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"Sustainable Development through Multidisciplinary Research"

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MESSAGE FROM THE MINISTER OF SCIENCE, TECHNOLOGY AND RESEARCH

I am pleased to issue this message on the occasion of the 4th International Conference on Multidisciplinary Approaches (iCMA 2017) organized by the Faculty of Graduate Studies of the University of Sri Jayewardenepura , Ministry of Science, Technology & Research and the National Science Foundation. As the Ministry responsible for Science and Technology, we have understood the necessity of supporting this timely important event as a co-organizer; therefore I wish to express my warm well wishes to the Faculty of Graduate Studies of the University of Sri Jayewardenepura for organizing this annual conference.

The theme 'Sustainable Development through Multidisciplinary Research' is most appropriate and great importance as we are working towards sustainable development goals. The name of the conference implies the engagement of academics and researchers of wider range of disciplines working collaboratively for finding practical solutions.

In an era where food security, poverty alleviation, sustainable development, decline of natural recourses and hazards to the environment have become key areas under consideration, the thematic sessions of the conference such as; agriculture in transition, food security and poverty alleviation, sustainable cities and communities, innovation and green industry development and community role of eco system services for sustainable development is great importance.

The approach highlighted in the conference name as well as the selected themes, appropriately demonstrate the path taken by the Faculty of Graduate Studies and the University of Sri Jayewardenapura towards great contribution to the Economic Development of the Country.

Therefore, the Ministry entrusted with the development of research and technology for the betterment of the country, is delighted to be associated in this endeavour as the co-organizer in the event as it has placed highest emphasis on mobilizing research finding for the future development of the country.

I hope the research findings and discussions presented during the conference by foreign and local participants will definitely help to create a conducive environment for the country to address its development needs. Also, I am confident that the multidisciplinary approach will show us the way forward in meeting the challenges.

My sincere gratitude goes to all those who made contributions to make this event a success. I wish this conference a great success.

Hon. Susil Premajayantha MP,
Minister of Science, Technology and Research
Sri Lanka

MESSAGE FROM THE VICE CHANCELLOR

It is with my great pleasure; I take the opportunity to send this message to the 4th international Conference on Multidisciplinary Approaches 2017, jointly organized by Faculty of Graduate Studies of University of Sri Jayewardenepura, Ministry of Science, & Research and the National Science Foundation.

I am happy that the conference theme 'Sustainable Development through Multidisciplinary Research' is very appropriate and important at this juncture, as the prime research and development responsibilities of University of Sri Jayewardenepura as a centre of excellence for higher learning of the country are aimed at sustainable development goals. In addition to the above I am sure that the University's role as a Nation Building Institution is thoroughly supported by the engagement of academics and researchers of different disciplines working collaboratively for practical solutions.
The sharing of world experience in this endure especially in thematic sessions ensure the updated knowledge will be available for the betterment of the country through high quality research programmes. In this context the iCMA 2017 will be a challenging but exciting experience.

The Faculty of graduate Studies has taken great effort in organizing this conference. The synergy created by its partnership with two other key organizations responsible for promoting research and innovation in the country; Ministry of Science, technology & Research and the National Science Foundation will be definitely lead the country to a better position.

I wish to thank Ministry of Science, Technology & Research and the National Science Foundation for joining with the University as co-organizers of the conference. My sincere appreciation also goes to organizing committee of the iCMA 2017 for the admirable contribution by them in ensuring a successful annual event. I wish that the iCMA 2017 be a ground breaking event for the benefit of the country and the participants.

Prof. Sampath Amaratunge
The Vice-Chancellor
University of Sri Jayewardenepura
Sri Lanka

MESSAGE FROM THE CONFERENCE CHAIR

As the Dean of the FGS of the University of Sri Jayewardenepura and the Chair of the Organizing Committee of the iCMA, I am delighted to issue this message.

The Faculty of Graduate Studies is one of the seven faculties in the University and was established in 1996. It is instrumental in managing and coordinating all the postgraduate programs in the University. Fueled by its vision to become the Centre of Excellence in advanced learning, research and scholarship both inside and outside the domain of the country, it embarks on a journey to produce professionals with knowledge, skills and sound attitude towards sustainable development.

The International Conference on Multidisciplinary Approaches (iCMA) is a forum which facilitates the research findings generated within the University and outside to be presented to the peers, practitioners, policy makers and implementers to enable them to reach a wide cross section of the society and be immediately put into use. This year the Theme of the Conference is 'Sustainable Development through Multidisciplinary Research'. With the backdrop of declaring Sustainable Development Goals by the United Nations and the development of the Vision for Sustainable Development for 2020, 2025 and 2030 by the Government of Sri Lanka, the Faculty has taken the initiative to discuss these goals explicitly by a renowned panel of experts with international experience in the Theme Seminar followed by research paper presentations under 6 tracks to cover all relevant disciplines. This effort is ably supported by the Ministry of Science, Technology and Research and National Science Foundation.

