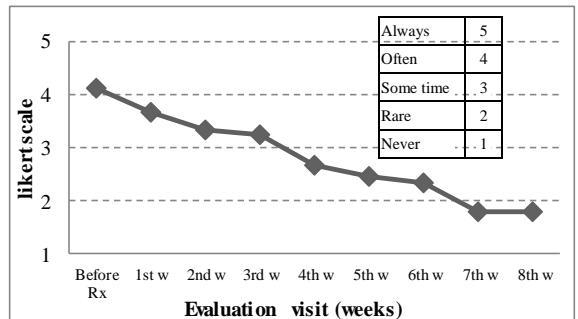


Fig-5 Mean change in exertional tiredness over subsequent visit.

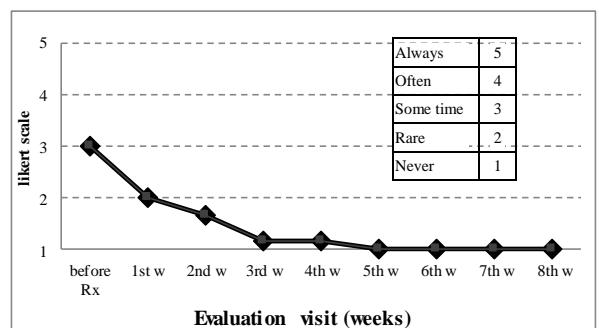


Fig-6 Mean change in palpitation over subsequent visit

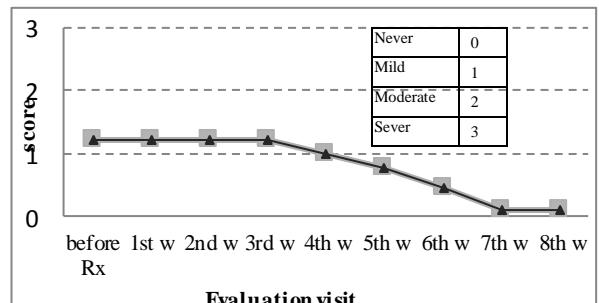


Fig-7 Mean change in paleness over subsequent visit

TABLE -4 EFFECT OF THERAPY ON HEART RATE

Heart rate		(<80)	(81-90)	(91-100)	(>100)
Before treatment	Pt No	2	3	3	1
	% of total	22.22%	33.33%	33.33%	11.11%
After treatment	Pt No	9	0	0	0
	% of total	100%	0%	0%	0%

V. DISCUSSION

According to this clinical study, *Corallocarpus epigaeus* rhizome Choornam on Pandu Rogam with special reference to iron deficiency anemia showed moderately significant result in improving hemoglobin concentration and significant result in the relieving of symptoms like Exretional tiredness, Palpitation, Paleness and Tachycardia.

Effectiveness of drug is discussed on the basis of *suva*, *Veeriya*, *Vipaka*, action and properties of selected plant. According to Siddha medicine, *Paandu Rogam* is as a problem arising due to the reduction of *Pitham* specially *Ranjaka Pitham* and aggravation of *Kapham* (Rajeswari, 1983). Therefore the trial drug should be has the property of normalizing *pitham* and *kapham*.

C. epigaeus has bitter taste (Murugesa muthaliyar, 2008), it helps to normalizing the *Azhal Dosha* and also Bitter taste has got *Deepana* (facilitate digestion), *Pachana* (augment digestion) properties (shanmugavelu, 2009), this helps to treat iron deficiency due to digestion and absorption problem.

The plant is *ushna veeriyam* and pungent *vipakam*. *ushna veeryam* and pungent *vipakam* aggravates *pitham*, has the property of pacify *kapham* and also improve digestive fire (Anaivaari, et al, 2005).

Plant has the action like tonic and alterative actions (Murugesa muthaliyar, 2008). Which helps to alleviate weakness occur in *pandu rogam* and strengthen the body.

C. epigaeus also has the property of Anthelmintic, anti inflammatory, anti microbial activities (Aboaba et al, 2001) (Ramkumar, et al, 2007) (Shri Vijaya Kirubha et al, 2011) this may helps to treat causes of iron deficiency anemia likes worm infestation, gastritis and other inflammatory condition of gastro intestinal tract and menorrhagia due to pelvic inflammatory diseases.

Therefore stanza for *Corallocarpus epigaeus* mentioned in *Gunapadam* text was scientifically proved through this study.

VI. CONCLUSION

According to this clinical study, following conclusion can be drawn. *Corallocarpus epigaeus* rhizome *Choornam* provided moderate significant improvement on hemoglobin concentration. The *Choornam* is effective to relieve the signs and symptoms of *Pandu Rogam* like Exretional tiredness, Palpitation, Paleness and Tachycardia.

Among the general character of *C. epigaeus* quoted in *Gunapadam* text, *Paandu Rogam* is proven scientifically from this study.

VII. SUGGESTIONS AND RECOMMENDATION

Evaluation of Haemopoietic activity of rhizome of *Corallocarpus epigaeus* since it is a under graduate research procedure, there for the future research can be consider with large number of patients and prolong duration.

Corallocarpus epigaeus has several medical claims even though; all general characters of *Corallocarpus epigaeus* mentioned by siddhars are not scientifically proved. Therefore future study can be considered to prove remaining general character of this plant.

Plant has significant effect on haemopoietic activity therefore future study can be consider to analysis nutrition value of the plant rhizome.

REFERENCE

- [1] Aboaba, O.O. and Efuvape, B.M. (2001). Antibacterial properties of some Nigerian species. Bio. Res. Comm , 183-88.
- [2] Aiyelaagbe, Osamudiamen,. (2009). Phytochemical screening for active compounds in *Mangifera indica* leaves from Ibadan. Oyo state. Pl. Sci. Res , 11.
- [3] Anaivaari, Anandan.R. (2005). A compendium of siddha doctrine (1E ed.). chennai: dept of indian medicine & homeopathy, Chennai 600106.
- [4] Gupta. (1994). Prospects and perspectives of natural plant products in medicine. Ind. J. Pharmacol .
- [5] Jayaseelan M, T.Arumugam, N.Thangaraj. (2014). Evaluation of antioxidant and anti-inflammatory activities of *Corallocarpus epigaeus* (Hook.F.) rhizomes. Int J Pharm Biomed Res , 5(1).
- [6] Jayaweera, D. (2006). Medicinal Plants (Indigenous &Exotic) Used in Ceylon (Vol. 2). Colombo, sri lanka: The national science foundation of Srilanka.
- [7] Matsubara Y, Kumamoto H , Iizuka Y. (1985). Structure and hypotensive effect of flavonoid glycosides in *Citrus unshiu* peelings. J. Agri.Biol. Chem .
- [8] Murray longmore, I. B. (2014). oxford hand book of clinical medicine (9 ed.). india: oxford university press.
- [9] Murugesa muthaliyar, K. (2008). siddha material medica, medicinal plants division (2 ed.). india maruthuvam homeopathy Chennai 600106.
- [10] Narayanaswamy.V (1995) Pharmacopia of hospital of Indian medicine, siddha (2 ed) Tamilnadu siddha medical board, Madras-600 106.
- [11] Nisha Shr C, J. Balaji, S. Venkatramanan, K.L. Madhumathi. (2010). Pharmacognostical and preliminary phytochemical screening of the root and rhizome of *Corallocarpus epigaeus*.. Int J Pharm Biomed Res , 2.
- [12] Priyavardhini S, V. K. (2012). Efficacy of Phytochemical and Antibacterial activity of *Corallocarpus epigaeus* Hook.f. International Journal of PharmTech Research , 4.
- [13] Ramkumar, K.M., Rajaguru, P. and Anantham, R. (2007). Antimicrobial properties and phytochemical

constituents of an antidiabetic plant *Gymnema montanum*. *Adv. Biol. Res.*, 1, 67-71.

[14] Renuka Jayatissa,. (2014). Iron Deficiency in Sri Lanka;. Sri Lanka: UNICEF.

[15] shanmugavelu, D. (2009). *Noi nadal Noi muthal nadal thiraddu* (1 ed., Vol. part 1). india maruthuvam homeopathy Chennai 600106.

[16] Shri Vijaya Kirubha, R. Senthamarai, K. Vasuki, A.Venkateswara Rao, S. Selvadurai. (2011). Anthelmintic activity of roots and rhizomes of *Corallocarpus Epigaeus*. *Jurnal of Natural Product Plant Resource*, 1 (1).

[17] The World Bank, H. D. (2007). *Malnutrition in Sri Lanka: Scale, Scope, Causes and Potential Response*. other health study, South Asia Region, Washington, DC, USA.

[18] Vidyaratne, D. (2011). Prevalence of anaemia among children and women. *Demographic and Health Survey 2006/7*. Health Sector Development Project, Department of Census and Statistics, Ministry of Healthcare and Nutrition, Sri Lanka.

[19] web.source. Important of medicinal plant. www.Botanical-online.com.

A Review on the recent advances in Pharmacological and Phytochemical studies of *Phyla nodiflora* (Poduthalai)

V. Sivalathajini

Unit of Siddha Medicine, University of Jaffna

latha.jini@yahoo.com

Abstract - *Phyla nodiflora* is a small creeping herb, commonly known as Poduthalai. The objective of this study review of literature revealed less work on this plant and knowledge on medicinal plants uses of *Phyla nodiflora* is limited among Sri Lankan physicians. Data was gathered from Siddha and Traditional medical books, Journals and internet. The plant is used to cure many problems. It is used for pain in knee joints, for lack of bowel movement, used in ulcers and boils, in swollen cervical glands. It is also used in gonorrhea. The Antimicrobial activity, Larvicidal Activity, Antitumor activity, Anti-diuretic activity, Anti-inflammatory activity, Antiulithiatic activity, Antidiabetic activity of plant have also been traced. The plant has showed antibacterial activity against bacteria such as *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*. *Phyla nodiflora* has been the source of traditional medicines against diseases like liver disorders, dandruff control, indigestion in children etc. In this paper the plant has been reviewed for its phytochemistry, pharmacological studies. *Phyla nodiflora* is widespread all over the world. It has been used by the different tribes as traditional medicines. Certain compound has been isolated. However more investigations are to be done on the biological activity and for the action of more biologically active compounds. Presence of large number of phytochemicals indicates towards its future perspective to use it as an indigenous medicine in the pharmaceutical industry.

Keywords - *Phyla nodiflora*, Phytochemicals, Pharmacological.

I. INTRODUCTION

Plants are an essential component of the universe. After various observations and experimentations many medicinal plants were identified as source of important medicine.¹ Medicinal plants have been used since prehistoric period for the cure of various diseases. Since these are in common use by the local people and are of great importance that's why a lot of people are engaged in the trade of important medicinal herbs throughout the world. Especially, people living in villages have been using indigenous plants as medicine. Knowledge of medicinal values of plants is recognized by almost every society on earth. The inhabitants of the remote places have good knowledge about the utilization of plants because of the non- availability of synthetic drugs. In addition, for the survival, they use the plant based drugs growing nearby their villages. Based on their right or wrong experiences they discovered the therapeutic agents of these plants in particular diseases. These experiences are

transferred from parents to offspring. Forests are the richest source of the medicinal plants. India is rich in its forest wealth. The medicinal plants have contributed lot in the development of the Indian system of medicine and India is a store house of genetic diversity of medicinal plant with the increasing acceptance of traditional medicine as an alternative form of health care. The screening of the medicinal plants for active compounds is very important. Traditional medicine based on plants has played a key role in the health care system of many countries like- India, China etc. ³ Herbal medicine is still the main stay of about 70- 80% of the world population stay on the herbal medicine. *Phyla nodiflora* is the important member of the family verbenaceae showing a variety of medicinal uses. It can be the source of the indigenous medicine.

II. MATERIAL AND METHODS

Type of study: Literacy research

Study duration: March 2015- December 2015

Data collection: Data was gathered from Authentic text books of Siddha medicine, Traditional medicine and Western medical books, Journals, and internet.

III. RESULTS

Plant Name is *Phyla nodiflora* Linn. Vernacular Names are Tamil : Poduthalai, English : Frog fruit, Hindi : Bukkan, Jalpapi, Sanskrit : Vasir Vasuka, Marathi : Ratolia Vakkan. Synonyms are *Lippia incisa*, *Lippia nodiflora*, *Lippia reptans* Kunth, *Phyla incisa* Small. Classifications are Kingdom : Plantae, Division : Magnoliophyta, Class : Magnoliopsida, Order : Lamiales, Family : Verbenaceae, Genus : *Phyla*, Species : *Nodiflora*.

It is distributed in, Sri Lanka (Jaffna - Kaithady, Madduvil), India, South and Central America and Tropical Africa. It is native of California. In Jaffna, it is found wet places along bunds or irrigation canal edges and sliver banks.

Habitat and ecology are in Jaffna *Phyla nodiflora* grows best on bared ground in periodically moist sites (heavy rainfall, flooding or opening of springs that also undergo periods of water stress and with apparently poor soil structure. It is found mostly on high-moisture holding clay to clay loams soils in floodplains or wetlands. Its tolerance towards inundation seems dependent on the length of time it is flooded and the turbidity of the water. It can tolerate extended periods of waterlogged soil. However four to eight weeks of turbid water inundation may be enough to kill most individuals and up to three months inundation may be intolerable .

There are about 34 genera in this family. Genus *Phyla nodiflora* includes 21 scientific plant names of which 13 are accepted species name. *Phyla nodiflora* is a fast-growing, mat-forming and prostrate perennial plant. When in competition with other species, it can grow to a height of 20-30 cm, and dominate other plants. Once dominance is established, lippia tends to become more prostrate and lower growing. Stems of *Phyla nodiflora* are green to purple in colour when young and can become somewhat grey and woody with age. Young stems are 2-3 mm thick and can be between 30-95 cm long. Roots are produced from leaf axils along stems and consist of a central taproot; usually 50-60 cm in length, but thought to extend up to 2 m. An extensive fibrous root system extends from the taproot. Lippia also produces fibrous roots from some stem nodes. Leaves arise in pairs at stem nodes and are rounded (10- 20 mm long and 3-7 mm wide), entire or bluntly toothed at the tip and narrow towards the petiole (2-5 mm) at the leaf base. Leaves can be somewhat canescent, that is, having a greyish green appearance due to a covering of fine hairs on their surface (hence the botanical name) Flowers White to purple flowers are produced in heads (10 mm in diameter) on long peduncles (15-45 mm) arising from leaf axils. As they mature, individual flowers become tubular at their bases, ending in a 2-lipped calyx and surrounded by longer broad overlapping bracts. The lower lip (2-lobed and yellow towards the base) is twice as long as the upper lip (3-lobed). Fruits 1-1.5 mm in diameter, release two tiny brown, oval, flattened seeds at maturity. Seeds barely visible to the naked eye.



Phytochemistry

The plant is rich in many important medicinal useful compounds. The plant contains a variety of constituents such as triterpenoids, flavonoids, phenols, steroids, and many others. Among these flavonoids were the most commonly found. Nodifloretin, β -sitosterol glycoside and stigmasterol glycoside from the leaves of *Phyla nodiflora*. Nodifloridin A and Nodifloridin B along with lactose, maltose, glucose, fructose, and xylose were isolated from the plant. Two new flavone glycosides lippiflorin A and lippiflorin B, along with the known compound nepetin and batalifolin from the ethanol extract of *Phyla nodiflora* were isolated. From the flowers of *Phyla nodiflora*, two flavones glycosides, 6-hydroxyluteolin-7-Oapioside and luteolin-7-O-glucoside,

and three flavones 6-hydroxyluteolin, nepetin, and batatifolin were isolated. From the alcoholic extracts of *Phyla nodiflora* two phenylpropanoid compounds acteoside and 2'-O-acetyleinacoside and a flavones demethoxycentaureidin were isolated. From *Phyla nodiflora*, twelve flavones sulfates Hispidulin 7-sulfate, Hispidulin 7,4'-disulfate, Jaceosidin 7,4'-disulfate, Nepetin 3',4'-disulfate, Nodifloretin 6,7-disulfate, 6-Hydroxyluteolin 6,7-disulfate, Nodifloretin 7-sulfate, 6-Hydroxyluteolin 6-sulfate, 6-Hydroxyluteolin 7-sulfate, Jaceosidin 7-sulfate, Nepetin 7-sulfate, and Hispidulin 4'-sulfate along with the known compounds Nepetin, Hispidulin, and Jaceosidin. Halleridone and Hallerone as their acetyl derivatives from the leaves of *Phyla nodiflora* were isolated. From the methanolic extract of the aerial parts of *L. nodiflora*, a new triterpenoid lippiacin, a new steroid 4', 5'- dimethoxybenzoloxy stigmasterol along with the known stigmasterol and β -sitosterol were isolated.

Published researches:

Antimicrobial activity

The antimicrobial activities of *Phyla nodiflora* was also seen.

Antifungal activity

The antifungal activity of crude extracts of *Phyla nodiflora* against the human pathogenic fungi was reported. The crude extract of various solvents of *Phyla nodiflora* had been screened for Antifungal activity against *Aspergillus niger*, *A. Flavus*, *Paecilomyces varioti*, *Microsporum gypseum*, *Trichophyton rubrum*. All crude extract had significant inhibition activity against most of the fungi. Ethanol extract had maximum inhibition activity (100 %) against tested organism as compared to aqueous (82.6%), Methanol (61 %), Ethyl acetate (87 %) extracts. There are some terpenoids in *Phyla nodiflora* composition,

Larvicidal Activity

The essential oils of the leaves of *Phyla nodiflora* were tested for larvicidal activity against the instar larvae of *Aedes aegypti*.

Antibacterial activity

The Methanolic extract of *Phyla nodiflora* had been evaluated for antibacterial.

Antitumor activity

The methanolic extract of *Lippia nodiflora* has been evaluated for antitumor activity using Erich'sascites carcinoma (EAC) bearing swiss albino mice. The mice were administrated with the methanol extract at 200and 400 mg/kg of body weight daily for nine days after 24hours of tumor inoculation.

Anti-diuretic activity

The diuretic potential of methanol and aqueous extracts of the aerial parts was assessed in albino rats using *in-vivo* Lipschitz test model. The volumes of urine, urinary concentration of sodium and potassium ions were the parameters of the study.

Anti-inflammatory activity

The crude methanol extract and the isolated compound of cyclo-pentano phenanthrenol from *Phyla nodiflora* were

assessed for anti-inflammatory activity. Human peripheral blood mono nuclear cells were used as models to examine intracellular protein levels of pro-inflammatory mediators(MAPK and NF-KB) and the mitogen induced lymphocyte proliferation.

Antiulithiatic activity

The ethanolic extract of *Phyla nodiflora* had been evaluated against calculi producing Diet induced urolithiasis. *Phyla* was studied for its antiulithiatic activity against most common type of renal stones.