This is an event organized mainly from the government funds which finally comes from the tax payers' money of this country. Therefore, I earnestly request all of you to actively participate, share your experience, understand the reality, enhance your knowledge and see how you can find answers to burning issues of our country from the valuable presentations that would be made in this conference. Then our effort in organizing this event and broader objectives of the government in funding science and education in finding solutions to issue of our nation will be fulfilled.

On behalf of the Organizing Committee I express my appreciation and gratitude to the co organizers of the event, the Ministry of Science, Technology and Research and National Science Foundation for joining with the University in this great partnership towards knowledge dissemination. The local and international speakers, paper and poster contributors and dear participants are highly appreciated for their contribution in making this event a reality. At last not by least, my sincere thanks goes to consultants and members of the staff at FGS who worked tirelessly to make this event a success. I wish the iCMA 2017 to be a highly great event.

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Snr. Prof. Hemanthi Ranasinghe
Conference Chair & the Dean, Faculty of Graduate Studies
University of Sri Jayewardenepura
Sri Lanka

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TECHNICAL SESSIONS
ON
ENGINEERING, TECHNOLOGY &
PHYSICAL SCIENCES

POLICIES ALIGNED BUSINESS RULE FRAMEWORK FOR HEALTHCARE SERVICE SOLUTIONS

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Healthcare (HC) services involve with a set of complex policies that are required to realize with HC service rules in terms of lower level technical requirements which are mainly focusing on service processes. Ensuring compliance of the HC service process with policies and rules stemming from various sources such as corporate guidelines, standards laws and government acts is a fundamental challenge to e-solution development. Current e-Health solutions are lack in realizing these higher level policies. Although these solution designing have used global standard such as HL7 it is limited on technical level message passing. Also, another limitation is the tendency of focusing only on security policies and acts such as HIPAA even though there are many other higher level acts and policies to control HC service process. Thus, it is necessary to design a systematic approach to fill the gap between higher level service policies with lower level service processes. Therefore, the proposed framework could be considered as a bridge facilitating e-Health solution developers to systematically realize high level policy level requirements on underlying technologies. This research work is an initiative contributing to design a framework with three main consecutive layers for higher level policy driven service process designing. The proposed framework uses different modeling ontologies for designing artifacts of each layer. The framework consists of three modeling layers; HC Governance (HG), HC Service Rules (HSR) and HC Service Process (HSP). Principals of global HC service interoperability standards (SAIF) and business modeling ontologies are considered when designing each layer of the framework. Governance layer is designed based on the principals of SAIF governance layer that refers higher level policy decisions and constraints with considering responsible authorities. A set of main policy perspectives are introduced in the research and top down application of them towards lower rule identification is discussed in the research. The work reported here introduced a contribution in an endeavor to develop a complete and sound business rule oriented service designing framework. Yet another commendable contribution is the facilitation to bi-directional traceability between these modeling layers that designers could be achieve with the adoption of the proposed framework.

***Keywords**: Healthcare, HC governance, HC Service Rules, HC Service process*

MoO_3/Au BACK CONTACT FOR ELECTRODEPOSITED CdS/CdTe SOLAR CELLS

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CdS/CdTe based solar cell is one of leading photovoltaic (PV) device structures that can be found in the territory of second generation solar cells. Among the existing fabrication methods of CdS/CdTe solar cells, electrodeposition (ED) is a promising technique due to its low cost, simplicity, scalability and manufacturability. However, to fabricate stable solar cells with good power conversion efficiency, the role of back contacts on CdS/CdTe is crucial to improve the device performances and need further investigations to establish a stable back contact. In this study, the effect of back contact material on the PV properties of CdS/CdTe solar cells was investigated using three different back contact combinations namely; Au, Cu/Au, MoO_3/Au. Prior to the fabrication of back contacts, CdS and CdTe thin layers were electrodeposited on glass/FTO one after the other to form the stack of glass/FTO/CdS/CdTe. Then the samples were annealed in air atmosphere in the presence of $CdCl_2$ and chemically etched using HNO_3:H_3PO_4. Subsequently different back contact combinations were thermally evaporated on chemically etched CdTe layers. Fabricated devices were evaluated by current density-voltage (J-V) characteristics under AM 1.5 illumination. According to the obtained results, device with MoO_3/Au back contact showed about 40 % efficiency improvement, by increasing fill factor and open circuit voltage, in comparison with the device with Au back contact. This suggests that MoO_3 is an effective hole blocking layer that can be introduced for CdS/CdTe back contacts. Device with Cu/Au back contact further improved the efficiency to 5.6 %, with open circuit voltage (V_{oc}) of 0.57 V, short circuit current (J_{sc}) of 23.8 mA cm^{-2} and fill factor of 0.41, which is highest among the three types of devices studied. In this study, MoO_3/Au layer is found to be a promising alternative back contact for CdS/CdTe solar cells.

Keywords: *Back contacts; Electrodeposition; Cadmium sulfide; Cadmium telluride; Solar cells*

Acknowledgement: Financial assistance by the UGC (Sri Lanka) Innovative Research Grant.

CAPABILITY OF USING ORE MAGNETITE DIRECTLY AS CATHODE MATERIAL FOR SODIUM-ION RECHARGEABLE BATTERIES

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This research was conducted to increase the performance of Sodium-ion (Na-ion) batteries by developing low cost cathode materials using metal oxides. Magnetite (Fe_3O_4), which is a semiconducting metal oxide which gives good conductivity and capacity to apply in electrodes of sodium-ion batteries. Here in this report, Magnetite (Fe_3O_4) found from Buththala was used as the cathode material for Na-ion batteries. The Magnetite ore was hammered and then ball milled at 600 rpm. Then this powder that was mixed with carbon black and 5% (w/w) and 5% (w/w) of polyvinylidene fluoride (PVDF) which was dissolved in 1-methyl-2-pyrrolidinon was coated on stainless steel sheet as a thin layer and dried at 100 ^oC .This films were used to fabricate Na-ion batteries which were then tested in anoxia conditions. Electrochemical properties such as cyclic voltammetry, charge-discharge capacity and impedance analysis were performed. The charge discharge capacity data shows that highest capacity of 8.903 $mAhg^{-1}$ and specific energy density 14.45 $Whkg^{-1}$ was given by the magnetite with 5% (w/w) of carbon black and the cyclic voltammetry analysis shows that there was no any chemical reaction occurred while charging and discharging. Impedance analysis shows resistance and the capacitance of the two phase of the cell. These data confirmed that magnetite can be applied as cathode material for Na-ion batteries and which need to be further investigated.

Keywords: *Sodium-ion, Magnetite, Fe_3O_4, Cathode, rechargeable batteries.*

Acknowledgement: The author would like to thank Department of Physics, Sri Jayewardenepura University, for the funding under the grant No: ASP/01/RE/SCI/2016/24, and Department of Geology, University of Peradeniya for supplying some of the row materials. Also to the Department of Physics, Sri Lanka Open University for providing laboratory facilities.

A NEW COSMOLOGICAL MODEL INCLUDING INFLATION, DECELERATION, ACCELERATION AND DECELERATION AGAIN

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Since Perlmutter and A.G. Riess observed that the Universe expands with an acceleration, many models involving dark energy have been proposed to explain this phenomenon. A family of cosmological models with both acceleration and deceleration are presented in this research. Einstein's Field Equations in General Relativity is written in the form,

$$R^{\mu\nu} - \frac{1}{2}\bar{R}g^{\mu\nu} = kT^{\mu\nu} - \Lambda g^{\mu\nu}$$

Here Λ is the cosmological constant. The Einstein's Field Equations are modified. Λ is considered as a variable of cosmic time. The assumptions of a homogeneous and isotropic universe based on the Mach's principal are made. The Robertson-Walker metric in spherical polar coordinates are started. The Christoffel symbols were found to define the Ricci tensor, the curvature scalar and the energy-momentum tensor using the Robertson-Walker metric. Using the Robertson-Walker metric and Energy momentum tensor are solved modified Einstein's Field Equations for scalar factor $R(t)$ which is called "radius of the universe''. The solution is introduced in the following form, so that it shows the inflation at the beginning.

$$R = b\sqrt{(1 - \cos^3 \omega t)}$$

A solution is assumed for the Universe which results in inflation, deceleration, acceleration and deceleration again. The age of the Universe is estimated to be 13.7 billion years. Taking the present value of the cosmic time t as 13.7 billion years the density of the inflationary Universe is found as $2.0211 \times 10^{-31} g\, cm^{-3}$ and deceleration of the Universe as $9.1822 \times 10^{5}\, cm\, s^{-2}$ which are in agreement with the observations. The redshift of light from extragalactic sources, which arise from the Robertson-Walker metric was discussed. This redshift is a measure of the expansion of the universe in a given period of time. The scalar factor is increasing with time t at present. However, there could be epochs where the scalar factor is decreasing.

Keywords: *cosmological model, Einstein's Field Equations, scalar factor*

A NEW UPPER MATRIX BOUND FOR THE SOLUTION OF THE DISCRETE ALGEBRAIC RICCATI EQUATION

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This work concerns the discrete algebraic Riccati equation (DARE) which arises from the discrete-time linear quadratic control problem. We study a new upper matrix bound for the positive semidefinite solution of the DARE and derive the upper matrix bound using some matrix algebraic techniques and some properties of positive semidefinite matrices. Then we justify the upper matrix bound for the solution of the DARE using numerical examples and we prove that the matrix upper bound is less restrictive than some existing bounds in the literature.

Keywords: *Discrete algebraic Riccati equation, Upper matrix bound, positive semidefinite matrices, linear quadratic control.*

APPLICATION OF SURVIVAL ANALYSIS FOR LOAN DATA

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In recent years banking plays a significant role in the growth of the countries. One of the most important services of the bank is to provide the loans to their clients for different purposes. However, determining probability of default on repayment of a loan is one of the main problems in banking system. Further, there are so many factors influencing the time to repayment of a loan, such as demographic factors and loan related factors which were observed at the commencement of the loan. Therefore, present study was performed in order to find out the factors influencing the time to repayment of a loan. The data were obtained from the records of Merchant bank of Sri Lanka (MBSL) in Kurunegala District for the period covers from January 2010 to December 2015. In this study, Kaplan-Meier method was used to estimate the survival curves and log rank test was used to compare the significance of differences in the survival curves for each risk group. Further, Cox proportional hazard (Cox PH) model was applied to model the right censored data. Based on the results from the log rank test and Cox PH analysis, it was concluded that age, loan experience, marital status, purposes of loan and types of loan were highly associated with the time to repayment of a loan while gender was moderately associated with the time to repayment of a loan. Furthermore, it was observed that risk of default for unmarried person and leasing loan are higher than that for married person and personal loan, respectively. In addition, risk of default for business loan and consumer loan are higher than that for investment loan. Banks should be provided a particular importance on these factors to reduce the probability of default on repayment of a loan.