Antidiabetic activity

The effect of methanol extract of *Phyla nodiflora*. In Streptozotocin induced diabetic rats was reported. The methanol extract of *Lippia nodiflora* at three dose levels were administered orally to Streptozotocin (STZ) (40mg/kg bw) induced diabetic rats for 15 days.

IV. CONCLUSION

Phyla nodiflora is widespread all over the world. It has been used by the different tribes as traditional medicines. Certain compound has been isolated. However more investigations are to be done on the biological activity and for the action of more biologically active compounds. Presence of large number of phyto chemicals indicates towards its future perspective to use it as an indigenous medicine in the pharmaceutical industry.

REFERENCES

- [1] K.R.Kirtikar, B.D.Basu, Indian medicinal plants, 2nd edition, Volume-I, 1998, Page – 465-468.
- [2] Compendium of Indian medicinal plants, Volume-III, 1998, Page – 648-650.
- [3] Nadkarani A.K Indian Materia Medica. 3rd ed., India; Popular prakashan private limited, 2010, Page - 1221-1224.
- [4] Trimen H, Hooker J.D. A Hand book to the Flora of Ceylon – Part one, 1st ed., Bishen singh mahendra pal singh, 1984, Page – 425.
- [5] The Wealth of India raw materials Vol . V. 1st ed; New Delhi; Council of scientific & industrial research, 2001, Page – 37.
- [6] Jeyaweera D.M.A. Medicinal plants used in Ceylon-Part -05; The national Science foundation, Sri Lanka, 2006, Page – 429.
- [7] Sivalathanji.V, Sathyaseelan.V, Present status of Potential medicinal plants at Kallakam, Jaffna, National Conference on Indigenous System of Medicine-2015, Page-35.
- [8] Murugesamuthaliyar, K.S Gunapadam Part I Mooligaivagupu 7th edition Indian medicine & homeopathy dept Chennai Page - 512.
- [9] Jayatunga Y.N.A. and Jayakody R.L. 1995. Symposium on “Medicinal plant – biodiversity and economy” Environment committee of the SLAAS. Colombo – 7.
- [10] Mahan Ram, H.Y.Sharma, A.K. and Sukhdev, 1998. The Wealth of India (Volumes 1-3)– Council of Scientific & Industrial Research New Delhi.
- [11] CL Quave, LRW Plano, T Pantuso, BC Bennett, *Journal of Ethnopharmacology*, 2008, 118, 418–428.
- [12] F Cutillo, B D’Abrosca, M DellaGreca, A Fiorentino, A Zarrelli, *Phytochemistry*, 2006, 67, 481–485
- [13] PF Esteves, A Sato, M A Esquibel, F C Buzzi, AV Meira, VC Filho, *Lat. Am. J.Pharm.*, 2009, 28, 454-456.
- [14] T.V.sambasivam pillai ,Tamil- English dictionary 1314_1317
- [15] Malik HMA. Treatment through Herbs in: Medicinal Plants of Pakistan, (Eds.): R. Anwar, N. Haq, And S. Masood. 2001 pp. 21-23
- [16] Qureshi, R. Floristic and ethnobotanical study of Desert- Nara Region, sindh. Shah Abdul Latif University, Pakistan Research Repository ,2004, pp. 454
- [17] Sudershan C. Shoot bud regeneration from leaf explants of a medicinal plant. *Enicosternma Oxillare*. Current science 74, 1998, 1099-1100.
- [18] Richardson R. *Lippia (Phyla nodiflora)*: its distribution and impact throughout the eastern mainland states of Australia, a post graduate report, Faculty of Applied Science, The University of Queensland, Gatton College, Lawes, 1994.
- [19] Lucy M, Powell E, McCosker R, Inglis G & Richardson R . *Lippia (Phyla canescens)*: A review of its economic and environmental impact on floodplain ecosystems in the Murray Darling Basin, Department of Primary Industries, Brisbane, 1995.
- [20] Lazarides M, Cowley KJ & Hohen P. CSIRO handbook of Australian weeds, CSIRO, Australia, Collingwood, Victoria, 1997.
- [21] Dellow JJ, Motley K, Storrie A, Spenceley J.), *Lippia*, Agfact, 2001, P7.6.52, NSW Agriculture
- [22] Fensham RJ. ‘The grassy vegetation of the Darling Downs, south-eastern Queensland, Australia: floristic and grazing effects’, *Biological Conservation*, vol. 84, 1998 no. 3, 301–1.
- [23] McCosker, RO. *Lippia (Phyla nodiflora)*: an invasive plant of floodplain systems in the Murray–Darling Basin, a report on the distribution and ecology of *lippia* in the lower Gwydir Valley and the Murray–Darling Basin prepared for the Gingham WatercourseLandcare Group, Department of Ecosystem Management, University of New England, Armidale, NSW. 1994
- [24] Jenson M. ‘From the best to the worst’, *The Border News*, 29 April 2002, p. 1.0.

Literature review on Mud therapy

V.Sivalathajini¹, K.Sounthararajan²

^{1,2}Unit of Siddha Medicine, University of Jaffna.

latha.jini@yahoo.com

Abstract - Historically, Mud therapy is the treatment has been used for centuries in Eastern and Western countries. It is a type of treatment, mud is one of five elements of nature having immense impact on the body in health as well as in sickness. It can be employed conveniently as therapeutic agent in many diseases. The objective of this study the growing interest caused by the mud therapy in indigenous medicine, employed to free interference in body, interference field it's an area on the body that tests abnormally as a results of individual of multiple factors. Such as Scars, Nutritional deficiencies, metal toxicity, Contusion and other skin affections. Data was gathered from Siddha, Traditional, Western medical books, Journals and internet. Mud retains moisture for a long time, when applied over the body part it causes cooling and its shape, consistency can be changed easily by adding water. Mud procured for treatment purpose should be black cotton soil with greasiness and free from pollution and contamination. Mud once purified, comes in to diverse usage and applications like bathing with mud, sleeping or walking bare foot in mud, mud massage. Mud therapy uses in five ways, mud pack, mud massage, mud nap, mud bath, and mud walk. Most imperative usage of the mud therapy is the application of mud packs. Scrubbing the skin mildly with mud helps to overhaul skin tissues and improves on the working of body organs rendering good blood circulation in the same, where thermal mud that contains high concentrations of minerals are spread over the body help cleanse, purify and revitalize the skin. Many health benefits in mud therapy as acne and pimples, digestive aid, constipation, diarrhoea, vomiting, eye maladies, skin affections, headache, fever, remedy of skin, for skin glow, healing benefit, anti-aging, for stress relief.

Key words - Mud therapy, Indigenous medicine, Application

I. BACKGROUND AND OBJECTIVES

Mud therapy uses for beauty culture, mud is the important element of the nature. It contain important mineral nutrition which have positive effects on human health. Mud can absorb toxic material and unwanted fluids from the human body. So it is useful for preventing any diseases, specially known for it's healing property.

General objective

Literature review on Mud therapy

Specific objective

- i. To describe the Structure of medicinal mud
- ii. To describe the effects of the Mud therapy
- iii. To carry out the Indication and Contraindication of Mud therapy
- iv. To describe the method of treatment

1. To describe the Structure of medicinal mud

Parts of Mud: Biological active substances, Microorganism, Organic substances, Non organic substances

- i. Black mud: Dark cotton soil having some greasiness is suitable for mud therapy as it is rich in minerals and also retains water for long time. It should always be free from contamination and any kind of pollution.
- ii. Colloidal complex – Includes ferrum composite, aluminium, and organo mineral connection.
- iii. Muddy solution – Consists of salts, dissolved water, sodium, magnesium, zinc sulphate, trace substance and others.
- iv. Moor Mud: It is mud produced over thousands of years from organic residue of flowers, grasses and herbs.

2. To describe the effects of the Mud therapy

- General effects : Immuno stimulant, Vaso dilative
- Local effects : Improve metabolic process in skin, Stimulate bone cells activity, Provides relaxation to the eyes, Stimulate synthesis of synovial fluid and myo relaxant.
- Biological effects : Increase flow of lymph and blood circulation, Resorptional, Analgesic, Anti spastic, Heating of tissue, Immuno modulator effect, Trophic effect, Bactericidal, Anti inflammatory

3. To carry out the Indication and Contraindication of Mud therapy

No	Indication	Contraindication
1.	Acne and pimples, eye maladies, headache, fever, healing benefit, anti-aging, for stress relief	Acute inflammation
2.	Post – traumatic condition, Hypotrophy, Atonia of muscle after fracture, Muscle rigidity	Neoplasm
3.	Digestive aid, constipation, diarrhea, vomiting	Tuberculosis
4.	Skin diseases : Psoriasis, Lecoderma, Leprosy, Urticaria, for skin glow	Hypertension Heart diseases in decompensation state
5.	Conjunctivitis, Hemorrhage in the eyeball.	Cachexia Neurosis

4. To describe the method of treatment

Mud pack

Smooth paste of the clay is made with warm water. It is cooled and spread over a strip of cloth. This mud bandages is placed on the body and covered with protective material like flannel. It is kept for 10 to 30 minutes.

Mud bath

It is applied to a large portion of the body. The clay is first grounded and then sifted to remove impurities and then made into a smooth paste with warm water. The paste is spread on a sheet and wrapped around the body. It is then covered with one or two blankets. The bath is followed by cleansing bath by a hot water shower and then a cold water shower. The duration of the bath lasts from 30 minutes to one hour.

Mud Massage - This is the simple body massage with the aid of mud. This helps to remove and expel toxins from the body via the minute pores of the skin.

Mud Nap - This is good news for all those suffering from stress, anxiety, insomnia and related maladies. Sleeping in the mud also benefits significantly in case of nervine debility and mental instability.

Mud Walk - This means walking barefoot in mud. This practice has since ages been accepted as it is believed to be wonderful for the optimum functioning of the kidneys. Not only this, it has other advantages like enhancing the gravitational influence within the body. Older generations have always believed that the mud walk is highly amicable for the eye vision.



II. MATERIAL AND METHODS

Type of study: Literacy research

Study duration: October 2015- February 2016

Inclusion criteria: Authentic text books of Siddha medical system.

Text book of Western medicine.
Text books of indigenous medicine.
Journals.

III. RESULTS AND DISCUSSION

- Therefore it is essential to keep the pack moistened to avoid excessive dryness and stretching. Also, the mud must be carefully chosen for obtaining desired results, and its quality must be ensured to avoid any complications.
- Regular mud baths may be considered as natural beauty treatment procedure as it also helps in improving skin complexion and reducing spots and patches, possibly the result of some skin disorder.
- It relaxes muscles and improves blood circulation. It maintains metabolism rendering positive impact on digestion.
- It is useful in conditions of inflammation/swelling and relieves pain, good hair conditioner and is good for skin, useful in condition of stiff joints.

IV. CONCLUSION

- Despite therapeutic properties of mud which are very useful in maintaining good health

REFERENCES

- [1] Dr.R.Thiyagarajan, Gunapadam thathujeeva vakuppu, India maruththuwan, Chennai-600106, 2009.
- [2] T.V.Sambasivampillai, Tamil – English dictionary Medicine, Chemistry, Botany & allied sciences,1998
- [3] I.C.Chopra, Indigenous drugs of India, B.K.Dhur of Academic Publishers, Calcutta-700073,1982
- [4] Related web sites (www.wikipedia.com)
- [5] Subramanian.S.V;Madhavan,V.R 'Heritage of the tamils Siddha Medicine 1st edition pg. 362-381 March 1983, International Institute of tamil studies, Madras 113.
- [6] Murugesamuthaliyar, K.S Gunapadam Part I Mooligaivagupu 7th edition Indian medicine & Jeyaweera, M.A ; Medicinal plants used in Ceylon Part 4
- [7] National Science Council of Sri Lanka pg. 9.Nadkarni K.M; Indian meteriamedicavol I reprint 2002 pg. 8-9.
- [8] The wealth of India Raw materials vol 1-A reprint 2003 National institute of science communication
- [9] Kirtikar.K.R&Basu B.D Indian Medicinal plants volume I 2nd edition,1993 pg. 314
- [10] Kuppusamymudhaliyar.K.N, Siddha maruththuvam Indian medicine, Homeopathy Chennai 6th edition,2004, 600 106 Pg. 434-459
- [11] Shanmugavellu. M NoinadalNoimuthalNadalThiraddu Part II 2nd edition, 1988, Indian Medicine ,Homeopathy, Chennai 600 108 Pg. 397-417
- [12] Uthamarajan.K.SSiddharAruvaiMaruththuvam 3rd edition, 1999, Indian Medicine, Homeopathy Chennai 600 106 Pg. 65-72
- [13] Kannusamipillai, Patharthagunavilakkam, August 2003, Jeyam print Madurai 625001 pg.429-431
- [14] John A.A Hunter, Davidson's Principles & practice of Medicine 19th edition, Churchill livingstone 2002 pg. 829
- [15] Kaushik P., Kaushik D.,Khokra S., Chaudhary B.,IJPCR Apr-June n2009 Vol.I Issue I pg. 4-9
- [16] Ponnaiyappillai, Sekarajeskaravaithiyam, Reprint 2000, Pg No – 61- 73
- [17] CaseemMohdeenRavuth 1932, PatharthagunasinthamaniB Rathnanayakar sons ChennaiPg 177.

Literature review of Preventing Thotraa Noigal in the modern society through ethics and codes of conducts relevant to Siddha and creation of stress relieved community through spiritual performance.

P.V. Thillary ^{*1}, V. Sathyaseelan ^{*2}

**Unit of Siddha Medicine, University of Jaffna, Kaithady, Srilanka.*

¹dhilany@gmail.com

²dr.vivian@ymail.com

Abstract— In the modern age when we are in an indiscriminate race of industrialization and urbanization, we are going ahead with unnatural way of living life. Consequently the human health is constantly deteriorating. This induces “Prevention is better than cure”. The high end of medical science is the preservation of health and can be attained in two ways. Firstly by eradicating diseases which may invade the body and secondly by due to observation of such rules as would keep away diseases. These rules are no less important than the treatment of diseases and the methods of cure. The rules in respect of food and exercise by observing which a person succeeds in maintaining normal health constitute that branch of medical science, which is called hygiene. With respect to that, certain preventive measures (1) Food habits and ethics , (2) Mind and spiritual wellbeing , (3) Social behavior and discipline , (4) Social relationship, (5) Prevention of alcoholics and gambling, (6) Awareness of sexual life are analyzed in the tamil literary ancient texts Aacharakkovai, Thirikadugam, Elathi, Sirupanjamoolam, Thirukkural and in Saiva Siddhanta text Tirumandiram to state the major problem that prevails in the modern society middle and old aged community that are affected by thotraa noigal. The analytical study will render the knowledge to bringout the philosophical perspective into action to avoid affected by such diseases. The authors of these texts too justify their views through religious and practical life in concern to healthy and spiritual wellbeing in orderly relieving the mankind from disease proning through yoga therapy and meditation. Thus the idea could be attained that the good social behaviors and relationships guide to a good social understanding to lead a diseaseless life. This social concern and community related medical advises are overruled in these texts.

Keywords— Preventive measures, Ancient texts, Thotraa Noigal , Social concern.

I. INTRODUCTION

Minor eighteen books were arised after the Sangakala approximately 1800years back has been considered as the Sangakala and it extended up to 2nd century AC. The books arised before 2nd century AC were thought as sanga literature by some people but it takes place after Sangakala. Aacharakkovai (Kayathurperuvaayinmulliyar), Sirupanjamooalam (Kaariyaasan), Elathi (Kanimethaviyar), Thirikadugam (Nallathanar), Thirukkural(Thiruvalluvar) . These texts are compilation of moral and ethical codes also rules to be followed in everyday life. These books do not consist of any partiality regarding castes and spiritual, but convey the common system of moral codes for the folks whether they are followed. It is the uniqueness of tamil tradition. The books under minor eighteen majorly have sameness in giving the ethical codes to the public.

Another text Tirumandiram by Siddhar Tirumoolar is a sacred, monumental work of philosophical and spiritual wisdom rendered in verse form. Encyclopedic, in its vast scope and written perhaps as early 200 BC. It is one of India’s greatest texts, a spiritual treasure trove and a sastra containing astonishing insight. It is a seminal work and is the first treatise in tamil that deals with different aspects of yoga, tantra and saiva siddhanta.

So the study of these valuable texts lead the people to live a healthy life and how they have to act in public places in order to avoid diseases and gain spiritual wellbeing.

II. JUSTIFICATION OF STUDY.

The ancestors of old time according to the natural environment they lived, had the tendency to use the herbal and natural medications for the wellbeing and to avoid diseases. The diseases were limited to an extent in their time. But nowerdays the situation concurrently reverse givingway to disorders because of changing in life-styles, consuming fast foods and unhealthy diets, the tendency for consumption of more alcohol and tobacco, living in polluted environments

and trauma due to occupational exposures are drivers of enhanced health risks. In the olden days, in process of ageing, people were physically active in ages above 80's but now this changed and the mortality ranges now onwards of 50-60 years of age. The major problem in the community is increase in thotraa noigal. They are thamaragarogam, mathumegam, putru and iraipirumal. They are becoming more frequent as the population ages, incomes rise, urbanization becomes more prevalent and life styles become more sedentary. There has also been a risk in metho rogam, smoking and alcoholism which increase the risk of thotraa noigal. These all are effects of carelessness of the generations.

So studying the above mentioned texts guide the humanbeings to a healthy life by conveying the way to be followed. In a community, morally demolished, the people will follow the ethics only when they are practically proved. These texts predict the preliminary usage of ethics and it not only gives the morals but also the life rules of routine work. The individual and community considered healthy life is also discussed to lead a diseaseless wellbeing. Furthermore, for a stressed, depressed individual will be guided with meditation and yoga to overcome a stressful environment. This lacks the society with suffering from various diseases and leads to a healthy community with natural medications and life styles.

III. GENERAL OBJECTIVE.

The Objective of the study is to analyze the certain preventive measures (Food habbits and ethics, Mind and spiritual wellbeing, Social behavior and discipline, Social relationship, Prevention of alcoholics and gambling, Awareness of sexual life) that are discussed in above texts with respect to Siddha medicine to avoid thotraa noigal and for a natural longitivity of life.

A. Objectives

- To make the modern society conscious of their diets from the modern food dilemma.
- The spiritual performance of Yoga and Meditation that act as an exercise which keeps mind and mentality healthy.
- Social relationships and concerns that relates to the public health and caring.
- To establish codes of good conducts and ethics to be accustomed to rightway of living.
- To prevent alcoholic and bad acts to avoid physical and mental disabilities.
- To avoid unsafe sexual intercourse and venerable diseases.