Keywords*: Kaplan-Meier method, Log-rank test, Cox proportional hazard model, loan repayment time*

LOOSELY-COUPLED SYSTEM DESIGN FOR MODERN HOME AUTOMATION SYSTEMS

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Home automation and Internet of Things are heavily discussed topics in the industry. This paper introduces a new design concept of a loosely-coupled system. Which addresses many major obstacles faced by system architects and developers. Suggested system is a modularized approach to minimize inter-dependency thus improving overall efficiency, performance. Prototype implementation suggests that the concept discussed is feasible and adaptable. Simplified message transmission and centralized data repository plays a major role in this conceptual design while controller circuitry and event listeners simplifies handling various tasks and functions. The same concept can be cultivated to focus on advanced technologies such as machine learning, artificial intelligence etc.

Keywords*: Home Automation, Loosely-coupled, Artificial Intelligence, Machine Learning, Data Mining.*

PEER-TO-PEER MOBILE COLLABORATION PLATFORM FOR REAL TIME VISUALIZATION OF MEDICAL IMAGE

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Medical images are very useful in medical diagnosis, because they can convey information literally cannot be conveying through other mediums such as text or voice. Thus, it can lift the accuracy of diagnoses significantly. Therefore, it is essential to have a robust infrastructure to facilitate storing and transferring medical images to the point of care when necessary. However, for a developing country like Sri Lanka, it is not possible to construct such a system to cover the whole country. Due to small geographical area and the well established mobile network, mobile technology is the most suitable method for Sri Lanka to fulfill this requirement. Therefore, an Android based peer to peer real-time collaborative platform has been developed to visualize medical images remotely. A DICOM (Digital Imaging and Communications in Medicine) reader has been developed to read DICOM images and convert them to bitmaps. Further, a customized gesture enabled image viewer is developed to view the images. The image viewer zooms, slides and rotates images with gesture events. Moreover, this app can facilitate discussing a case with an expert or a colleague in emergencies. In such virtual meetings, it provides features such as real-time collaborative drawing, texting, audio, and video conferencing. App uses Java socket connections to share images and data among mobile peers. To establish such connections, device either needs to have a public IP (internet protocol) address or all the peers should be in the same local IP range. However, due to peer-to-peer communication, peers can communicate with each other without connecting to a centralized server. Besides, it uses number of security measures to assure the privacy and security of sensitive medical data. The results show that the app has made positive impact on real-time visualization of medical images.

Keywords: *Computer Security, Mobile Computing, Image Processing, eHealth, Medical Imaging*

MATHEMATICAL MODELLING AND SIMULATION OF THE TEMPERATURE OF SESAME OIL EXTRACTED IN SEKKU - A TRADITIONAL OIL EXTRACTION TECHNOLOGY

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In sekku technology, 15 to 20 kg batch of sesame seeds are crushed to extract oil in the scooped circular pit of the stationary wooden mortar using a wooden pestle, which is revolved on its own axis while rotated about the vertical axis of the wooden mortar at 1 to 4 revolutions per min (rpm) by a complex mechanism powered by animal or hand tractors. Extracted sesame oil is subjected to gravity settling to separate the clear golden coloured sesame oil from the sediments. Sesame oil produced using sekku technology therefore has the potential to qualify as a candidate for attaining the cold-pressed or virgin-oil status. To attain cold-pressed oil standards, oil should be extracted at temperatures below 50^{o}C. Field measurements showed that sekku extracted sesame oils reached temperatures well above 50^{o}C. In this study, we mathematically model the temperature profile of sesame oil extracted in a sekku with the objective of understanding the governing mechanisms and thereby to explore viable means to control the temperature. Frictional heat generated at the sliding contact between the mortar and the pestle and viscous heat generated by the swirling flow of sesame slurry were found to be dominant energy input mechanisms in sekku, and were modeled using fundamental equations and property models. During processing, sesame seed gradually turns to a slurry of oil and cake, and the material properties of this paste are not known for certain. The said uncertainty was dealt with Monte Carlo simulation methodology. Simulation of the said model with data obtained from a real-life sekku resulted in an oil temperature band of 52-65^{o}C. The said model could be used for optimizing system parameters to gain desired oil temperature and hence to improve or control the oil quality towards cold-pressed oil status.