IV. RESEARCH METHODOLOGY

According to Siddha, discordance of doshas is disease and the concordance of doshas is health. Relevant to this Siddha medical system conveys that “ Prevention is better than

cure”. Likewise precare of disease proning is the main, first and foremost truth of Siddha medical view. So as accordingly the preventive measures,

1. Food habbits and ethics
2. Mind and spiritual wellbeing
3. Social behavior and discipline
4. Social relationship
5. Prevention of alcoholics and gambling
6. Awareness of sexual life

are analyzed in the texts

1. Tirumandiram
2. Aacharakkovai
3. Elathi
4. Thirikadugam
5. Sirupanjamoolam
6. Thirukkural

With the idea of getting rid of thotraa noikal affecting the mankind and studied the modern science related to these old ethics from March ,2015 to April, 2016 within a year.

V. RESULTS AND DISCUSSION

In relation to the preventive measures that connects and concerns certain prospects are clarified.

A. Food habbits and ethics.

Food (Ahara) is the basis of life prana. Siddha emphasis right diet as the foundation of all healing therapies. So in these texts the importance of Saatvic diet (killing or harming of animals)(conveyed in Elathi, sirupanja moolam, Tirumandiram and thirukkural), eating food without condemning or abusing, Praying before eating in order to avoid mental depressions of previous actions, Purification before eating , sharing and limitation of food are discussed in the view of free from upcoming diseases.

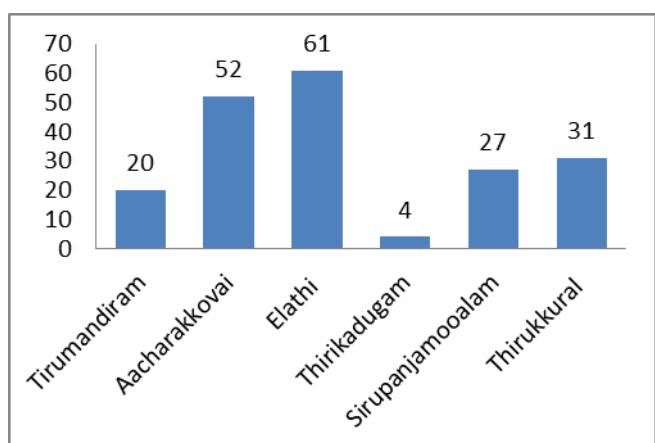


Figure 1. Texts Vs No of Ethics regarding food habbits.

B. Mind and Spiritual wellbeing.

Soul, Body and Mind are connected to each other. When the stability between them destroys it causes disease. The clarity of the mind is the basic element of health. For keeping the corpulent body free from diseases ancient sages studied nature and rendered them by safer medical methods as herbal therapy, Yoga therapy, Meditation Etc. These ideas over viewed in Tirumandiram 3rdtandra as Attanga Yoga(Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana, Samadhi)and Meditation in Elathi (Verses 38,64,65,75,76,77), Sirupanjamooalam (Verses 4,6,34,65,96,101)

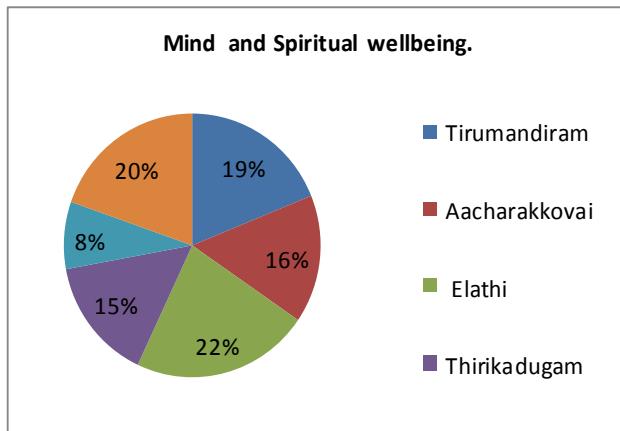


Figure 2. Percentage of Ethics regarding mind and spiritual wellbeing

C. Social behavior and relationships.

The texts term that code of good conduct provides an easy base on which health can be established on proper lines. They also state that one who follows then letter a spirit will not be sorry throughout his life physically or mentally and he will enjoy a long and healthy life. The idea of Dinacharya related to morning rise, drinking fresh cool water, morning walk or jogging, brushing teeth, oil massage,bath,meditation, breakfast ,nocturnal schedule and Rudhucharya including the regimens of six seasons are seen in every text. Relevant to Siddha both Dinacharya and Rudhucharya are important measures for a healthy life.

Texts	Number of ethics found
Tirumandiram	117
Aacharakkovai	87
Elathi	52
Thirikadugam	105
Sirupanjamoolam	129
Thirukkural	60

Figure 3. No of Ethics regarding social behavior and relationships.

D. Social relationships.

The philosophical perspective of these authors of these texts is “Loving other beings as oneself” is an important facet of their spiritual wisdom. Likewise when one soul reflects the suffering of another soul it is by knowing the spiritual relationship existing between them. Through this religious views the authors tried to convey certain prospects that are serving the public(children, extremities of life, pregnant mothers, handicapped and diseased) providing them medicaments, foods, place to live ,giving love and care. Under certain pressing circumstances some social customs and manners come into practice.

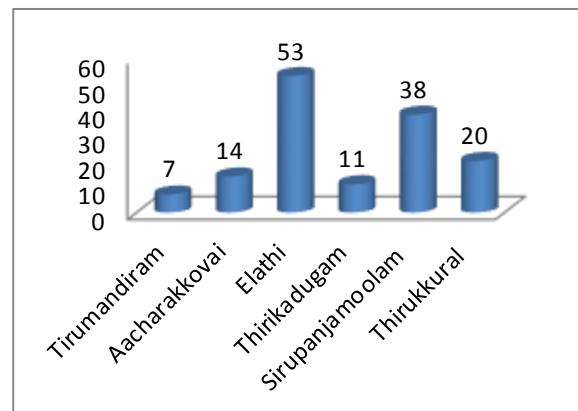


Figure 4. Texts Vs No of Ethics regarding Socialrelationships.

E. Prevention of alcoholics and gambling.

The texts clearly mention the experiences of drinking alcoholic beverages causes swoon, fear, grief, depression, fury, and death. And one who is free from these alcoholics will not be touched by any physical or mental disabilities. The authors also tell to be away from sinful acts like gambling, adultery and smoking .

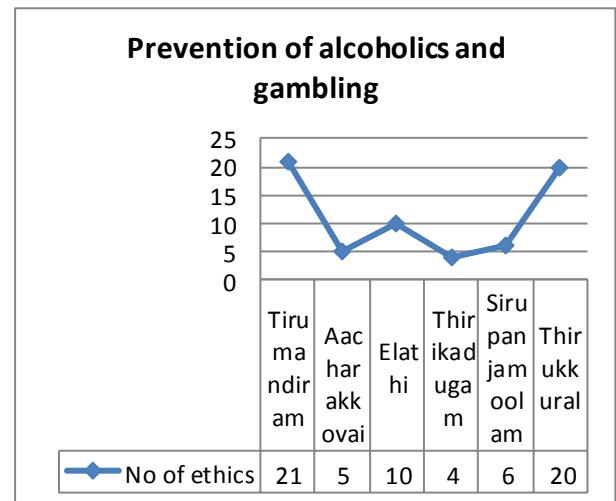


Figure 5. Texts Vs No of Ethics regarding prevention of alcoholics and gambling.

F. Awareness of sexual life.

The texts depict the proper health maintenance in sexual intercourse. Sexual connection with wife is permitted and with other ladies who are diseased, unclean, another's wife are strictly disallowed.

They also guide the public to follow proper acts in sexual intercourse. This connects to the modern science as unsafe

sexual contact causes venerable diseases, loss of semen and loss of virility.

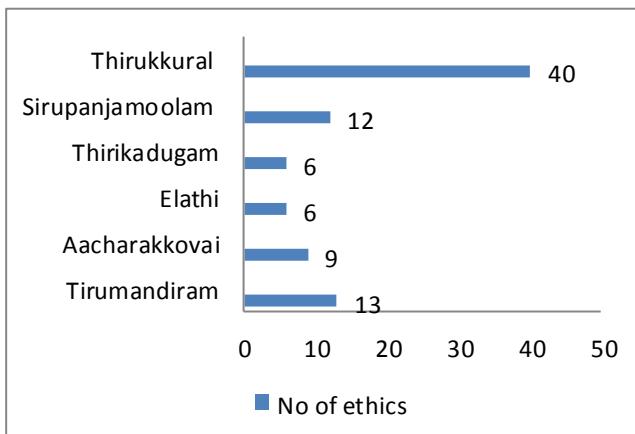


Figure 6. Texts Vs No of Ethics regarding sexual life.

The fertilization regarding births and caring is focused in the texts Tirumandra and Sirupanjamooalam. In Tirumantra it describes of sukla ,sronidha and formation of humanbody. Thus Sirupanjamooalam gives the idea of care to be taken to safeguard the fertilized egg. So in Sirupanjamooalam it concerns the care a female in food , bathing and other while they are in menstruating period, lactating period, pregnanacy and delivery period. This is why Siddha insists the public in caring a female child in the above conditions to strengthen the uterus. Hence the pre-natal care, pregnanacy care and post-natal care are taken to avoid certain problems like kakaivalippu and kaayasuvatham after delivery.

VI .CONCLUSION

In the time of these texts human life was determined as being hundred years or more. The longevity was possible with the help of natural medicinal systems, natural care, natural life style. But in the present age, life span has been significantly reduced to an average of 50 years but that too is not free from diseases. In the present day materialistic society suffering from thotraa noikal, physical senility, Mathumegam, Thamaragarogam, Ajeeranam, insomnia and many other frustrations result from following an indiscipline life style.

In view of the above reasons it becomes necessary that human health should remain freely secured in close association of nature. So in order to get away from diseases the philosophical truths and ethics that are mentioned in the above texts have to be followed in day today life. They are not only just utterings, but according to the modern science they are the main ideas for a healthy life. Hence these ethics are of social concerns,have dominancy on a stress relieved life. Thus they also provide the humankind with yoga and meditation for the mind relaxlity relevantly the idea is come from Siddha that considers disease is caused by imbalance of body and mind.

“He who duly observes the regulations laid down about the preservations of health, succeeds in living for more than a century” – Charca

In the time of Vedas(ancient Indian texts) lifespan of human was considered as being hundred years. This is possible with daily routine practices according to the dinacharya and rudhucharya. It was combined with day to day life in the

olden days without the knowledge of books with regards to the nature. The present hygiene and medical system do not establish consistency with nature. The corpulent body is their main objective and also heart ,mind, mentality, food and physical activities. The ancient peoples culture were mainly based on nature, whereas the modern science is taking man away from nature. In ancient days people had proper physical and mental rest, diet according to diseases and disorders based on doshas, followup of daily and seasonal routines meant for energy for body but is also essential for a healthy mind and healthy mentality. This state is the state of perfect health.

In the modern society materialism has become one single object of life. Consequently, human being has drowned into unlimited ocean of desires and the mind indulges badly in the cyclone of these desires. When the illusions of desires turn into failures, man begins to pass life in a dreadful and tragic situations. He then acts in wrong and right ways with great zeal to change his failure into successes. These are same acts which lead him away from human sensitivity and social values and his mentality becomes dangerous for the main social stream. This is the point where the mans downfall begins and mind treads towards criminal activities. As a result , man begins to step in feeble mindedness, dejection, escapism and restlessness etc.

In the present day materialistic society, environmentally polluted contaminated food and intoxicated drugs take man away from nature and fill his body with different constituents of disease. So to overcome these circumstances affecting mankind people have to concern their life styles through gathering knowledge in relationship to nature and natural ways. There are a lot of ancient treaties like above mentioned texts that reveals the daily regimen of day to day life. This has to be followed by generation to generation to a sustainable healthy society. Todays generation stay on questioning with the scientific truths hence the olden morals and ethic when studying they co-relate with the modern science but some are not. Thus each and every truth couldn't be justified with proper scientific knowledge but they are followed by our ancestors. This renders us the practical life views. Following these ethics will help in disease free life.. Every ethics stated in these treasured texts can be rendered to the society by

- Giving a good idea of Siddha Medicine, hence the medicinal system focused on prevention of diseases than curing.
- Having awareness programmes regarding the ethics that are quoted in these texts by implicating with leaflets and making the public to gather knowledge and follow up routine.
- Siddha doctors advising with proper knowledge to the public regarding day today rudhucharya and dinacharya while giving medicaments.
- Siddha students implicating their knowledge with the public through awareness campaigns and educating the rurals with health tips for a diseaseless life.

REFERENCES

- [1] Tirumoolar,(1997).TirumularTirumandiram,Vol-1.2ndedition.Mayiladuthurai: Gnasampantha pathippagam.Tharumai Aathinam,pp.302, 303-311, 354-383, 413-421,629-633.
- [2] Tirumoolar,(1997).TirumularTirumandiram,Vol-3.2ndedition.Mayiladuthurai: Gnasampantha pathippagam. Thrumai Aathinam, pp.253-254, 361-380, 399-413, 829-842, 928-939.
- [3] David Frawly.(1999).Yoga and Ayurveda Self healing and Self realization. New DelhiMotilal Banarsidass Publishers PVT(LTD).pp 3,167-174, 283.
- [4] Sivashanmugaraja,S.(2002). Yazhpana Makkalin Saiva Unavu Pazhakka vazakangal. Siddha Maruthuva valarchi Kalagam:pp 33-54.
- [5] Chokkalingam,S.N. Inna Naatpathu, Aacharakkovai.pp 103-196.
- [6] Ramnarayan Sharma,P.T.Arogya Prakash vol-1.2nd edition.Nagpur.Shree Baidyanath Ayurved Bhawan LTD:pp 1-18, 157-165, 229-265.
- [7] Ramanathapillai,P.(2001). Tirumandiram vilakkavuraiudan(1-5 Tandra).Chennai.
- [8] Thiruvalluvar.(1998).Thirukkural.5th edition.Singapore.EVS Publishers.
- [9] Iyarkaipriyan Ratnavel Sakthivel. (2005). Mana azuththathitku Maruthuvam. Chennai. Kalieshwary Pathippagam.
- [10] Ashok Majumdar.(1998).Ayurveda The ancient science of healing. New delhi. A.H.Wheelers & Co Ltd.
- [11] Sami Sithambaranar. Pathinen keezhkanakkum Thamizhar Vaazhvum.
- [12] Pathinen Keezhkanakku Noolkalin Nanmanikal.
- [13] Balasuntharam,I(1990)Iilakkiyaththil Maruthuva Karuththukkal.Jaffna.Folklore Society Jaffna.
- [14] Phoon,W.O and Chen,P.C.Y.Textbook of community medicine in South- East Asia. A Wiley Medical Publications.

ANTIOXIDANT ACTIVITY IN AQUEOUS EXTRACTS OF Leaf of *Gymnema sylvestrae* STORED FOR SIX MONTHS AT ROOM TEMPERATURE AND AT 4 °C USING 1, 1-DIPHENYL-2-PICRYLHYDRAZYL (DPPH) ASSAY

Thilageswary Kumutharanjan*, Ramaiyah Sivakanesan**, Vasanthy Arasaratnam***

*Unit of Siddha Medicine, University of Jaffna;

**Dept of Biochemistry, Faculty of Medicine, University of Pradeniya;

***Department of Biochemistry, Faculty of Medicine, University of Jaffna.

*tkumutharanjan@yahoo.com

Abstract— Aim of the present study is to evaluate antioxidant activity of the leaf of *Gymnema sylvestrae*. It is one of the ingredients of preparation of several anti diabetic preparations used by Siddha, Ayurvedha and Unani medicine. Leaves were dried to constant weight, powdered and sieved. TAC was estimated by using the method described by Blois (1958). The initial TAC of cold and hot water extracts was 2632.7, 2277.9 µg/ml dry weights respectively. When the powder was stored at room temperature for a month and the TAC was analysed, the cold and hot water extracts contained 2931.4, 2474.4 µg/ml dry weight respectively. When the leaf of the *Gymnema sylvestrae* powder was stored at room temperature for 6 months, TAC of cold and hot water extracts was 11632.6, 10337 µg/ml dry weights respectively while the TAC of cold and hot water extracts of the *Gymnema sylvestrae* powder stored at 4°C for six months respectively was 10303.2, 8751.6 µg/ml dry weight. Extraction of antioxidant activity was better with hot water than with cold water. TAC of the *Gymnema sylvestrae* powder decreased when stored both at room temperature and at 4°C. At 3 months the decline in TAC of the powder stored at Room temperature is higher than that stored at 4°C. In the Siddha Medicine the lifespan of 'Chooranam' which is prepared from herbs is used for 3 months. However freshly prepared powder is recommended for the preparation of 'Chooranam'.

Keywords— Antioxidant activity, DPPH radical scavenging activity, *Gymnema sylvestrae*, Siddha medicine

I. INTRODUCTION

Oxidative stress in cells and tissues results from the increased generation of reactive oxygen species and / or from decreases in antioxidant defense potential (Gumieniczek et al., 2002). Antioxidants are significant in the prevention of human illness and may function as free radical scavengers, complexes of pro-oxidant metals,

reducing agents and quencher of single oxygen formation (Andlauer and Furst, 1998). More than 1200 plants have been described in scientific and popular literature of their hypoglycemic agents. Plant drugs are frequently considered less toxic and free from side effects than synthetic ones. Free radicals contribute to more than one hundred disorders in humans including atherosclerosis, arthritis, ischemia and reperfusion injury of many tissues, central nervous system injury, diabetes mellitus, gastritis cancer and aids. It has been mentioned the antioxidant activity of plants might be due to their phenolic compounds. *Gymnema sylvestrae* is recommended for anti diabetic herb. In addition, an anti diabetic effect in animal models reduce intestinal transport of maltose and reduce absorption of free oleic acid. *Gymnema S.* Has regeneration of the islets of Langerhans. *Gymnema sylvestrae* has Insulinotropic Activity.

II. MATERIALS AND METHODS

A. Plant Material

Leaves of *Gymnema S.* were collected from Karaveddy Village of Jaffna Peninsula

B. Preparation of Plant Extract

Leaves of *Gymnema S.* were cleaned washed and dried under shade at room temperature for 10 days. Then it was powdered by wooden motor and pestle and sieved with muslin cloth. Then it was stored in air tight plastic container. 100 mg quantities in air tight polythene packets were kept in refrigerator and room temperature. Cold and hot aqueous extract using stored powder were prepared at monthly interval. 100 mg of powder was dissolved in 10ml distilled water and one part was kept in room temperature, other part was kept in water bath at 100°C for 5 minutes. Then these were centrifuged at 10,000 rpm for 10 minutes. Supernatant was taken from the centrifuged extract.

C. Estimation of DPPH radical scavenging activity:

The free radical scavenging of plant extracts evaluated by DPPH assay according to the method described by Blois

(1958) briefly, 0.1 mm solution of DPPH in methanol prepared and 500 μ L of this solution added to 1 mL of extract containing 0.1, 0.2, 0.3, 0.4, 0.5 mg/ml. The mixture allowed standing at room temperature for 30 minutes. Then the absorbance measured at 517nm with uv-vis spectrophotometer. In order to measure the absorbance of the control, 500 μ L of DPPH mixed with 1 mL of distilled water and then the absorbance were taken as in the case of samples.

III. RESULTS AND DISCUSSION

Antioxidant activity by 1, 1-Diphyenyl 1-2- Picrylhydrazyl (DPPH) radical Scavenging Assay (DPPH) of cold and hot water extracts of *Gymnema sylvestre* leaf powder stored at Room Temperature and at 4°C

IC 50 values are inversely proportional to antioxidant activity. Initially the Total Anti oxidant Capacity of the leaf powder of the *Gymnema sylvestre* in cold and hot extracts were 2632.7,2277.9 μ g/ml dry weights respectively (Table 1).The TAC was better extracted with hot water than with cold water .and hence when compared with the cold extracts, the hot extracts contained higher TAC (Table 1)

(Table 1)

Time (Months)	1-Diphyenyl 1-2- Picrylhydrazyl (DPPH) radical Scavenging Assay)			
	Stored at Room		Stored at 4°C	
	Cold	Hot	Cold	Hot
0	2632.7	2227.9		
1	2931.4	2474.4	2889.1	2445.5
2	3633.5	3172.5	3580.3	3071.6
3	4859.5	4191.9	4508.7	3814
4	6666.9	5848.9	5754.9	4742.7
5	9143.1	7838.4	7881.6	6739.1
6	11632.6	10337	10303.2	8751.6

When the powder was stored at room temperature for a month and the TAC was analyzed, the cold and hot water extracts contained 2931.4,2474.4 μ g/ml room temperature dry weight respectively. The *Gymnema sylvestre* powder stored at room temperature for 3 months showed TAC of 4859.5, 4191.9 μ g/ml dry weights respectively in cold and hot water extracts. The *Gymnema sylvestre* powder stored at room temperature for 6 months showed TAC of 11632.6, 10337 μ g/ml dry weights respectively in cold and hot water extracts. With time, the TAC of the skin of the seeds powder stored at room temperature decreased (Table1).

When the powder was stored at 4°C for a month and the TAC was analyzed, the cold and hot water extracts contained 2889.1, 2445.5 μ g/ml dry weight respectively (Table 1). When compared with the cold extracts, the hot extracts contained higher TAC than cold extract (Table 1). The *Gymnema sylvestre* powder stored at 4 ° C for 3 months showed TAC of 4508.7, 3814 μ g/ml dry weights respectively in cold and hot water extracts the skin of the seeds powder stored at 4°C for six months showed TAC of 10303.2, 8751.6 μ g/ml dry weights respectively in cold and hot water extracts. With time, the TAC of the skin of the seeds powder stored at 4°C decreased (Table1).

The cold and hot aqueous extracts of the dried powder of the *Gymnema sylvestre* possess antioxidant activity. When compared with the cold extracts of *Gymnema sylvestre* powder with hot extracts, hot extracts contained higher antioxidant activity than cold extracts. Antioxidant activity was higher at 4°C than stored at Room temperature. Antioxidant activity decreased according to the months of storage, when stored at either room temperature or 4°C. But decreasing activity is higher at room temperature than 4°C (Table2).

(Table2).

Decrease, 1-Diphyenyl 1-2- Picrylhydrazyl (DPPH) radical Scavenging Assay in <i>Gymnema sylvestre</i> leaf powder stored at Room Temperature and at 4°C (months)									
Time(Months)	Stored at Room Temperature				Stored at 4°C				Cumulative loss
	Cold water extract	Hot water extract	Cold water extract	Hot water extract					
1	293.7	293.7	246.5	246.5	256.4	256.4	217.6	217.6	
2	702.1	995.8	698.1	944	691.2	947.6	626.1	843.7	
3	1226	2221.8	1019.4	1964	928.4	1876	745.4	1589.1	
4	1807.4	4029.2	1657	3621	1236.2	3112.2	928.7	2517.8	
5	2476.2	6505.4	1989.5	5610.5	2126.7	5238.9	1996.4	4514.2	
6	2789.5	9294.9	2498.6	8109.1	2421.6	7660.5	2012.5	6536.7	

REFERENCE

- [1] Andlauer,W.,Furst,P.(1998). Antioxidative power of phytochemicals with special reference to cereals. Cereal Foods World 43: 356-359.
- [2] Cragg,GM. Newman,D.Sander,KM, Natural products in drug discovery and development .J Nat Prod. 1997;60:52-60
- [3] Coock,NC. Samman, S. " Flavonoids chemistry metabolism, cardio protective effects, and dietary sources Nutritional Biochemistry -7: 66-76(1996)
- [4] Gumieniczek, A. Hopkala, H. Wojtowich,Z. Nikolajuk, J. (2002)Changes in antioxidant status of heart muscle tissue in experimental diabetes in rabbits. Acta Bio Chem Pol. 49: 529-535.
- [5] Heiiekant,G. Ninomlya,Y. Danilova, V. "Taste in chimpanzees 111: Labeled – line coding in sweet taste " physiology & behavior 65 (2) : 191=200.doi: 10.1016/soo31-9384(97)00532-5 PMID 9855466(2000)
- [6] Kumplainen, JT. Salonen, JT. . "Natural antioxidants and Anticarcinogen in Nutrition, Health and Disease. The Royal Society of Chemistry, UK pp178-187(1999)
- [7] Luo, H. Wang, LF. Imoto, T. Hiji, Y. "Inhibitory effect and mechanism of acarbose combined with gymnemic acid on maltose absorption in rat intestine" world Journal of gastroenterology 7 (1): 9-15 .PMID 1181925. .(2001)

[8] LiuBo,AsareAnane, Henry, AlRamaiany, Altcfi, Guocai, Amiel,Stephanie, A.Jones, PeterM, Persaud, Shanta, J. "Characterisation of the Insulinotropic Activity of an Extract of *Gymnema sylvestrae* in mouse β cells and human Islets of Lahgerhans" cellular physiology and Biochemistry 23(1-3): 125-32(2009)

[9] Murugesa muthaliyar, K.S. *Materia medica* ,Vegetable section –Part 1 Government of Indian Medicine,Chennai 600079. (1998).

[10] Padma,TV. *India Ayurveda Nature*.2005:436-486.

[11] Sugihara,Y. Nojima, H. Matsuda,H. Murakami,T. Yoshikawa, M. Kimura,I. " Antihyperglycemic effects of gymnemic acid iv, a compound derived from *Gymnema* . S leaves in on streptozotocin- diabetic mice" *Journal of Asian natural products research* 2(4): 321-7, doi: 10. 1080/ 10286020008041372. PMID 11249615(2000)

[12] Schuler, P. "Natural antioxidants exploited commercially, in food antioxidants, Hudson BJF (ed) Elsevier, London, pp 99-170. (1990)

[13] Shanmugasundram, KR. Paneerselvam, C. Sumudrum, P. Shanmugasundram,ERB. (1081). "Insulinotropic Activity of an Extract of *Gymnema*, R.Br. and Indian medicinal herb used in controllingbiabetic mellitus". *Pharmacol Res Commun* 13 (5): 475- 486. Doi: 10. 1016/S0031- 6989(81) 80074-4. PMID 7027275.(1983)

[14] Shanmugasundram,ERB. Gopinath, KL. Shanmugasundram, KR. Rajendran,VM."Possible regeneration of the Islets of Lahgerhans in streptozotocin- diabetes rats given *Gymnema sylvestre* leaf extracts. *J of Ethnopharmacol*. 30: 265-279. (1990)

[15] WHO, Regional office for the western pacific, Research Guideliness for Evaluating the safety, and Efflcacy of Herbal medicine, Manila, WHO,(1993)

[16] Wang, H. Ng,TB."Natural products with hypoglycemic, Hypotencive, hypocholesterolemic, anti atherosclerotic and anti thrombotic activities *Life Sci*,65: 2663-2677(1999),

Deposition and Characterization of Cu₂ZnSnS₄ Thin Film for Solar Cell Application

N. Muhunthan^{1,2}, S. Loheeswaran¹, V.N. Singh².

¹*Department of Physical Science, Faculty of Applied Science, Trincomalee Campus, Eastern University, Sri Lanka.*

²*CSIR-National Physical Laboratory, Dr. K. S. Krishnan Marg, New Delhi-110012, India.*

¹muhunpl@gmail.com

²loheeswaran@esn.ac.lk

³singhvn@nplindia.org

Abstract - Cu₂ZnSnS₄ (CZTS)’s earth abundant and non – toxic elemental composition makes it an ideal candidate as one of the alternative for solar cell applications due to low cost and competitive photo voltaic performance. In this study, CZTS thin film was grown on soda lime glass (SLG) by co – sputtering and post deposition sulfurization of sputtered film using H₂S gas. The structural, microstructural, compositional and optical properties were studied using glancing incidence XRD, Raman, SEM, EDS, XRF and UV-VIS spectrophotometry. Grazing incidence XRD analysis showed that sulfurized films were Kesterite CZTS with strong orientation along (112) plane. Raman peak at 336 cm⁻¹ confirmed the presence of kesterite structure of CZTS film. The energy dispersive x-ray spectroscopic (EDS) and XRF analysis showed that the film consist of Cu, Zn, Sn and S. SEM analysis showed large columnar grains throughout the surface of the film. The CZTS film showed an optical absorption coefficient higher than 10⁴ cm⁻¹ and an optical band gap of 1.49 eV was estimated using Tauc’s plot. Nelson–Reilly function (NRF) vs $\delta d/d$ plot revealed the presence of defects in the CZTS thin film.

Key Words - CZTS thin film; Co-sputtering; Sulfurization using H₂S, Solar cell, Renewal energy

I. INTRODUCTION

CZTS earth abundant and non – toxic elemental composition makes it an ideal candidate to replace Cu(In,Ga)Se₂ (CIGS) and CdTe solar cells which face material scarcity and toxicity issues. A thin film CZTS solar cell is proposed as the technology to achieve this Holy Grail and thus it has received much attention in recent years. CZTS is reported to have a band gap of between(1.40 to 1.50) eV [1-3] and a band edge absorption coefficient of above 10⁴ cm⁻¹ which make it highly attractive as a single junction solar cell material.

Electronic loss of current transporting through interfaces in a delicate device structure has always been a problem with thin film technologies. It has hampered improvement of thin film CZTS solar cells. Related issues to current loss are a common difficulty through out thin film technologies since the quality control of device constructed with thin film which thickness in micro meters, or even in nano meters is always a big challenge during fabrication when coming to the commercial needs in high throughput of large area devices.

The highest reported efficiency of 9.2% [4], is relatively low compared to the expected theoretical efficiency of CZTS solar cell (more than 30%) [5]. Therefore, a systematic study of the efficiency limiting factors such as defects, grain boundary etc. is necessary. Although, the research to materialize CZTS as a photovoltaic absorber is on full steam, still there is a need to research into the properties of it. In the present work, the results of structural and optical measurement on the CZTS thin film grown by sulfurizing the metallic precursors deposited by co-sputtering from metal targets on soda lime glass are reported.

II. EXPERIMENTAL

In order to deposit copper zinc tin (CZT) thin films, Cu, Zn and Sn metal targets were co-sputtered from three individual sputter guns on cleaned soda lime glass (SLG) substrate. The deposition was carried out in a DC/RF magnetron sputtering system having arrangements for mounting three two inch targets confocally in addition to one ion gun for substrate cleaning. It has a substrate rotation facility which allows uniform deposition. The depositions can be carried out from 30°C- 450°C. The magnetron sputtering system is automated through a PLC-PC based automation system. In the present work, Cu (38.5W), and Zn (32.2W) were deposited using DC power and Sn (65W) was deposited using RF power. The thickness of the individual elements can be controlled by controlling the power. All the targets were either 99.99% or more pure. Substrate was kept at 100°C and substrate rotation was 10 rpm. Prior to deposition, a base pressure of 1.1 X 10⁻⁶ mbar was achieved using turbo molecular pump (800 liters per second). The deposition was carried out at a pressure of 5.2 X 10⁻³ mbar. Sulfurization was carried out in a horizontal tube furnace fitted with quartz tube. CZT film on a ceramic substrate was kept at the centre of the single zone furnace. H₂S (15%) gas mixed with Ar was passed through the quartz tube at a flow rate of 12.5 sccm. The system was evacuated to a pressure of 2 X 10⁻² mbar and purged with nitrogen gas. The furnace temperature was increased to 400°C in 10 min. After 10 min, the temperature was increased 550°C in another 10 min and was kept at 550°C for 25 min. Finally, furnace was cooled down to room temperature.

III. RESULTS AND DISCUSSION.

A. Chemical composition.

The results of compositional analysis of CZTS sample by EDS and XRF are shown in Table 1. The estimated ratio of Cu/(Zn+Sn) and Zn/Sn are 1.13 and

1.28 by EDS and 0.77 and 1.69 by XRF (XRF gives average value), respectively. Thus, the sample is almost stoichiometric but Zn-rich. XRF result also confirmed that CZTS thin films are almost stoichiometric but are Zn-rich and copper deficient, which are reported to lead to good optoelectronic properties (this avoids segregation of copper sulfide and copper tin sulfide compounds which are conductive and therefore detrimental for the solar cell) [6].

Table 1 Elemental composition of CZTS thin film as estimated by EDS and XRF analysis

Element		S	Cu	Zn	Sn
Atomic(%)	EDS	49.68	24.75	13.94	11.63
	XRF	50.80	24.62	13.86	10.72

B. Structure analysis.

Figure 1(a). Show the G-XRD pattern of the CZTS film. It is clear from the XRD pattern that the CZTS thin film is having good crystallinity (low background and sharp peaks) and the growth is oriented along (112) direction. Other observed peaks correspond to (002), (101), (110), (200), (202), (114), (220), (312), (008) and (322) planes of CZTS, which is characteristic of kesterite CZTS (JCPDS 26-0575) [7] it is an evidence of improved the grain growth.

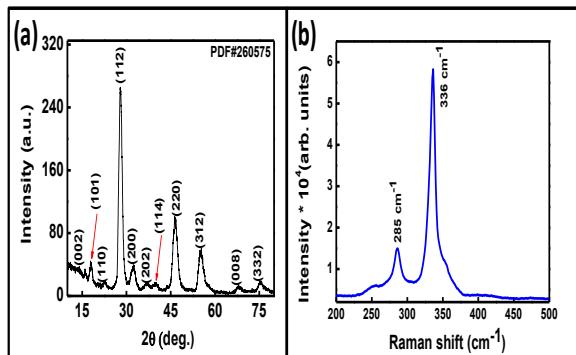


Figure 1 (a) GI-XRD, and (b) room temperature Raman spectrum of CZTS thin film deposited on SLG.

The Raman spectrum of CZTS film is shown in Fig. 1(b). Raman peaks at 285 and 336 cm⁻¹ correspond to kesterite CZTS [6,7]. Peaks due to Cu₂SnS₃, ZnS, and Cu_{2-x}S phases were absent in the Raman spectrum. Thus, Raman study also supports the presence of kesterite structure and it is also an evidence of improved the grain growth.

C. Surface morphology and optical properties

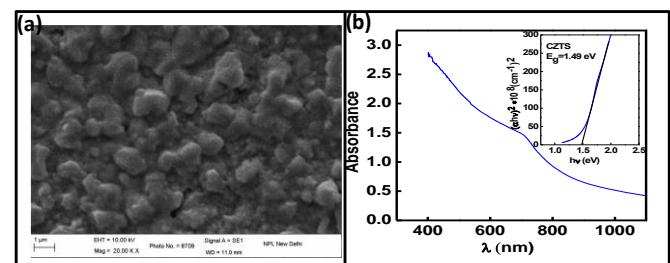


Figure 2(a) SEM topography, and (b) The Tauc's plot of $h\nu$ versus $(\alpha h\nu)^2$ of CZTS thin film. The estimated band gap is 1.49 eV.

The SEM micrograph of the surface of the CZTS film is shown in Fig. 2(a), It consists of larger grains (of about 300 nm in size), and are therefore beneficial for decreasing the minority carrier recombination and provide a current path way for minority carriers to reach the n – type CdS when used in solar cell.

The Tauc's plot is shown in the Fig. 2(b). CZTS film is having an optical absorption coefficient higher than 104 cm⁻¹. The estimated direct optical band gap of the CZTS film (obtained by extrapolating the linear region of the plot $(\alpha h\nu)^2$ versus $h\nu$ to $h\nu=0$) is 1.49 eV. The value is consistent with the value reported in the literature [8-12]. This value is quite close to the theoretical optimal value of 1.50 eV for a single-junction solar cell [8-12]. Above optical characteristic indicate that the CZTS film grown by co-sputtering can be used as an absorber layer in thin film solar cells.

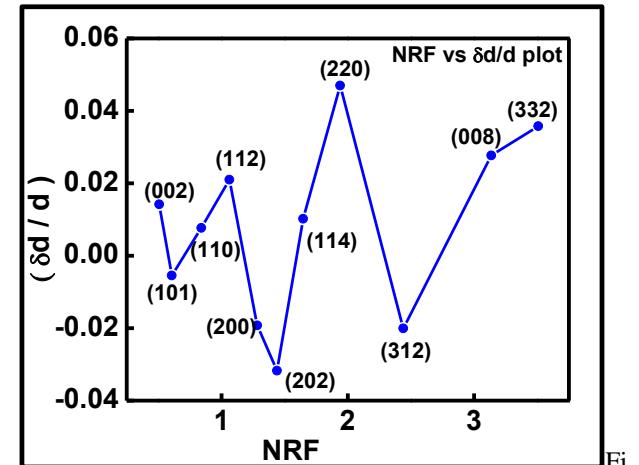


Figure 3 Nelson–Reily function NRF vs. $\delta d/d$ plots for CZTS thin film on SLG.

Nelson–Reily function (NRF) vs $\delta d/d$ plots for CZTS thin film sample (plotted using the XRD data) is shown in Fig. 3, where δd is the difference between the experimental and standard JCPDS value of d (lattice spacing). NRF is defined as $(1/2) \{(\cos 2\theta / \sin \theta) + (\cos 2\theta / \theta)\}$, where θ is the Bragg angle [13,14]. The large scatter in $\delta d/d$ values for different values of NRF in CZTS sample is indicative of large concentration of defects in the CZTS structure. Nelson–Reily function (NRF) vs $\delta d/d$ plot revealed the presence of defects in the CZTS thin film.

IV. CONCLUSIONS

Sulfurization of the metallic precursors grown on SLG substrate yielded single phase CZTS thin film with kesterite structure. Film having good crystallinity and compactness was obtained. The thin film was Zn rich and Cu deficient. The CZTS film showed an optical absorption coefficient higher than 104 cm⁻¹ and an optical band gap of 1.49 eV. Nelson–Reilly function (NRF) vs $\delta d/d$ plot revealed the presence of defects in the CZTS thin film. This work has shown thoroughly that the goal of achieving a low cost high efficiency solar cell composed of earth abundant, non toxic elements could be made highly possible through CZTS thin film solar cell.