Keywords: *Modelling, Sekku, Sesame oil, Monte Carlo Simulation, Temperature*

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MODELLING, CONTROLLING AND SIMULATION OF A WIND TURBINE DRIVE TRAIN IN 'SimulationX' PLATFORM

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The research describes the design process of wind turbine controllers in a computer simulation platform. A wind turbine drive train is examined to implement a control system satisfying some of the standard site operative parameters. Wind turbine controllers are designed to regulate the output power of the rotor for different operational regions of wind speed. The wind turbine is mainly operated in four regions, i.e, cut-in region, torque controller region, pitch controller region and cut-off region, where each control strategies are implemented to extract the maximum power. Two main controllers; pitch controller and torque controller are configured in order to satisfy the power requirement. Firstly, the power coefficient is estimated for all regions and the available power of the rotor is investigated through output power characteristics. Subsequently, the available power in the rotor is input to the synchronous generator and converted by estimating the efficiency of electrical power conversion, in order to finalize the output power of the whole system. Some of the main parameters are specified at the beginning. Here, two Proportional Integral Derivative (PID) controllers are implemented in SimulationX software platform as the pitch controller and torque controller. PID Gains are turned on trial and error basis in order to obtain the maximum power. The implemented controllers are capable of handling all possible power variations under ordinary weather conditions. Finally the controllers' performance are investigated at different operative regions by analyzing step response and impulse response for sudden changes in wind speed. The results show that controllers drive generator torque and generator speed to stable values when wind speed is suddenly varied.

Keywords: *Controller, Pitch, Power, Torque, Wind-Turbine*

FORECASTING MONTHLY AVERAGE PEPPER RETAIL PRICES USING A TRADITIONAL TIME SERIES MODEL AND AN ARTIFICIAL NEURAL NETWORK MODEL

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Sri Lanka produces the world's best pepper which is made from the ground dried berries of a tropical climbing plant. It is the second important commodity among spices in the country. Export price of this commodity is affected by its' retail price, as it affects the exporting companies of the country. Therefore it is very important for the country's economy to identify the behaviour of one of their main commodities' price in advance. Accurate forecasting of retail price of pepper will significantly reduce the risk of economic decision making and may result in increasing the pepper production where there is no evidence of such forecasting in the literature. The objective of this research is to forecast monthly pepper retail prices in Sri Lanka with higher accuracy. In the study 475 monthly average pepper retail prices (Rs/kg) from June 1976 to December 2015 were considered. The performance of two models: Auto Regressive Integrated Moving Average (ARIMA) as a traditional time series model and Feed-Froward Neural Network (FFNN) with Back-propagation algorithm as an Artificial Neural Network (ANN) model were compared and evaluated using two performance measures; Mean Absolute Percent Error (MAPE) and Directional Symmetry (DS). Selected ARIMA(3,2,3) model exhibits MAPE of 15.208% and DS of 52.174%. In FFNN model building seven potential inputs; lag 1 and moving averages from 3 to 8 were identified. Then the most suitable FFNN model was identified by changing model parameters. Final FFNN model consists of three hidden layers with 4, 3, 4 neurons and logsig, tansig, purelin transfer functions respectively in each layer. Learning parameters were minimum gradient of 0.05×10-6 and initial momentum of 0.61×10-3 which exhibits MAPE of 1.521% and DS of 90.91%. Therefore it can be concluded that the FFNN with above mentioned parameters is more suitable for forecasting monthly pepper retail prices in Sri Lanka compared to the fitted ARIMA(3,2,3) model.

***Keywords**: Auto Regressive Integrated Moving Average model, Feed-forward Neural Network, Mean Absolute Percent Error, Directional Symmetry*

AUTOMATIC TYRE PRESSURE REGULATION SYSTEM FOR THE OPTIMIZATION OF RIDE COMFORT

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Comfort is a major concern for a person when selecting a vehicle for his/her personal use. Even though designs that offer a superb ride quality are in the market today, passenger comfort inevitably differs with the terrain and the road profile that the vehicle travels on. More specifically, it is the vibrations transmitted from the road to the vehicle which cause the familiar feeling of tiredness among the passengers. Attempts to dampen these vibrations have resulted in changes of the seat design and modifications to the vehicle suspension. However, the parameter of the vehicle selected for scrutiny in this research is the tyre pressure, as the tyre is the component of the vehicle that is the closest to the source of vibration i.e. the road. A Fuzzy-based algorithm is presented to optimize ride comfort by means of fluctuating vehicle tyre pressure. The defining parameter used in estimating vibrations is the frequency weighted root-mean-squared acceleration with reference to the ISO 2631-1. The aforementioned parameter and the current tyre pressure are passed through the algorithm. The resulting output is an increment or decrement in tyre pressure accomplished by the actuation of pneumatic valves. Decision-making is accomplished by a Mamdani Fuzzy inference system comprising 12 rules formulated by analyzing experimental data collected with the passenger vehicle driven in real-world conditions. The control algorithm is validated by implementing it on an experimental quarter-car model. It is also shown that an optimal tyre pressure exists for each type of terrain when the terrain is categorized according to the frequency weighted root-mean-square acceleration.

Keywords*: acceleration, comfort, Fuzzy, terrain, tyre pressure*

CONTEMPORARY AND COMPARATIVE STUDY OF CUSTOMS AND BELIEFS IN HOUSE CONSTRUCTION

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Although this is an era with marvels of Science and Engineering, the shadows of customs and beliefs of diverse fields are still followed in different levels. It is evident that a considerable number of customs and beliefs in house construction are yet followed by people in countries like Sri Lanka, India and China. In this study, contemporary status and reasons behind admitting those beliefs were investigated through a questionnaire survey carried out among the main stakeholders of the construction industry. A sample of 210 individuals consist of 75 Civil Engineers, 45 Architects, 30 Astrologers, 30 Carpenters and 30 Masons were randomly selected for this study. The study revealed that 68% of respondents are believed in customs and beliefs while 32% disregard. 41% of Civil Engineers, 27% of Architects, 97% of Astrologers, 100% of Masons and 97% of Carpenters are believed in customs and beliefs. As specific responses of respondents, 81% opted not to erect three or more aligned openings and not to place wall plates, rafters or beams directly on top of the openings, 75% of respondents have no willingness to place more west facing doors and windows while 73% respondents reluctant on cross wall junctions in brick walls. The study revealed that, though Masons, Carpenters and Astrologers adopt those beliefs as they inherit them from generation to generation which are being startled of their occult grab, Civil Engineers and Architects believe on these with some understanding in Engineering concepts. It divulged that when the people become more educated they tend to discard traditional beliefs in building construction and deal with some knowledge on Engineering and Scientific concepts.

***Keywords**: residential buildings, mini commercial buildings, customs and beliefs*

SYNTHESIS AND CHARACTERIZATION OF A NAPHTHALENE-DERIVATIZED LIGAND AND ITS RHENIUM TRICARBONYL COMPLEX TOWARDS FLUORESCENT IMAGING

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Renewed interest has been garnered in tertiary sulfonamide linear tridentate ligands and their metal complexes due to promising biomedical properties being reported in rhenium complexes bearing such ligands. In this study, a novel tertiary sulfonamide ligand ($N(SO_2)$(2-nap)dpa) has been synthesized in good yield (78%) by utilizing di-(2-picolyl)amine (*N*(H)dpa) and 2-naphthalenesulfonyl chloride. The corresponding Re complex ($[Re(CO)_3(N(SO_2)$(2-nap)dpa)]PF_6) was synthesized by treating the ligand with the *fac*-$[Re(CO)_3]^+$ core. In ^{1}H NMR spectra of $N(SO_2)$(2-nap)dpa and $[Re(CO)_3(N(SO_2)$(2-nap)dpa)]PF_6 recorded in DMSO-d_6, the peaks of the ligand were de-shielded upon metal binding and the singlet peak at 4.60 ppm for methylene protons in the ligand spectrum appeared as two doublets (5.67, 4.59 ppm) in a spectrum of the complex. The high energy absorption peaks around 200-300 nm in UV-visible spectra may be due to intra-ligand $\pi\rightarrow\pi^*$ and $n\rightarrow\pi^*$ transitions. In an FTIR spectrum of the metal complex, the two strong absorption peaks at 2037.48 and 1912.79 cm^{-1} were assigned to the stretching vibrations of the metal-CO ligands. The peak at 928 cm^{-1} due to S-N stretching vibrations in the spectrum of the ligand has shifted to 833 cm^{-1} in the spectrum of the metal complex. The $N(SO_2)$(2-nap)dpa ligand shows high fluorescence emission both in methanol and in acetonitrile. However, it was lowered in the metal complex possibly attributed to the quenching effect upon direct binding of sulfonamide nitrogen to Re metal. This novel ligand and its metal complex are currently being investigated as potential anti-cancer agents and cell imaging agents.

Keywords: *anti-cancer agent, sulfonamide complexes, Rhenium tricarbonyl, fluorescent*

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AN EXTENSION OF GOLDBACH'S CONJECTURE

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Goldbach's Conjecture (GC), established in 1742 by the German mathematician, Christian Goldbach, is one of the most challenging and well-popularized unsolved problems in Number Theory which remains to be proved or disproved. The conjecture states that every even integer $N = 2n_2 (n_2 > 1)$ can be decomposed into two prime numbers p_1 and p_2 such that $N = 2n_2 = p_1 + p_2$. This result furthermore has now been numerically verified up to all $N \le 4\times 10^{18}$. It is also viewed from the conjecture that when N has the prime divisor 2, it can be decomposed into two prime numbers. Consequently, it is conjectured in this paper that if every composite integer $N(>2)$ possesses a prime divisor p, then N can be decomposed into p primes for which $N = pn_p = p_1 + p_2 + \cdots + p_p$, where n_p is an integer such that $2 \le n_p < N$. For instance, $3n_3, 5n_5, 7n_7$, and $11n_{11}$ can be decomposed into 3, 5, 7, and 11 prime numbers, respectively. In this paper, the latter is called the Extended Goldbach Conjecture (EGC) and it will be proved by assuming the fact that the former holds its validity. We call a p-tuple $(p_1, p_2, \ldots, p_p)$, satisfying the EGC a prime number decomposition of N. It is found that when $N = pn_p (p \ge 3)$ is even, any prime number decomposition of N necessarily includes at least one 2(the smallest prime number), while when $N = pn_p (p \ge 3)$ is odd, any prime number decomposition of N necessarily includes at least one prime number in the interval $(2, N-2)$. We further formulate an algorithm to determine the so-called prime number decompositions of N. Eventually, it can also be concluded that the EGC must hold its validity up to all $N \le 4\times 10^{18}$ since the GC has now been verified for all $N \le 4\times 10^{18}$.