ACKNOWLEDGEMENTS

Authors are grateful to Director, NPL, Prof. R.C. Budhani for his close guidance in this work. We are thankful to CSIR-India and MNRE, Govt. of India (Sanction No. 31/ 29/2010-11/PVSE) for their financial support. N.Muhunthan is thankful to University Grants Commission of India for the Senior Research Fellowship.

REFERENCES

- [1] H. Katagiri, N. Sasaguchi, S. Hando, S. Hoshino, J. Ohashi, and T. Yokota, Preparation and evaluation of Cu₂ZnSnS₄ thin films by sulfurization of E-B evaporated precursors, *Sol. Energy Mater. Sol. Cells* 49 (1997) 407-13.
- [2] J.S. Seol, S.Y. Lee, J.C. Lee, H.D. Nam, and K.H. Kim, Electrical and optical properties of Cu₂ZnSnS₄ thin films prepared by rf magnetron sputtering process, *Sol. Energy Mater. Sol. Cells* 75, (2003) 155-62.
- [3] K. Tanaka, N. Moritake, and H. Uchiki, Preparation of Cu₂ZnSnS₄ thin films by sulfurizing sol–gel deposited precursors, *Sol. Energy Mater. Sol. Cells*, 91 (2007) 1199-1201.
- [4] T. Kato, H. Hiroi, N. Sakai, S. Muraoka and H. Sugimoto, Characterization of front and back interfaces on Cu₂ZnSnS₄ thin-film solar cells, In Proc. of the 27th EU-PVSEC, 2012.
- [5] W. Shockley, H.J. Queisser, Detailed balance limit of efficiency of p-n junction solar cells *Journal of Applied Physics*, 32 (1961): 510-519.
- [6] 15. F. Liu, Y. Li, K. Zhang, B. Wang, C. Yan, Y. Lai, Z. Zhang, J. Li, Y. Liu, In situ growth of Cu₂ZnSnS₄ thin films by reactive magnetron co-sputtering, *Sol. Energy Mater. Sol. Cells* 94 (2010) 2431–2434.
- [7] K. Tanaka, N. Moritake, and H. Uchiki, Preparation of Cu₂ZnSnS₄ thin films by sulfurizing sol–gel deposited precursors, *Sol. Energy Mater. Sol. Cells* 91 (2007) 1199–1201.
- [8] 16. K. Ito, and T. Nakazawa, Electrical and optical properties of stannite-type quaternary semiconductor thin films, *Jpn. J. Appl. Phys.* 27 (1988) 2094–2097.
- [9] T. Tanaka, T. Nagatomo, D. Kawasaki, M. Nishio, Q. Guo, A. Wakahara, A. Yoshida, and H. Ogawa, Preparation of Cu₂ZnSnS₄ thin films by hybrid sputtering, *J. Phys. Chem. Solids*, 66 (2005) 1978–1981.
- [10] C.P. Chan, H. Lam, and C. Surya, Preparation of Cu₂ZnSnS₄ films by electro- deposition using ionic liquids, *Sol. Energy Mater. Sol. Cells* 94 (2010) 207–211.
- [11] 20. K. Tanaka, M. Oonuki, N. Moritake, and H. Uchiki, Cu₂ZnSnS₄ thin film solar cells prepared by non-vacuum processing, *Sol. Energy Mater. Sol. Cells* 93 (2009) 583–587.
- [12] N. Muhunthan, O.P. Singh, S. Singh, and V.N. Singh, Growth of CZTS thin films by co-sputtering of metal targets and sulfurization in H₂S, *Int. J. Photoenergy*, 2013 (2013) 752012.
- [13] R.W. Vook and F. Witt, Structure and annealing behavior of metal films deposited on substrates near 80 K: I. copper films on glass, *J. Vac. Sci. Technol.* 2 (1965) 49-57.
- [14] V.N. Singh and B.R. Mehta, A two-step synthesis procedure for In₂O₃ nanoparticle films having well-defined particle size, *Jpn. J. Appl. Phys.* 42 (2003) 4226-4232.

Benzimidazolyl pyridine complex as accelerator in Epoxy Resin Systems for electrical insulation

Sakuntala Samuelson[#], N M Nanjegowda^{*}, P V Reddy^{*}

[#]*Surana College, Bangalore*

^{*}*Central College, Bangalore*

^{*}*Central Power Research Institute, Bangalore*

Abstract— The synthesis and characterisation of [2,6-bis(benzimidazolyl)pyridine]cobalt(III)chloridetrihydrate has been described. The complex serves as an accelerator for anhydride curable epoxy resin system and the rate of curing has been found to increase with enhanced concentrations of the metal chelate. An appreciable reduction in the cure gel time has been noticed. Based on the kinetic studies, a cure schedule has been proposed. It is also observed that the electrical and thermal properties of the cured epoxy system have not been altered by the presence of the metal chelate at the concentration studied.

Keywords— Epoxy resin, Accelerator, Curing

I. INTRODUCTION

The International Monetary Fund has projected slow growth in the advanced economies between 2012-17. In such a scenario, risks to business establishments can prove to be a serious obstacle to development. In order to stimulate growth, we need a risk free environment. It is important to analyse and quantify potentially destructive risks to industries so that sustainable growth can be assured. Risk surveys in industries show that almost 10% of the risk factor points to fire accidents. 26% of industrial fires are attributed to faulty electrical circuits. Electrical fires are mainly caused due to short circuiting. The smoke that evolves due to the incomplete combustion chokes and causes breathlessness and most deaths are due to this cause. Smoke kills faster than fire. An effort is made to substitute carbon atoms with nitrogen atoms in electrical insulation material to check if its properties can be improved.

Epoxy resins are currently among the most intensively investigated compounds as electrical insulators owing to their remarkable chemical resistance, good adhesion, extraordinary toughness high mechanical strength and good heat resistance. When properly cured, they yield tough materials, which find application in industrial flooring, foam and electrical insulation. The applications of epoxy resins depend on the nature of curing. Generally curing takes place in the presence of a hardener or a curing agent. Anhydrides are used as curing agents for epoxy resins, and the latter are used in casting and lamination. Bases such as tertiary amines are commonly used to accelerate the curing process. Chemical reactions that take place during the period of curing determine the properties of the cured thermoset. Organometallic compounds are known to act as curing agents for various epoxy resin systems^[1-3].

Several acetyl acetones act as latent accelerators for anhydride cure of bisphenol A based resins^[4-8]. Cobalt(III)

acetyl acetone is known to be a suitable accelerator^[9]. In the present work an attempt has been made to use [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate as accelerator for curing epoxy – anhydride system [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate was synthesized and its crystal structure has been established by X-ray crystallography. The cure and kinetic aspects of the resin and the anhydride in the presence of these compounds have been studied. Gel time and storage life studies have also been carried out. Electrical properties such as loss factor of the resin – anhydride system have been investigated.

II. EXPERIMENTAL

2.1 Materials used

A based epoxy resin, Lapox C-17 with an epoxy content of 5.2- 5.5 eq/kg, K-12 hardener (anhydride content of about 94%) and commercial accelerator K-112 were procured from Cibatul, India and were used as such. Silica flour (w-12 grade) of 300 mesh was also procured from Cibatul India and it was dried at 383K for 3 hours and then used as filler. [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate was synthesized using cobalt(II) chloride and 2,6-bis(benzimidazolyl)pyridine.

2.2 Physical Measurements

Elemental analysis was performed with a Thermo Finnigan Flash 1112 CHN analyzer. ESMS was recorded on a Micromass Q-ToF micro instrument (electrospray ionizations, ESI). ¹H, NMR measurements was carried out with a Bruker AMX400 spectrometer in CDCl₃ as the solvent at 400MHz with tetramethylsilane as external reference. Molar conductivities were determined using an Elico model CM-82T conductivity bridge with an conventional dip type conductivity cell. Thermo gravimetric analyser TA HE-20(mettler) was used for thermal characterisation. Thermo mechanical analysis was carried out using TMA Q 400 and loss factor values were determined as per ASTM D 150 specifications. The structure of ligand has been determined by single crystal X-ray crystallography (BRUKER SMARX CCD) and (EDAX by JEOL, JFC-1100E ion sputtering device). The gel time characteristics of the resin system were determined using Gel norm Gel timer(Switzerland). Differential scanning calorimeter with data station (Perkin Elmer DSC-2C) was used for cure kinetic studies. The viscosity measurements were made using Brookfield viscometer (Model – RVT).

In order to measure the gel time characteristics of the resin system, about 5 to 10 g of the resin mix was taken in a tube provided with spiral wire for agitation. This was

introduced into a bath maintained at a particular temperature. The mixture was allowed to attain thermal equilibrium and then the spiral wire was mechanically moved up and down. The viscosity of the resin system gradually increased and a rubbery mass was formed. At this stage the movement of the wire gets arrested. The time taken for the entire process was noted as gel time. The viscosity measurements were made for the resin system in presence of 0.5 phr (parts per hundred) of benzimidazole and the number of days taken for a ten-fold increase in viscosity was recorded and tabulated as the storage life.

Dynamic DSC scans of the epoxy systems were carried out in the temperature range 40-400°C at varying heating rates of 5°-40°C/min. The temperature corresponding to the T_m of the curing exotherm was determined at various concentrations of the benzimidazole. The electrical and thermal measurements were carried out as per IS: 1998 specifications. All thermal analysis were carried out in nitrogen atmosphere at a flow rate of 20 ml/min.

2.3 Preparation of 2,6-bis(benzimidazolyl)pyridine

2,6-pyridine dicarboxylic acid (0.05 m mole) was added to a mixture of o-phenylene diamine (0.1 m mole) in syrupy phosphoric acid (50 ml) and stirred for 4 hours in sand bath at 240°C. The greenish blue melt that was obtained was poured into cold water and subsequently neutralized with 10% sodium carbonate solution. A pink colored solid was separated and it was recrystallised from ethanol and the resultant white needles were checked for its melting point (70-80% yield).

2.4 Preparation of

diaquochloro[2,6-bis(benzimidazolyl)pyridine]cobalt(III) [Co(bBzI₂py)₂]Cl₃H₂O: Cobalt(II) chloride hexa hydrate (1 m mole) was dissolved in distilled warm ethanol. To this was added 2 m mole of 2,6-bis(benzimidazolyl)pyridine in ethanol (10 ml). The mixture was refluxed for three hours. The resulting yellow solid was filtered. The dry compound was recrystallised in ethanol and crystals analysed.

III. RESULTS AND DISCUSSION

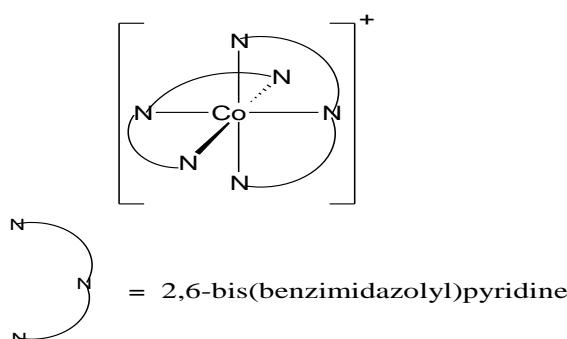
3.1 Structure of

[2,6-bis(benzimidazolyl)pyridine]cobalt(III)chloride trihydrate

Elemental analysis was conducted and the following is reported.

Calculated: C 59.23%, H 3.66%, N 18.17%.

Experimental: C 59.23%, H 3.3%, N 18.28%.



3.2 Resin – Hardener Stoichiometry

The resin-hardener stoichiometry was determined using dynamic DSC runs by plotting enthalpy change ΔH against the amount of hardener used and the stoichiometry was found to be 1:1^[13]. For commercial applications the epoxy system is generally associated with a suitable filler. In the present study flour was added as filler in such a way that the control system had the formulation of resin, hardener and filler in the ratio of 1:1:3.

3.3 Effect of [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate on Resin System

The observed temperature minimum (T_m) value of the cure exotherm was plotted against concentration of the [2,6-bis(benzimidazolyl)pyridine]cobalt(III)chloride trihydrate. Such a plot is shown in Fig.1. The rate of decrease in the T_m value was appreciable upto 0.5 phr of [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate and thereafter it remains almost constant. In view of this, further evaluation was carried out upto 0.5 phr of the benzimidazole.

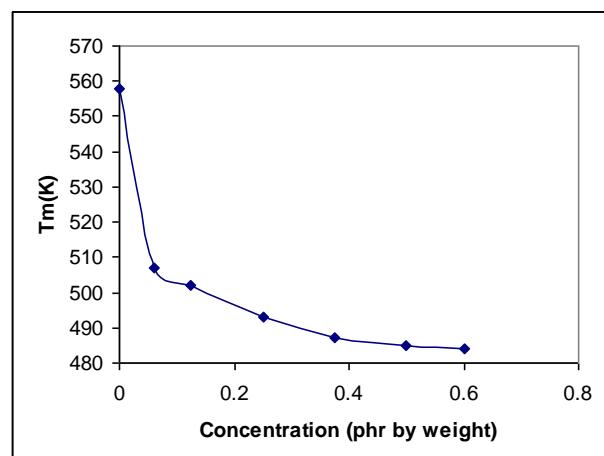


Figure 1: Effect of [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate on T_m (K) of cure exotherm of resin-hardener system

3.4 Gel time and storage life

The effect of [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate on the gel time and storage life of the epoxy resins system at different temperature was monitored. The values obtained are listed in Table 1. The results indicate that the gel times for the resins system in the presence of [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate are lower when compared to the control system and the values decrease with temperature.

It is observed that with increase in concentration of complex, the gel time values of the epoxy resins system decreases. Also the values decrease with increase in temperature at a given concentration of the ligand. The storage life also decreases with increase in concentration of the accelerator. The values are comparable to that of a commercial accelerator.

Table 1: Gel time and storage life of resin system with [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate

Concentration of ligand (phr)	Gel Time (minutes)					Storage life (days)
	373K	393K	413K	433K	453K	
0.0000	110	690	257	114	43	46
0.0625	390	362	165	84	37	27
0.1250	334	240	85	42	20	22
0.2500	276	211	67	36	17	20
0.3750	164	128	39	17	10	18
0.5000	128	90	30	15	06	15
K-112 (0.375 phr)	101	47	13	12	18	18

3.5 Kinetic studies and Cure studies:

By considering the degradation process as a simple chemical reaction, Toop^[14] has derived an expression to evaluate the thermal life of wire enamels. Also, several reports are available based on thermal analytical techniques. This concept has been used for the purpose of finding out the cure schedules^[15] using the cure kinetics, which is based on the data obtained from DSC.

Dynamic DSC scans of the epoxy systems were carried out in the temperature range 40° – 400°C at varying heating rates of 5° to 40°C/min. The temperatures corresponding to the peak minimum (T_m) of the curing exotherm were determined at various parts per hundred of [2,6bis(benzimidazolyl)pyridine]cobalt(III)chloride trihydrate. The energy of activation (E_a) for the curing reaction was calculated by plotting log of heating rate versus (1/T_m). Using these values, the pre-exponential factor(Z) and the rate constant (k) were also evaluated^[16,17]. The E_a value for the curing of epoxy system in presence of various [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate has been found to be in the range of 22-29 kcal/mol (Table 2).

Table 2: Kinetic and cure schedules of epoxy system with[2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate.

Concentration of [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate (phr)	E _a (k.cal/mol)	K x 10 ³ (minute)	Z x 10 ⁶	Cure time, minutes at 140°C
0.0000	19.24	21	27-30	293
0.0625	29.18	38	8-7	61
0.1250	28.6	40	7-6	54
0.2500	27.26	42	5-6	48
0.3750	23.34	46	4-5	40
0.5000	22.17	49	3-4	26
K112 commercial accelerator (0.375 phr)	16.1	45.2	1.3	15

Generally the rate constant was found to increase with enhanced concentrations. It has been observed that with

enhanced concentrations of the accelerator the rate constant was found to be increased from 38×10^{-3} min at 140°C to 46×10^{-3} min at the same temperature. The activation energy was found to decrease from 29.2 k.cal/mol at zero concentration to a value of 22.17 k.cal/mole at 0.5 phr of the accelerator. The exponential factor increased with increase in concentration of diaquochloro[2,6-bis(benzimidazolyl)pyridine]cobalt(III). Table 3 also indicate the cure time of the epoxy resin system in presence of the accelerator. The data indicate a large decrease in cure time values at the concentrations studied. The values are 61 minutes at 0.0625 phr of the ligand where as the cure time is about 293 minutes in the absence of the accelerator. This suggests that the ligand acts as a better curing agent.

IV. ELECTRICAL PROPERTIES

For application in high voltage insulation involving generators, transformers and a.c.motors, the highest voltages used usually dictate the limitations. Hence, the present epoxy samples were subjected to variations of voltage. The capacitance and the loss factor of the cured epoxy resin system at different concentrations of the ligands and their complexes have been studied both at room temperature as well as at higher temperatures. At room temperature there is no difference in terms of the loss factor of the cured system. The loss factor data obtained for the epoxy system with variation of temperature is shown in Figure 2. The plot indicates that the trend in loss factor values is almost same with different concentrations of the ligand and at 0.25 phr, the loss factor values are almost equivalent to the blank system. The tan delta tip up for the ligand under study is indicating lower temperature than the blank system. This suggests that the concentrations of the ligand studied, one of the important electrical properties is not deteriorated for the epoxy system.

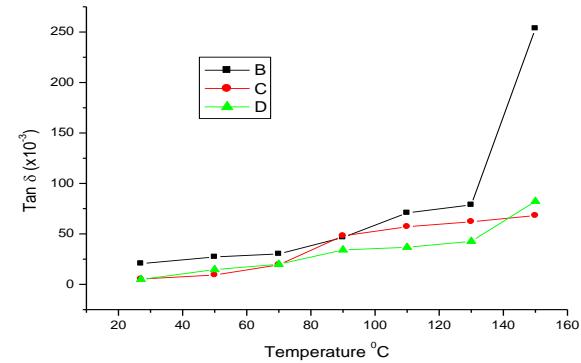


Figure 2: Plot of Tan δ (loss factor) versus temperature for
B Blank system
C K-112 (commercial accelerator)
D Diaquochloro[2,6-bis(benzimidazolyl)pyridine]cobalt(III)

V. THERMAL PROPERTIES

Thermo gravimetric analysis for the cured sample of epoxy system in the presence of 0.5 phr of [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate was done. Normally when a metallic impurity is added to an insulating material the thermal stability will be affected. But at 0.5 phr, there was no appreciable change in the decomposition temperature (at 10% weight loss) was observed when the cured samples were subjected to dynamic TGA runs under nitrogen atmosphere.