Keywords: *Prime Numbers, Goldbach's Conjecture, Extended Goldbach Conjecture*

VOICE AND GESTURAL CONTROL OF HOUSEHOLD APPLIANCES USING KINECT MOTION SENSOR

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Voice recognition and gesture recognition have given a considerable contribution in bringing human-machine interactions into a different level without requiring physical touch, or contact with devices. In this proposed work, voice recognition and gesture recognition involve creating a system which is able to interpret specific human gestures and vocal inputs via mathematical algorithms. We use these algorithms to convey meaningful information and to control appliances in the home. This proposed system mainly focuses on people who are differently abled and it can be used as a solution for their problem, the inability of controlling appliances in their own room by themselves. Microsoft Kinect motion sensor plays a major role in this developed system by taking gesture inputs and vocal inputs and feeding them to the central controlling system through a preliminary process. The speech model of the system uses Microsoft speech grammar and Speech recognition engine to recognize the vocal input commands. Gesture model of the system uses Visual Gesture Builder software to train the "ON" input gesture command and the "OFF" input gesture command. The whole system runs with a Graphical User Interface making it easier to contact with the user. Ultimately, the user can select the device and its location, by using pre-defined voice command such as, "Living Room TV". And also, that appliance can be controlled by using pre-defined gesture commands which have been assigned for "ON" and "OFF". The accuracy of the system is very important when it is used as a real-time home device controlling system. So the system was subjected to an experiment which provided response rate. It showed more than 95% accuracy when the distance to the sensor was 4 m and even when the noise level at the Kinect sensor was about 53 dB. Hence, this proposed system will be an efficient home automation system which will make people's day-to-day life easier and also will be a very useful system for people who are differently abled and will help them to live like normal people.

Keywords*: Microsoft Kinect motion sensor 2.0, home automation, speech recognition, gesture recognition, human-machine interactions.*

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EFFECT OF LIGAND ATTACHED TO FLUORESCEIN ON THE PHOTOCURRENT OF DYE SENSITIZED SOLAR CELLS

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In today's society, it is becoming ever important to find alternative sources of energy that are both cheap and efficient. Converting solar energy into electricity provides a much-needed solution to the energy crisis the world is facing today. With continuous research studies conducted in this field, we have come across the third generation of solar cells; the dye sensitized solar cells. Several types of dyes have been individually employed to study sensitization process of TiO_2|sensitizer|p-semiconductor type solar cells and to produce low-cost dyes; much work is being directed toward synthesizing all-organic, ruthenium-free dyes with high extinction coefficients and broad absorption bands with large solar spectrum overlap. An enhancement of efficiency of this type of solar cells was observed by appropriate coupling of dyes with a same chromophore and different ligand attachments. A comparable study of multi-dye systems was carried out by means of understanding the chare transfer mechanism of multi-dye coated electrodes. The dyes used in this study are organic dyes without any metal influences. They have given photocurrent of 172 μAcm^{-2}, 252μAcm^{-2} and 127 μAcm^{-2} and a lower efficiency of performance compared to any metal centered dyes.

Keywords: *Fluorescein; Ligand effect; Photocurrent; Dye sensitized solar cell; Anthrance A; 5(6) Carboxy fluorescein; Erythrosin B.*

ANALYSIS OF "ANGULIMALA SUTTA" USING VOICED TO UNVOICED RATIO AND FORMANT VARIATIONS

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Pirith is a style of intoned recitation based on phonological properties of the Pali language and it is considered as a protective doctrine preached by the Load Buddha. The aim of this study is to analyze Pirith using parameters like formant frequencies and energy variation using computer-aided methods and identify the special characteristics and patterns. In this study, two methods were used to identify special characteristics of Angulimala Sutta. First method is to calculate voiced to unvoiced ratio; divides the speech sample into several segments depending on the length of time series and counts number of frames less than reference amplitude as unvoiced and others as voiced. Results indicate around 96% of frames are voiced frames. Speech samples were further analyzed using zero crossing rate and energy content of the signal. The second method is based on analyzing formant frequencies. Voice source produces a harmonic series, consisting of the fundamental frequency (f0) and a large number of harmonic frequencies which are called as formants (F). The values of the frequencies of F1 and F2 are sufficient to distinguish most vowel contrasts in most languages. The results suggest that higher number of vowels concentrate around the frequency range of F1, 500 Hz to 750 Hz and F2, 1250 Hz to 1500 Hz.