VI. CONCLUSIONS

- [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate act as accelerator to the resin system. Its addition decreases the cure time. The addition of the complex enhances the curing activity of bisphenol-A based resin and its activity is comparable to that of the commercial accelerator. The kinetic data indicate that the rate of curing is enhanced in the presence of the [2,6-bis(benzimidazolyl)pyridine]cobalt(III) chloride trihydrate. The storage life of the catalyzed system is also affected to certain extent in the presence of the accelerator but comparable to a commercial accelerator.
- The addition of the complex to the resin system is not affecting the important electrical properties and thermal properties of the cured resin system

REFERENCES

- [1] Starck H. and Schlenker F; U.S. Pat. 228, (1957)2801.
- [2] Naps M., U.S. Pat. 208, (1959) 2876.
- [3] Markovitz M., U.S. Pat. 214, (1973)3812.
- [4] Stoakley D.M., St. Clair, J. Appl. Polym. Sc., 31, (1986)225.
- [5] Smith J.D.B., J. Appl. Polym. Sc., 26, (1981) 979.
- [6] Reddy P.V., Thiagarajan R., Ratra M.C. and Nanjegowda M. N., J. Appl. Polym. Sc., 41, (1990) 319.
- [7] Reddy P.V. and Nanjegowda M.N., J. Appl. Polym. Sc., 53, (1994) 1307.
- [8] Reddy P.V., Indian Pat. 181043, (1993).
- [9] Reddy P.V., Thiagarajan R., Ratra M.C., Nanjegowda N.M., J. Appl. Polym. Sc., 41, (1990) 319.
- [10] Bruker SMART , V.6.028 Bruker AXS Inc., Madison Wisconsin, USA, (1998).
- [11] Sheldrick, G.M. SHELXS-97 "Program for Crystal Structure Solution", University of Gottingen, Gottingen, Germany (1997).
- [12] Sheldrick, G.M. SHELXL-97 "Program for Crystal Structure Refinement", University of Gottingen, Gottingen, Germany (1997).
- [13] Borchardt H.R. & Daniels F., J. Am. Chem. Soc., 79, (1957)41,.
- [14] Toop D.J., IEEE Trans. Elec. Insul., EI, 6, (1971) 2.
- [15] Thiagarajan R., Reddy P.V., Sridhar S. and Ratra M.C., J. Therm. Anal., 36, (1990) 277.
- [16] Ozawa T., J. Therm. Anal, 7, 601, 1975, H.E. Kissinger, Anal. Chem., 29, (1957) 1702.
- [17] Kissinger H.E., Anal. Chem., 29, (1957) 1702.

Integrating APIs through Enterprise Service Bus

S. Sriashalya^{*1}, Y.Kalyani^{#2}

^{*}SVIAS, Eastern University, Srilanka,

[#]Department of Computer Science, Trincomalee campus, Eastern University, Srilanka

sriashalya93@gmail.com

ykalyani17@gmail.com

Abstract—This study evaluates the importance of integrating application-programming interface (APIs) with middleware in web services. Technologies are growing very faster and business trends are changing very frequently. Modern enterprise consists of disparate system and services. They may use different protocol and services in different platforms. Most of the IT solutions are not based on a single vendor or single solution and they may use on-premise services or on-cloud solutions. So there is a huge need of a system which can satisfy all business requirements. There are thousands of apps in different categories. It is important to connect them to achieve a business goal. This study integrates particular number of APIs together to reach a business requirement through a middleware.

Keywords— API, ESB

I. INTRODUCTION

Analysing and interpreting application-programming interface (APIs) is a fast growing topic in web applications. API is a set of programming instructions and standards for accessing a web-based software application or web tool. A software company releases its API to the public so that other software developers can design products that are powered by its service.

It is important to integrate two or more APIs together to satisfy most of the business requirements and their deals. Currently there were thousands of APIs in different categories such as E-commerce, Marketing, Messaging, Customer Relationship, etc. It is not enough to use a single API for a wide range of business requirement. So connecting two or more APIs may help to achieve the ultimate business goal.

Enterprise service bus (ESB) plays a major role to connect APIs together. It acts as a bridge between an operating system or database and applications, especially on a network.

II. ENTERPRISE SERVICE BUS (ESB)

An enterprise service bus (ESB) [1] is a software architecture model used for designing and implementing communication between mutually interacting software applications in a service-oriented architecture (SOA). As software architectural model for distributed computing, it is a specialty variant of the more general client server model and promotes agility and flexibility with regard to communication between applications. Its primary use is in enterprise

application integration (EAI) of heterogeneous and complex landscapes. The motivation was to find a standard, structured, and general purpose concept for describing implementation of loosely coupled software components (services) that are expected to be independently deployed, running, heterogeneous, and disparate within a network. ESB is also a common implementation pattern for service-oriented architecture. An ESB transports the design concept of modern operating systems to networks of disparate and independent computers.

III. METHODOLOGY

This study connects the APIs Shopify, Mailchimp, Facebook, ZohoCRM and Shippo through ESB to fulfill the business requirement such as product marketing, customer creation and shipping. Glimpse of APIs are following:

A. Shopify



Shopify is an shopping cart system used in e-commerce. All API usage happens through Shopify applications, shop owners can create applications for themselves through their own admin. Developers are given functionality across articles, assets, customers, events and more. The API uses a RESTful interface and responses are formatted in XML and JSON.

B. Mailchimp



Online email marketing solution to manage subscribers, send emails and track results. Offers integrations with other programs.

C. Facebook



Facebook is a popular free social networking website that allows registered users to create profiles, upload photos and video, send messages and keep in touch with friends, family and colleagues. The site, which is available in 37 different languages

D. ZohoCRM



ZohoCRM empowers small to large-sized organizations with a complete customer relationship lifecycle management solution for managing

organization-wide Sales, Marketing, Customer Support & Service and Inventory Management in a single business system.

E. Shippo



Shippo API helps to print shipping labels, track packages, and manage shipments all from one place, saving the time & money on shipping.

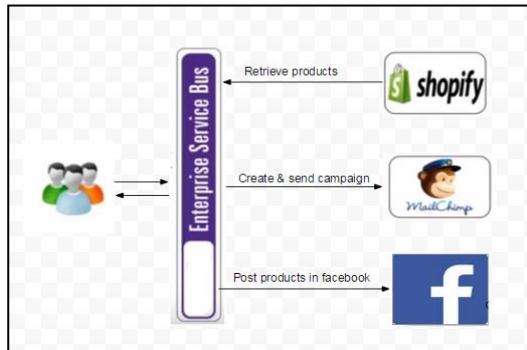
IV. EXPERIMENTAL SETUP

This work integrates Five APIs through an open source middleware. For each API we have used ESB connectors to connect with ESB. A connector allows you to interact with a third-party product's functionality and data from your ESB message flow, enabling you to connect to and interact with the APIs of services such as Shopify, Mailchimp, Facebook, and ZohoCRM. Shopify used as a main API and others get engaged with that to satisfy following concepts:

- Product Marketing
- Customer Creation
- Shipping

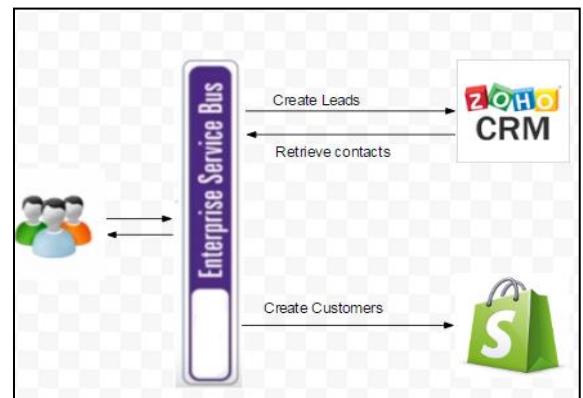
A. Product Marketing

In the product marketing phase product details are retrieved from Shopify API. Then draft campaign is created and sent to Mailchimp API. Then relevant page is published on the company's page in Facebook with instructions to viewers to comment on the post.



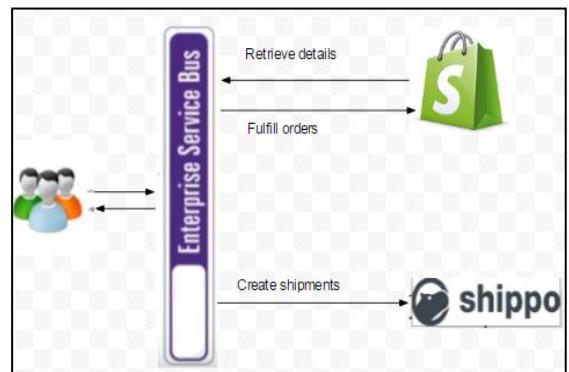
B. Customer Creation

In the customer creation phase, details of the potential customers are retrieved from Facebook and MailChimp and created as leads in ZohoCRM. Finally contacts are retrieved from the ZohoCRM API and they are created as customers in the Shopify API.



C. Shipping

In the shipping phase, unshipped orders are retrieved from Shopify and the orders are fulfilled. Then shipments are created in Shippo.



V. CONCLUSION

This study analyses the integration of multiple APIs through a middleware. ESB plays as a bridge between web services to bring data from one end to another. Here it is obviously proven that ESB can connect independent APIs together to complete a business requirement.

VI. FUTUREWORK

In modern enterprises most of the organization consist of various systems. It may use in different protocols, different standards or built by various vendors. And some systems might even on cloud. In order to get job done these systems may need to communicate with each other. ESB can integrate all disparate systems with a bus architecture. ESB is designed as the middleware layer that enables interoperability among heterogeneous systems and services using the SOA model. In future we will identify another use case for particular problem and going to do further research on this.

REFERENCES

- [1] J. Al-Jaroodi, N. Mohamed , Hong Jiang, Distributed systems middleware architecture from a software engineering perspective, in IEEE International Conference on Information Reuse and Integration, pp. 572 – 579, 2003
- [2] T. Keviczky, A. Packard, O. R. Natale, G. J. Balas, Application Programming Interface for Real-Time Receding Horizon Control in proceedings of the 44th IEEE Conference on Decision and Control, pp 1331 – 1336, 2005

A Lightweight tool for Learning Data Structures using Android Smart Phones (DSLT)

V. Thushika^{*1}, K. Thabotharan^{#2}

^{*1}*Department of Mathematics, Eastern University SriLanka,*

^{#2}*Department of Computer Science, University of Jaffna, Sri Lanka*

¹*thushiv07@gmail.com*

²*thabo@jfn.ac.lk*

Abstract—M-learning is expedient in that it is accessible from anywhere and virtually at any time. It is a novel and an innovative approach in education and it brings strong portability by replacing books and notes with huge learning opportunity to people from all walks of life. Learning the concepts of data structures and their operations is crucial for students who study Computer Science. A learning tool with visual representation of Data structures and their operations can be of great help to students who struggle to understand the fundamental concepts of Data structures in Computer Science. Android enabled smart phones have become very popular among young people and younger people find these small hand held devices as a convenient medium of knowledge gathering. In addition, these devices also provide a convenient platform for developers to develop attractive applications that exploit all the facilities available in these devices. In this paper, we present our lightweight tool for learning and understanding Data structures and their operations. Our tool is developed using the Android Operating System and the graphical user interface with animations will help anyone to understand the concepts of data structures easily.

Keywords—Android, Data structure, Learning tool

I. INTRODUCTION

Many people cannot imagine even a day without their favourite mobile device. People use these small hand held smart for everything: to find information, to stay connected with their friends and families, to find the way around, to decide on what to do, and many more other things. However, very often we come to the point when we would like to have an application for a particular situation or for a certain use, but we find it difficult to find such an application.

Smart phones with Android operating system offer many novel features to the end users to experience and, at the same time, provide a convenient and a well-supported platform for the creative developers to create brilliant applications. These novel features and the efficient working of the Operating system have enabled Android to gain much popularity among the users and developers within a short period.

Many newer features are being added in the newer versions of the Operating system and this has attracted more developers to pay their attention to develop applications that are more creative.

Many students find it difficult to learn and understand the fundamental concepts of Data structures and their operations during their early stages in studying Computer Science. Lack

of imagination in understanding the structural and operational sequences of Data structures make the students feel desperate in understanding Data structures that is a very fundamental and an essential component in Computer Science. Having a good understanding of Data structures helps students to be competent in writing efficient computer programs and also be talented in solving real world problems. A Smartphone based application, which students would prefer to use, would be an ideal medium to enlighten the students with the concepts and operations of Data structures, in solving real world problems. In this paper, we have developed an Android based application entitled, DSLT, which would help students to learn Data structures, their operations and their applicability in a more convenient way. Since storing data and making proper use of the available space are most important aspects in present day software development, it is essential for any developer to have a deep understanding about data structures and their applications. We believe that this tool will be much helpful to many students and other learners. Students, who are learning data structures via this tool, can easily understand the data object types and their operations.

II. BACKGROUND

A. Mobile operating systems

Every phone needs some type of operating system to run its services such as making phone calls, text messaging, taking photos, and so on. Early mobile Operating systems were fairly simple, since the capabilities of the phones they supported were limited. Modern smart phones have many advanced features that are comparable to applications of modern day computers. Higher processing powers, larger storage capacity, multitasking, higher resolution touch sensitive displays, sensors that can monitor camera movements, multiple communication interfaces etc., all make these phones more attractive to create novel applications that are preferred by users. Google's Android, Apple iOS, Symbian and Blackberry are some popular mobile operating systems that are used in present day smart phones.

B. Android operating system

A Smartphone with Android operating system offers brilliant functionality to the users offering a different experience and at the same time provides greater opportunities to developers to create applications that can satisfy the different needs of users. Android Operating system for mobile devices is developed by the Open Handset Alliance, which is led by Google. Most of the Android core

is released under the open-source Apache License. Android uses a Linux kernel with higher-level APIs written in C^[1].

C. Eclipse

Eclipse is a platform that has been designed from the ground up for building integrated web and application development tooling. The vast majority of android applications stand only because of the existence of Eclipse. It is an open source IDE for java projects. Google officially supports it, and has created the Android Development Tools plug-in for Eclipse and integrated its AVD Manager virtual device management into the tool as well^[2].

III. DATA STRUCTURE LEARNING TOOL

This section describes the user interface implementation of this DSLT application. When our program starts, it first shows a welcome screen. Once the program loading process is over, the program shows the list of data structures for which the explanation is available as shown in the Fig 1.

A. STACK

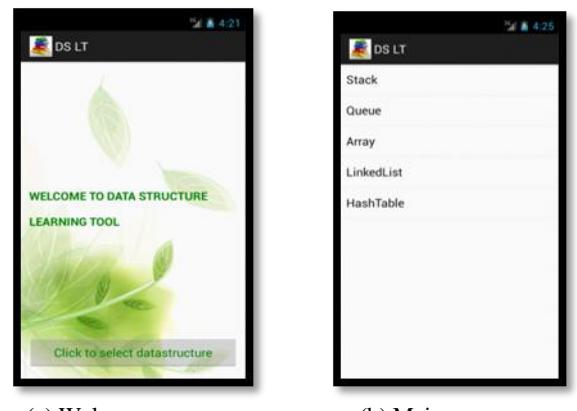
A stack is a restricted linear list in which all additions and deletions are made at one end, top. Stack follows Last in First Out mechanism (LIFO). A stack has two fundamental operations *push* and *pop*. The *push* operation stores something on the *top* of the stack and the *pop* operation retrieves something from the top of the stack^[3].

By clicking on the stack option, the user will be able to see stack operations push and pop with the aid of two images respectively, and two dropdown buttons, which allow user to execute push or pop examples. User will be able to select either number example or colour box example as shown in the Fig 2.

If the user selects push example, then it will move to another screen with an example as shown in the Fig 3. After that, when the user clicks on the PUSH button consecutively, the push operation will be depicted precisely Fig 3. Now if the user selects pop example then it will move to another screen with selected example as shown in the Fig 4. If the user clicks PUSHALL button all given elements pushed in the stack and also shows the TOP element of the stack. And then if the user clicks the POP button consequently, they will be able to do the pop operation. The process of pop operation is shown in the Fig 4.

B. QUEUE

Like Stack, Queue is also an ordered list of elements of similar data types. Queue is a Linear Data Structure, which follows First in First Out Mechanism. In a queue the first element inserted is the first one to be removed from the queue. A queue is a sequence in which items are inserted at one end (called rear of the queue) and deleted from the other end (the front). There are two main queue operations: Enqueue and Dequeue. Enqueue inserts an element at the end of the queue and Dequeue removes and returns the elements at the front of the queue^[3]. Queue can be implemented using an Array, Stack or Linked List.



(a) Welcome screen

(b) Main screen

Figure 1. Initial starting screens



(a) Stack definition

(b) Stack example selection

Figure 2. Stack operations

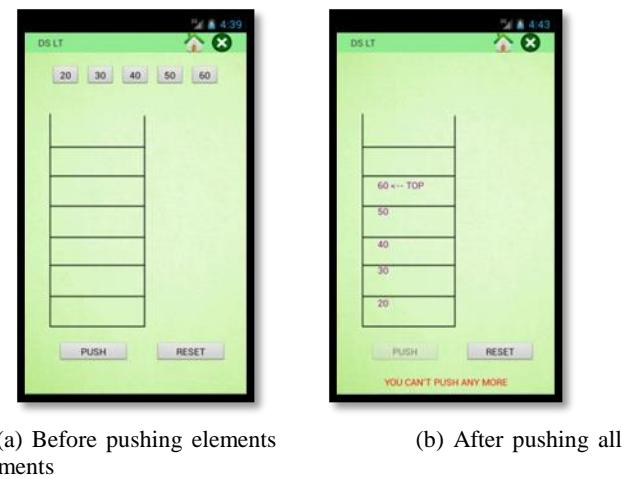
(a) Before pushing elements
(b) After pushing all elements

Figure 3. Push number example

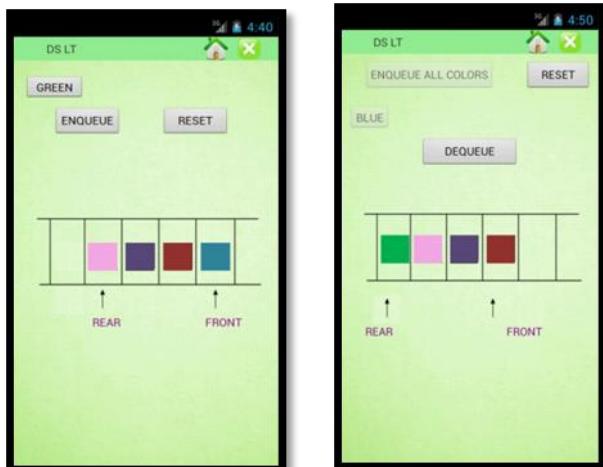
(a) before popping elements (b) At the start of popping operation
Figure 4. Pop number example

As stated for stack, queue operations also will able to implement with the option Queue in the main screen. If the user clicks on colour example, a new screen will be displayed as shown in the Fig 5. If the user clicks ENQUEUE button sequentially, each colour will be enqueued consequently with the indication of REAR and FRONT as shown in Fig 5. Now if the user selects dequeue example then it will move to another screen with selected example as shown in the Fig 5. By clicking ENQUEUE ALL COLORS button user will be able to enqueue all example colours as shown in the Fig 6. Then user will able to execute dequeue operation by clicking the DEQUEUE button consequently.

C. HASH TABLE

Hashing is the process of mapping large amount of data item to a smaller table with the help of a hashing function. Normally hashing is used to index and retrieve items in a database because it is faster to find the item using shorter hashed key than to find it using the original value. It is also used in many encryption algorithms. The essence of hashing is to facilitate the next level searching method when compared with the linear or binary search. Hash tables are a common approach to the storing / searching problem. The simplest kind of hash table is an array of records. The hash function is used to index the original value or key and then used later each time the data associated with the value or key is to be retrieved. Thus hashing is always a one-way operation. In open hashing strategy, collision is resolved by keeping the conflicting element in a list. That is to keep all elements in a list, which generates same hash. In closed hashing strategy, collision is resolved by placing the conflicting element near to the slot generated by the hash function. Associated with closed hashing is a rehash strategy^[4].

By clicking Hash table option in the main screen user can able to see hash table operations open hashing and closed hashing. If the user clicks on the open hashing option in dropdown box, a screen will be displayed as shown in Fig 7, and the user will be asked to enter a value in the input text box. Using that value hash key will be calculated and displayed in the screen.



(a) Before enqueue operation

(b) Progress of enqueue

Figure 5. Enqueue color



(a) Before the dequeue operation

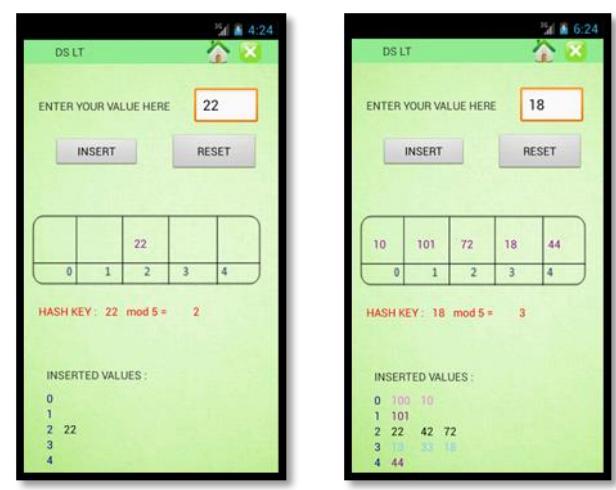
(b) Progress of dequeue operation

Figure 6. Dequeue colour example

In addition, already inserted values of the same hash key stored and displayed at the bottom of the screen. The whole set of operations is depicted in the Fig 7.

If the user clicks on the closed hashing option in dropdown box, a screen will be displayed. And there, the user asked to enter a value. Using that value hash key will be calculated and displayed in the screen as shown in the Fig 8. When a same hash key's value is entered it will be inserted to the next hash key's cell according to the rule of closed hashing. Therefore, after inserting all values into all cells of that table it will alert the user that they can't able to insert anymore.

Individual components are tested using unit testing with successful results. In Table I, we report the reason of testing and results for each test. Related collections of dependent components are also tested. Modules are integrated into sub-systems and tested; the focus here should be on interface testing. Finally, all these included as a whole system in the name of data structures learning tool (DSLT) and tested with user data to check that is acceptable or feasible.



(a) Inserting a value

(b) Progress of open

Figure 7. Open hashing



(a) Inserting a value (b) At the end of closed hashing
Figure 8. Closed hashing example

IV. TESTING RESULTS

Table 1. Unit testing results

Test Description	Reason of testing
The .apk file installaiton	To test the app is launching perfectly or not
Double click on DSLT icon	To test app is working on particular device
Click on the main screen button	To check correctly connected to the next screen
Click on the dropdown button	To check selected option is working correctly.
Click on the home button	To test current page move to home page
Click on the exit button	to test the app correctly quit by confirming the exit with alert
Insert values after insertion	To test app alerts the user about the limit of insertion
Delete values after all deletions	To test app alerts the user about the limit of deletion
Unable to click the button after finishing clicks	To test that the app not allowing any clicks after clicking all inouts

Test Description	Reason of testing
Displaying temporary calculated values every time in the screen	To check calculated value using the program is correct or not.
Inserting a value in input textbox	To test that an input is taken as integer and able to use it for calculation
Make sure of clicking an image	To check the particular image is clicked or not
Remove the app from the installed device	To test app is able to uninstall

V. CONCLUSION

In this work, we have designed, developed and implemented a user-friendly learning tool to learn the operations of Data structures. This tool will help students to learn data structures with the aid of visual effects. The animations and the screen changing have all been designed with human interaction concepts in mind, and provide a good user experience. Our testing indicates that our tool runs successfully for all cases and it proves that the system works without problem. We hope that this tool would be much useful for students and other learners. As future enhancement, we would like to improve our application to include the examples with more number of data elements. We would also like to enhance the application by extending it using some real world applications as examples.

REFERENCES

- [1] Wikipedia. (2016). Android (operating system). [online] Available at: [https://en.wikipedia.org/wiki/Android_\(operating_system\)](https://en.wikipedia.org/wiki/Android_(operating_system))
- [2] Wikipedia. (2016). Eclipse. [online] Available at: <https://en.wikipedia.org/wiki/Eclipse>
- [3] Introcs.cs.princeton.edu. (2016). Stacks and Queues. [online] Available at: <http://introcs.cs.princeton.edu/java/43stack>
- [4] Wikipedia. (2016). Hash table. [online] Available at: https://en.wikipedia.org/wiki/Hash_table

Phytochemical Constitution of cultured *Gracilaria edulis* from East coast of Batticaloa District, Sri Lanka

G.Umakanthan*¹, P.Vinobaba *², K. Radampola^{#3}

* Department Fisheries and Aquaculture - Department of Zoology,
University of Ruhuna Sri Lanka - Eastern University, Sri Lanka.

[#]University of Ruhuna Sri Lanka.

¹ghumakanth@gmail.com

Abstract— *Gracilaria edulis* is one of the macro algae that is known to produce a wide variety of bioactive secondary metabolites which are used in biotechnological industries. However, *Gracilaria edulis* of Sri Lanka have not been adequately explored for their potential as a source of bioactive substances. In this cause *Gracilaria edulis* were cultured in two sites from Batticaloa namely Palameenmadu Brackish water and Passikudah sea water for assessing their potential bioactivity. Phytochemical analyses of *Gracilaria edulis* showed the alkaloids, carbohydrates, saponins, flavonoids, terpenoids, cardiac glycosides, gum, fats and proteins. Amino acid analyses indicated the presence of free amino acids in moderate contents in this species. The study was correlated with the water quality parameters of the collection sites. The study depicted how the water quality parameters affect the nutritional composition of the *Gracilaria edulis*. The permitted levels of bio chemical components of *Gracilaria edulis* favouring a good nutritional source reported cultures from palameenmadu than passikudah.

Keywords— Phytochemical, Biochemical composition, *Gracilaria*.

I. INTRODUCTION

The brackish water and marine water contains more than 150,000 seaweeds which is a primary source of natural products (Lyase, 2011). Marine seaweeds are submerged and float plants of shallow marine meadows. These Marine algae lack true stems, leaves and Roots; however, they have a stipe that is stem like, blade that is leaf like and a holdfast that resembles roots like terrestrial plants.(Capo, et al.,1999) Seaweeds contain photosynthetic pigments and use sunlight to produce food and oxygen from carbon dioxide, and the water [Babuvelvam & Ravikumar, 2011]. They have salt tolerance so that desiccation does not occur because the osmolarity of cytoplasm is adjusted to match the osmolarity of the salty water. Marine macroalgae are ecologically and commercially important to many regions of the world, especially in Asian countries such as Korea, China, and Japan (Smith, 2004). Most of the sea weeds are a valuable food resource which contains low calories, and they are rich in, proteins, polysaccharides, steroids, dietary fibers, vitamins, and minerals (Ito & Hori, 1989, Darcy vrilion, 1993, Lahaye, 2011). They were also considered important as traditional remedies since as early as 3000 BC. (Smith, 2004). They have unsaturated lipids afford protection against cardiovascular pathogens (Vallinayagam, et al., 2009).

One of the richest and most promising sources of bioactive primary and secondary metabolites are found in Seaweeds. A primary metabolite is a kind of metabolite that is directly involved in Physiological function.one of the example is aminoacids. A secondary metabolite is not directly involved in those processes, but it has an important ecological function Some examples are alkaloids, antibiotics, terpenoids, and peptides. [Faulkner, 2002] and their discovery has significantly expanded in the past three decades [Smith, 2004, Cardozo et al., 2006]. xanthophylls, carotenoids, terpenoids, chlorophyll, vitamins, saturated and polyunsaturated fatty acids, amino acids, acetogenins, polysaccharides such as agar, carrageenan, proteoglycans, alginate, laminaran, rhamnan sulfate, galactosyl glycerol and

fucoidan and antioxidants such as polyphenols, alkaloids, halogenated compounds are synthetized variety of compounds by seaweed.[Cen-Pancheo et al., 2006, Souza et al., 2009, Guven et al., 2010, Cabrita. et al., 2010]. Currently, algae represent about 9% of biomedical compounds obtained from the sea [Jha & Zizong 2004]. Compounds with cytostatic, antiviral, antihelmintic, antibacterial activities and antifungal have been detected in green, brown and particularly red algae also [Newman et al., 2003, Lindequest & Schweder 2001]. Seaweeds can act as allelopathic, antimicrobial, antifouling, and herbivore deterrents, or as ultraviolet-screening agents due to diverse simultaneous functions of those compounds. [Ianova et al., 2006]. They are also used by the Biotechnological and pharmaceutical industry in drug development to treat diseases like inflammation, pain, arthritis, infection for virus, bacteria and fungus [Deig et al., 1974].

The seaweed synthesizes pure forms of the fatty acids. It is same as in human milk which is used to be building blocks for visual and mental development (Linsert, 1994) and have been extensively screened for syntheses of new drugs in pharmaceutical industry. (Khotimchenkoso et al., 1963). In 1975 Ryther and collaborators assessed numerous seaweed species for their potential growth rates and dry weight yields. They proved that the genus *Gracilaria* was the most important ones because of its ability to achieve high yields and while producing commercially valuable extracts [Capo et al., 1999]. Genus *Gracilaria* (Gracilariales, Rhodophyta) is a macroalgae group with more than 300 species of which 160 have been accepted taxonomically. These are usually red, green or greenish brown with a three-phase cycle and can be found in subtropical and tropical seas [Guiry, 2011, Skriptsova et al., 2001]. The *Gracilaria* species are important for the industrial and biotechnological uses because they have phycocolloids, the main source of agar α -(1,4)-3,6-anhydro-L-galactose and β -(1,3)-D-galactose with little esterification in cell wall [Kain & Destombec 1995, Lyase, 2011].

Seaweeds are an excellent source of hydrocarbons and single cell protein (Jha & Zinong, 2004) important medicines [Ito & Horik, 1989], polysaccharides such as agar-agar, alginic acid, carrageenan and Biogas [Lyase, 2011], antibiotics [Babuvelvam & Ravikumar, 1993], colouring pigments [Smith, 2004]. Macro alga is a natural sources of long-chain polyunsaturated essential fatty acids from the omega-3 family (LC-PUFAs x3), such as eicosapentaenoic acid, C20:5x3, which may reduce the risk of, thrombosis, atherosclerosis and heart disease. [Darcy vrilion, 1993, Lahage, 1993]. Therefore, seaweeds are used as a development of low-cost, highly nutritive diets for animal and human nutrition. Brown seaweeds is having small amount of protein. (average: 5-15 % of the dry weight). whereas higher protein contents are having in green and red seaweeds (on average 10-30 % of the dry weight). This investigation estimates the amount of Biochemical in the selected seaweeds Rhodophyceae of *Gracilaria edulis*.

In fact the potential biological resources of east coast aquatic environments of the Sri Lanka represented by the Passikudah and the Palameenmadu have not been adequately explored and harnessed for biotechnological applications and deriving biopharmaceuticals. In this context a study was

undertaken to isolate and evaluate prospective bioactive substances from cultured macro algae of the Passikudah and Palameenmadu. Herein investigate the isolation of Biochemical substances from *Gracilaria edulis* and the phytochemical composition of its extracts.

II. MATERIALS AND METHODS

A. Sampling site

The sea weed samples were cultued from Site 1: Passikudah (07° 44' 320"N; 081°42' 293"E), and Site 2: Palameenmadu (07° 44' 320"N; 081°42' 293"E),



Figure 1:Passikudah & Palameenmadu *Gracilaria edulis* cultured sites map in Sri Lanka

B. Collection and preparation of extracts

The collection sites were visited during rainy season and the samples were collected by hand picking. *Gracilaria edulis* on shores are collected by hand. Those in deeper zones were collected by diving and found attached to rocks were pulled out. The species collected were immediately transferred to dark polythene bags by keeping blotting papers in between. Water quality parameters are noted in the collection site. The collected samples were sorted and brought to laboratory for further analysis. Seaweeds were shade-dried and powdered in a blender. 500 g of powdered material was extracted sequentially with ethanol. The extracts were filtered using Whatman filter paper No. 1 and concentrated with rotary evaporator. The powdered samples were used for quantification.

C. Water quality analysis

The water quality analysis of the 5 water samples for each month from March to August were collected from the sample site was carried out. Temperature (°C) was measured using mercury filled Celsius thermometer with an accuracy of 1°C. pH was measured using digital pH meter with glass calomel electrode, pH 0.01 accuracy. Salinity (PSU) was determined by Salinometer.

D. Statistical analysis

All the Testing samples were carried out independently in triplicates, resulting data were expressed as the mean and the results were processed using Excel 2010 (Microsoft, Redmond, WA, USA).

E. Phytochemical screening

10g of *Gracilaria edulis* powder sample was added to 100 ml of methanol in a conical flask and plugged with cotton wool.(Herin et al.,2012) Supernatant was collected and the solvent was evaporated to make the crude extract after 24 hrs.The *Gracilaria edulis* methanolic extracts were used for phytochemical studies. Phytochemicals like glycosides, cardiac glycosides, carbohydrates, proteins and amino acids, flavonoid, saponins, gums, terpenoids, phenols, and starch were analysed by qualitative chemical method.

Major constituents were undertaken using standard qualitative methods as described by Sofowora (1993) method. The test for tannins was carried out by subjecting 3 g of each *Gracilaria edulis* extract (residue) in 6 ml of distilled water, filtered and ferric chloride reagents added to the filtrate. For cardiac glycosides, Killer-Kiliani test (Trease and Evans, 1989) was adopted (0.5 g of extract was added to 2 ml acetic anhydride plus H₂SO₄). The extract was subjected to frothing test for the identification of saponin. The presence of flavonoids was determined using 1% aluminum chloride solution in methanol concentrated HCl, magnesium turnins, and potassium hydroxide solution (Kapoor et al.,1969; Earnsworth et al., 1974).

F. Determination of total flavonoids

The spectroscopic method is based on the formation of the flavonoids - aluminium complex which has an absorptivity maximum at 415nm. *Gracilaria edulis* extracts in methanol (10 mg/ml) was mixed with 0.1ml of 20 % aluminum trichloride in methanol and a drop of acetic acid, and then diluted with methanol to 5ml. The absorption at 415 nm was read after 40 minutes. Blank samples were prepared from 100 ml of *Gracilaria edulis* extracts and a drop of acetic acid, and then diluted to 5ml with methanol. The absorption of standard rutin solution (0.5 mg/ml) in methanol was measured under the same conditions. All determinations were carried out in triplicates [Kumaran & Karunakaran 2006].

G. Determination of total alkaloids

Gracilaria edulis sample 5g was weighed into a 250 ml beaker and 200 ml of 10% acetic acid in ethanol was added and covered and allowed to stand for 4 h. the extract of the filtration was concentrated on a water bath to one-quarter of the original volume. Concentrated ammonium hydroxide was added drop wise to the extract until the precipitation was complete. The whole solution was allowed to settle and the precipitated was collected and washed with dilute ammonium hydroxide and then filtered. The residue is the alkaloid, which was dried and weighed [Harborne, 1973].

H. Determination of total saponins

20 g of *Gracilaria edulis* sample were put into a conical flask and 100 ml of 20% aqueous ethanol were added. The samples were heated over a hot water at about 55°C bath for 4 h with continuous stirring. After the filtration the residue re-extracted with another 200 ml 20% ethanol. The combined extracts were concentrated to 40 ml over water bath at about 90°C. The concentrated sample was transferred into a 250 ml separatory funnel and 20 ml of diethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process was repeated. 60 ml of n-butanol was added. The combined n-butanol extracts were washed twice

with 10 ml of 5% aqueous sodium chloride. The remaining solution was heated in a water bath. After evaporation the samples were dried in the oven to a constant weight; the saponin content was calculated [Obdoni & Ochuko, 2001].

III. RESULTS AND DISCUSSION

TABLE1: WATER QUALITY PARAMETERS OF WATER COLLECTED FROM THE CULTURED HABITAT OF *Gracillaria edulis*

Parameters	Palameenmadu	Passikudah
T D/O (mg/l)	6.11633(±)0.00718	5.95867(±)0.005074
Salinity(ppt)	24.62(±)1.14663	32.5047(±)0.828583
PH	6.65333(±)0.28736	7.98367(±)0.46856
Total Dissolved solid at 105°C (mg/l)	19906.7(±)20.0574	34549.4(±)0.808717
Alkalinity (as CaCO ₃ mg/ml)	0.16666(±)0.00606	0.129(±)0.004807
Total Hardness (as CaCO ₃ mg/l)	4950(±)6.43268	5100.37(±)0.927857
Iron (mg/ml)	1.467(±)0.00466	0.26833(±)0.00379
Calcium (mg/l)	597.167(±)5.52164	400.233(±)1.165106
Magnesium (mg/l)	849.3(±)1.44198	1049.8(±)0.550861
Sulphate (mg/ml)	3279.53(±)0.9371	1696.72(±)10.28308
Chlorine (mg/l)	14632.6(±)260.558	15800(±)0.694808
Florine (mg/ml)	0.39533(±)0.0073	0.49967(±)0.004138

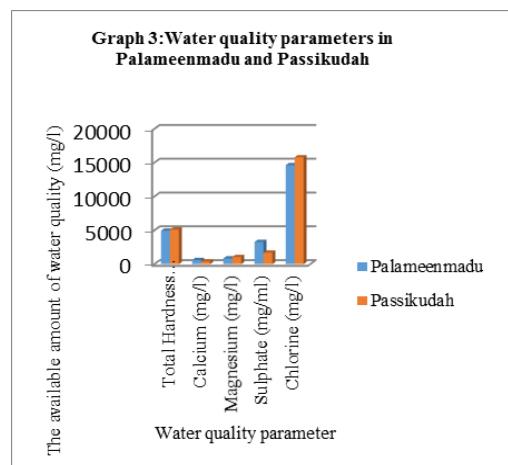
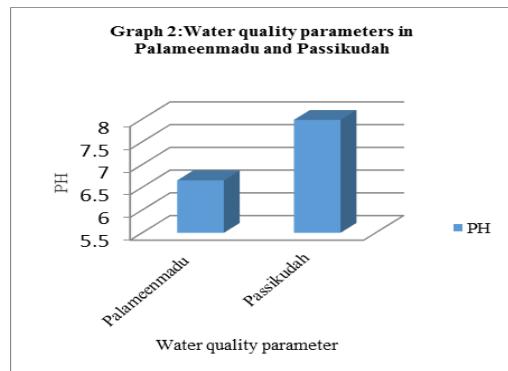
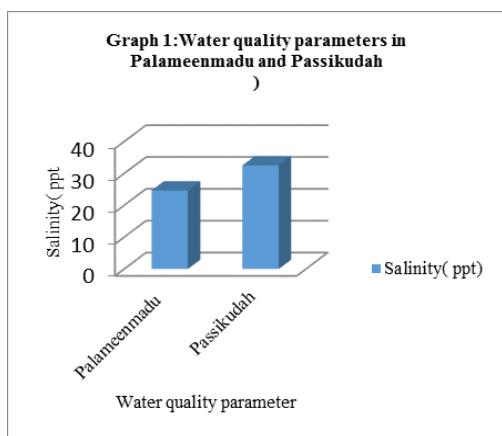


Table 2. Phytochemical analysis of *Gracillaria edulis*

Tests	<i>Gracilaria edulis</i> extract (Methanol)
Saponin	+
Flavonoids	+
Glycosides	+
Cardiac glycosides	-
Terpenoids	+
Phenols	+
Steroids and Phytosteroids	-

+ indicates presence and - indicates absence;

Table 2.1. Phytochemical analysis of *Gracilaria edulis*

Biochemical Tests	<i>Gracilaria edulis</i> extract (Methanol)
Carbohydrate	+
Protein	+

+ indicates presence and - indicates absence;

The results of phytochemical constituents present in the Methanol extracts of *Gracilaria edulis* are presented in table 2. Phytochemicals such as Saponins, Flavonoids, Glycosides, Terpenoids and Phenols were present in all the tested extracts of *Gracilaria edulis*. Cardiac glycosides, steroids, phytosteroids, are absence in *Gracilaria edulis*. The nutrient

biomolecules such as carbohydrate and protein are found in *Gracilaria edulis*. That is shown in the table 2.1. The tests were based on the visual observation of a change in color or formation of precipitate after the addition of specific reagents by following the standard phytochemical methods (Sofowora, 1993)

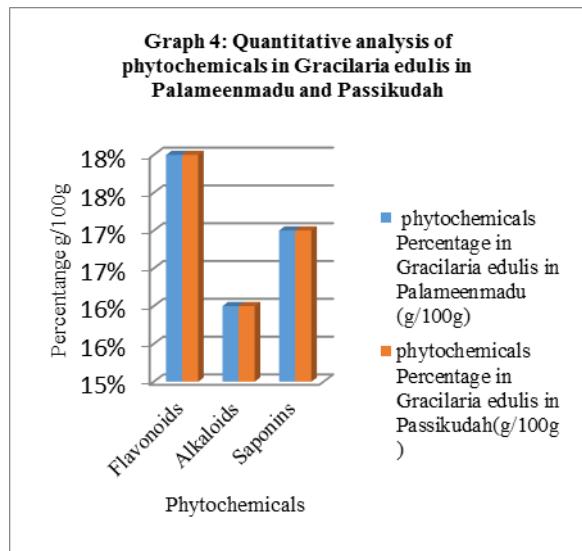
Table 3: Quantitative analysis of phytochemicals in *Gracilaria edulis*

Phytochemical(Flavonoids)	Method	Absorbance at 415nm	Percentage (g/100g)
<i>Gracilaria edulis</i> from Palameenmadu	Spectrophotometer (Dr 2800 Hach-U.S.A)	0.085	18%
<i>Gracilaria edulis</i> from Passikudah	Spectrophotometer (Dr 2800 Hach-U.S.A)	0.082	18%

$$\text{Absorbance} = 0.0296 \times \text{total flavonoid} [\mu\text{g RE/mg of dry extracts}] + 0.0204 \quad (R^2 = 0.9595)$$

Table 3: Quantitative analysis of phytochemicals in *Gracilaria edulis*

Phytochemical	<i>Gracilaria edulis</i> from Palameenmadu Percentage(weight of the extract/weight of the sample g/100g)	<i>Gracilaria edulis</i> from Passikudah Percentage(weight of the extract/weight of the sample g/100g)
Alkaloids	0.8/5*100=16%	0.5/5*100=16%
Saponins	3.4/20*100=17%	3.0/20*100=17%



Alkaloid is one of the metabolic byproducts and it was reported to be responsible for the antibacterial activity (Mantle et al., 2000). Glycosides serve as defence mechanisms against predation by many insects, microorganisms, and herbivores (Dhar et al., 1979). Phytochemicals such as flavonoids, saponins, terpenoids, alkaloids, steroids and tannins are reported to have anti-inflammatory effects (Orhan et al., 2007; Akhindele & Adeyemi 2007). Tannins play a major role as antihaemorrhagic agent and showed to have immense significance as antihypercholesterol, hypotensive and

cardiac depressant properties (Price et al., 1987). Flavonoids, Glycosides, tannins and alkaloids have hypoglycemic activities (Cherian and Augusti, 1995). Saponins, Steroids, and triterpenoids showed the analgesic properties (Sayyah et al., 2004; Malairajan et al., 2006).

The Methanol extract of *G. edulis* (10 g/100ml) showed 18% flavonoid content in table 3. Flavonoid compounds such as quercetin and genistein have antitumor activity and these compounds are cytotoxic to cancer cells but do not have insignificant activity in normal cells (Pouget et al., 2001). That flavonoid apigenin holds great potential as a chemopreventive agent for a variety of cancers and exhibits significant activity against UV induced DNA damage and thus protect against skin cancer (Baliga and Katiyar, 2006). The pH and salinity was found to be changing constantly according to seasonal variations and zonations particularly 6.65333(±)0.28736 and 24.62(±)1.14663 in site 1 Palameenmadu, being a brackish water source. The dissolved oxygen variations can also affect the growth of the algae. This may also vary according to the zones. Normally dissolved oxygen is going to decrease as we move to deeper zones. This may be due to reduced sunlight penetration and low photosynthetic rates. Site 2 Passikudah, being polluted area, due to oil discharge, lower rate of dissolved oxygen can be seen even in uppermost layers due to tourism. In results, alkalinity (as CaCO₃), points out the high amount of calcium in site 1 Palameenmadu compared to others. This may be the reason for high amount of Total Dissolved Solids in the site. Calcium, sulphates and iron contents (mg/ml) was found to be high in Palameenmadu. This influences the alkalinity too. Phosphates, Fluorides, magnesium and chlorides (mg/ml) showed moderate levels. The above mentioned parameters suggest that the selected seaweed samples *Gracilaria edulis* can show ambient growth and nutritional excellence in palameenmadu sites than Passikudah site.

Owing to the results, it can be concluded that seaweeds of *Gracilaria edulis* have high nutritive values and are ideal for consumption. Literature suggests this seaweed has high nutritive values and is edible, devoid of irritation, toxicity, allergy etc which makes it disagreeable as food source. It is also relevant to say that they also meet the standards for a balanced functional diet [Alonso D.L, et al., 2000]. *Gracilaria edulis* showed the highest protein value. However, the results as well as literature say that all the species of Rhodophyceae are highly nutritious. Carbohydrates, lipid and protein contents for this species were present. The high carbohydrate levels in cereals like rice, corn flakes etc. provide energy rich food to the body. According to [Mouristien et al., 2012], a bowl of white rice have a carbohydrate content of 34.1 (w/w%). Thus, an equivalent amount of *Gracilaria edulis*, can prove to be a good supplement to white rice. The protein content of egg yolk for one egg is 3 (w/w%). A gram of *Gracilaria edulis* can supplement with 4.090 (w/w%) of protein. The lipid content for average meals containing, Pistachio, coconut or flax neem and safflower have 53.7 (w/w%), 35 (w/w%) 40 (w/w%) and 59.5 (w/w%), respectively. The lipid content values of the *Gracilaria edulis* ranges from 31.44 (w/w%) to 54.30 (w/w%), which reveals its significance as supplement to these lipid sources.

IV. CONCLUSION

The present study of the phytochemical screening, total flavonoids, total alkaloids and total saponins of extracts of *Gracilaria edulis* showed that, these algae could be a potential source for natural antioxidants and good nutritional component so these may be responsible for many of the Pharmaceutic biotechnological actions and food production.

REFERECEES

- [1] Akhindele, AJ & Adeyemi, OO 2007, Antiinflammatory activity of the aqueous leaf extract of *Byrsocarpus coccineus*, *Fitoterapia*, **78**, 25-28.
- [2] Alonso D.L, Belarbi E.H, Fernández-Sevilla J.M, Rodrigues- Ruiz J, Grima E.M, Acyl lipid composition variation related to culture age and nitrogen concentration in continuous culture of the microalga *Phaeodactylum tricornutum*. *Phytochemistry*, **54** (2000) 461–471.
- [3] Babuselvam, M.; Ravikumar, S. Screening of Male Anti-Fertility Compounds from Marine Seaweed Macro Algae. Division of Marine Microbiology and Medicine, Manonmaniam Sundaranar University: Rajakkamangalam, India, 1993; pp. 1–14. Available online:http://www.scisoc.or.th/stt/32/sec_h/paper/stt32_H_H0001.pdf (accessed on 14 May 2011).
- [4] Baliga, MS & Katiyar, SK 2006, Chemoprevention of photocarcinogenesis by selected dietary botanicals, *Photochemical and Photobiological Sciences*, **5**, 243–253.
- [5] Cabrita, M.T.; Vale, C.; Rauter, A.P. Halogenated compounds from marine algae. *Mar. Drugs* 2010, **8**, 2301–2317. *Int. J. Mol. Sci.* 2011, **12** 4568
- [6] Cherian, S & Augusti, KT 1995, Insulin sparing action of leucopelargonidin derivative isolated from *Ficus bengalesis* L, *Indian Journal of Experimental Biology*, **33**, 608-611.
- [7] Capo, T.R.; Jaramillo, J.C.; Boyd, A.E.; Lapointe, B.E.; Serafy, J.E. Sustained high yields of *Gracilaria* (Rodophyta) grown in intensive large-scale culture. *J. Appl. Phycol.* 1999, **11**, 143–147.
- [8] Cardozo, K.H.M.; Guaratini, T.; Barros, M.P.; Falcão, V.R.; Tonon, A.P.; Lopes, N.P.; Campos, S.; Torres, M.A.; Souza, A.O.; Colepicolo, P.; *et al.* Metabolites from algae with economical impact. *Comp. Biochem. Physiol. C: Comp. Pharmacol.* 2006, **146**, 60–78.
- [9] Darcy-Vrillon, B. Nutritional aspects of the developing use of marine macroalgae for the Human food industry. *Int. J. Food Sci. Nutr.* 1993, **44**, 523–535.
- [10] Deig, E.F.; Ehresmann, D.W.; Hatch, M.T.; Riedlinger, D.J. Inhibition of herpesvirus replication by marine algae extracts. *Antimicrob. Agents Chemother.* 1974, **6**, 524–525.
- [11] Dhar, ML, Dhar, MM, Dhawan, BN & Ray C 1979, Screening of Indian plants for biological activity. Part I, *Indian Journal of Biology*, **6**, 232-234.
- [12] Earnsworth NR, Berderka JP, Moses M (1974). Screening of Medicinal Plants J. Pharm. Sci. **63**:457-459.
- [13] Faulkner, D.J. Marine natural products. *Nat. Prod. Rep.* 2002, **19**, 1–48.
- [14] Guiry, M.D. AlgaeBase. Martin Ryan Institute, National University of Ireland: Galway, Ireland, 1996–2011. Available online: <http://www.algaebase.org> (accessed on 14 May 2011).
- [15] Guven, K.C.; Percot, A.; Sezik, E. Alkaloids in marine algae. *Mar. Drugs* 2010, **8**, 269–284.
- [16] Harborne J, Phytochemical methods. Chapman and Hall, Ltd London; 1973.p.49-88.
- [17] Herin, D, Britto, A, Kumar, B,(2012) Qualitative and Quantitative Analysis of Phytochemicals in five Pteris species. *International Journal of Pharmacy and Pharmaceutical sciences*. **5**, 105-107
- [18] Ianora, A.; Boersma, M.; Casotti, R.; Fontana, A.; Harder, J.; Hoffmann F.; Pavia, H.; Potin, P.; Poulet, S.A.; Toth, G. New trends in marine chemical ecology. *Estuaries Coasts* 2006, **29**, 531–551.
- [19] Ito, K.; Hori, K. Seaweed: Chemical composition and potential uses. *Food Rev. Int.* 1989, **5**, 101–1144.
- [20] Jha, R.K.; Zi-rong, X. Biomedical compounds from marine organisms. *Mar. Drugs* 2004, **2**, 123–146.
- [21] Kain, J.M.; Destombe, C. A review of the life history, reproduction and phenology of *Gracilaria*. *J. Appl. Phycol.* 1995, **7**, 69–281.
- [22] Kapoor LD, Singh A, Kapoor SL, Shrivastava SN (1969).Survey of Indian medicinal plants for Saponins, Alkaloids and Flavanoids. *Lloydia*, **32**: 297-302.
- [23] Khotimchenko, S.V.; Vaskovsky, V.E.; Titlyanovo, T.V. Fatty acids of marine algae from the 12substances from marine algae Puerto Rico. *Antimicrob. Agents Chemother.* 1963, **161**, 68– 72.
- [24] Kumaran A, Karunakaran R. Anti oxidant and free radical scavenging activity of an aqueous extracts of *Coleus aromaticus*. *Food chemistry* 2006; **97**: 109-114.
- [25] Lahaye, M. Marine algae as a source of dietary fibers: Determination of soluble and insoluble dietary fiber contents in some ‘sea vegetable’. *J. Sci. Food Agric.* 1993, **54**, 523–535. *Int. J. Mol. Sci.* 2011, **12** 4567
- [26] Lindequist, U.; Schweder, T. Marine biotechnology, In *Biotechnology*; Rehm, H.J., Reed, G., Eds.;Wiley-VHC: Weinheim, Germany, 2001; **10**, pp. 441–484.
- [27] Linsert, P. Revolution in infant formula brewing in Herman’s calves. DNA algae. *Genet. Eng.Biotechnol. Monit.* 1994, **1**, 45–46.
- [28] Lyase. C.,2011 Bioactivities from Marine Algae of the Genus *Gracilaria* *Int. J. Mol. Sci.* 2011, **12**, 4550-4573; doi:10.3390/ijms12074550.
- [29] Malairajan, P, Gopalkrishnan, GS., Narasimhan & Jessi Kala Veni, K 2006, Analgesic activity of some Indian medicinal plants. *Journal of Ethnopharmacology*, **19**, 425-428.
- [30] Mantle, D, Eddeb, F & Pickering, AT 2000, Comparison of relative antioxidant activities of British medicinal plant species in vitro, *Journal of Ethnopharmacology*, **72**.

- [31] Mouristien D.G, L.Williams, B. Rasmas, Lars Due land, Seaweeds of umami flavour in the new Nordic cuisine, *Flavour* **1**: (2012)1-4.
- [32] Newman, D.J.; Cragg, G.M.; Snader, K.M. Natural products as sources of new drugs over the period 1981–2002. *J. Nat. Prod.* 2003, **66**, 1022–1037.
- [33] Obdoni B, Ochuko P. Phytochemical studies and comparative efficacy of the crude extracts of some homostatic plants in Edo and Delta States of Nigeria. *Global J. Pure Appl. Sci* 2001; **8**: 203–208.
- [34] Orhan, I, Kupeli, E, Sener, B & Yesilada, E 2007, Appraisal of anti-inflammatory potential of the clubmoss, *Lycopodium cuvatum* L, *Journal of Ethnopharmacology* **109**, 146-150.
- [35] Pouget, C, Lauthier, F, Simon, A, Fagnere, C, Basly, J, Delage, C & Chulia, A 2001, Biomolécules et cibles cellulaires tumorales, *Bioorganic and Medicinal Chemistry Letters*, **11**, 3095-3097.
- [36] Price, KR, Johnson, TI & Fenwick, GR 1987, The chemistry and biological significance of saponins in food and feeding stuffs, *Critical Reviews in Food Science and Nutrition*, **26**, 22- 48.
- [37] Ryther, J.H.; Goldman, J.C.; Gifford, C.E. Physical models of integrated waste recycling marine polyculture systems. *Aquaculture* 1975, **5**, 163–177.
- [38] Sayyah, M, Hadidi, N & Kamalinejad, M 2004, Analgesic and anti-inflammatory activity of *Lactuca sativa* seed extract in rats, *Journal of Ethnopharmacology*, **92**, 325-329.
- [39] Skriptsova, A.V.; Titlyanova, T.V.; Titlyanov, E.A. Red algae of the genus *Gracilaria* in south of the Russian far east. *Russ. J. Mar. Biol.* 2001, **27**, S38–S52.
- [40] Smit, A.J. Medicinal and pharmaceutical uses of seaweed natural products: A review. *J. Appl. Phycol.* 2004, **16**, 245–262.
- [41] SofoworaA(1993).MedicinalPlantsandTraditionalMedicinAfrica.SpectrumBooksLtd.,Ibadan,Nigeria,pp9
- [42] Souza, E.T.; Lira, D.P.; Queiroz, A.C.; Silva, D.J.C.; Aquino, A.B.; Mella, E.A.C.; Lorenzo, V.P.; Miranda, G.E.C.; Araújo-Júnior, J.X.; Chaves, M.C.O.; *et al.* The antinociceptive and anti-inflammatory activities of caulerpin, a bisindole alkaloid isolated from seaweeds of the genus *Caulerpa*. *Mar. Drugs* 2009, **7**, 689–704.
- [43] Trease, GE & Evans, WC 1987, A text book of Pharmacognosy, ELSB/Bailliere Tindal, Oxford.
- [44] Vallinayagam, K.; Arumugan, R.; Ragupathi Raja Kannan, R.R.R.; Thirumaram, G.; Anantharaman, P. Antibacterial activity of some selected seaweeds from Pudumadam coastal regions. *Glob. J. Pharmacol.* 2009, **3**, 50–52