***Keywords**: Pirith, Formant frequencies, Angulimala Sutta, voiced to unvoiced ratio, Zero crossing rate*

MODELLING OF MONTHLY VEHICLE REGISTRATION IN SRI LANKA USING SARIMA APPROACH

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Transportation system is an integral part of the daily commercial and industrial economic activities of a country. The type and the number of the vehicles have played a key role for the transportation system of the country. Therefore, developing a time series model and forecasting the vehicle registration of various types has been a nature of interest in government policy makers and others. The monthly data on the registration of the various types of vehicles for a period of 197 months from (Jan 2000 to May 2016) have been collected from Department of Motor Traffic of Sri Lanka. The objective of this study is to identify the best fit time series model for each type of vehicles. As a consequence, the forecasts for future values have been reported by the identified models. The models employed in this study are seasonal autoregressive integrated moving average (SARIMA) models. Model parameters were estimated by using the maximum likelihood method. Further, forecasting accuracy measures, Akaike information criterion (AIC), and mean square error (MSE) were used to identify the best forecasting model based on the lowest measure of accuracy. The seasonal $\text{SARIMA}(2,1,1)(1,0,1)_{12}$, $\text{SARIMA}(0,1,2)(0,0,1)_{12}$ and $\text{SARIMA}(1,1,0)(1,0,0)_{12}$ were selected as the best models to forecast the registration of vehicles categorized as three wheelers, motorbikes and lorries respectively in Sri Lanka. Also, the forecasted values showed that the future number of monthly registration is expected to gradually increase (vis-à-vis last year) in all the three types of vehicles. The three wheeler model revealed that the forecasted monthly registration amount will increase July to December in 2017. Hence, it is advisable to improve a reliability of the road network system to in order to emphasise the essential development of the country.

Keywords*: SARIMA model, Forecasting, Vehicle Registration, Vehicle type*

A STUDY ON THE PERFORMANCE OF MATHEMATICS AND SCIENCE SUBJECTS USING CANONICAL CORRELATION ANALYSIS

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Education has become one of the fundamental rights for every child. Particularly, Mathematics and Science education in secondary schools is the most important factor in the promotion of science capacity building of any country. However, there are multidimensional factors affecting the performance in mathematics and science subjects of the students, such as gender, social economic status, study time, residential area, available resources, etc. This inspires us to study the factors influencing the performance of mathematics and science subjects of the students. The main aim of this study is to investigate the influential factors on the performance of mathematics and science subjects of grade 10 students in Puttlam district. Data were collected from 643 students from randomly selected government schools in Puttlam district using a questionnaire. Since there are set of multiple independent and dependent variables, Canonical Correlation Analysis methodology was used to analyze the data. In addition, likelihood ratio test and redundancy measure were used to identify the significance of canonical correlation. First, based on likelihood ratio test and redundancy measure, first pair of canonical variates is retained among the two pairs of canonical variates. Secondly, the results based on the canonical loadings revealed that there exists high degree of inter-correlation among the two dependent variables. Further, according to the results of canonical coefficient and canonical loading, it was observed that residential area and study time have a significant effect on the performance of mathematics and science subjects. Furthermore, it was revealed that the amount of time a student spends on his or her studies increases, the academic achievements improves. In addition, parent's educational level is the most important variable among the social economic status variables considered. These findings support to improve the performance of mathematics and science subjects.

Keywords: *Canonical correlation, Likelihood Ratio Test, Redundancy Measure*

A SIMULATION PROCEDURE ON THE APPROPRIATE SEED SELECTION METHOD IN RESPONDENT DRIVEN SAMPLING

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Respondent Driven Sampling (RDS) which is in the fast growing phase with the experimenting platform is currently the best method to reach "hidden" or "hard to reach" populations. Application of RDS is predominantly employed when the sampling frame is not available. Seed selection method, which is with an utmost importance in the data collection procedure of RDS has become a popular topic in the relevant literature with several methods of selections. Among them, random seed selection and selection weighting against the network size have been used frequently. In this research these two methods are the main concerns. By considering an adjusted version of the publicly available Project 90 data of original Colorado Springs study as the population for the purpose of this study and proportion of females in the population as the parameter of interest, data were generated through a simulation study using R software and for calculation of estimates and other analysis, the RDS package in R was incorporated. Simulations were performed for particular seed selection by varying number of seeds from 4 to 14 in increments of 2 and fixing number of coupons and waves at 3 and 6 respectively. For each such combination, 1000 samples were generated and estimates were obtained with respect to the three mostly used RDS estimators, Salganik-Heckathorn (S-H), Volz-Heckathorn (V-H) and Successive Sampling (SS). Finally the results of this effort elaborate that probabilistic seed selection method outperforms the random seed selection method and SS estimator outperforms the other two estimators for this particular data set. On top of all other findings, this study has developed a procedure to resample RDS samples and a simulation code to compare these two methods using any population with any parameter of interest. It has also shed light on the importance of carrying out formative research in the area of RDS.

***Keywords**: Respondent Driven Sampling, Seed selection, Simulation, Resample, RDS*

DETERMINATION OF RARE EARTH ELEMENT CONTENT IN PULMODDAI BASED MONAZITE

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Rare earth elements (REE) have become significant to our technological world as they have unique magnetic, phosphorescent and catalytic properties. The demand for REE has increased recent past because they can be employed as both metals and alloys. Pulmoddai is the largest known heavy mineral sand deposit in Sri Lanka which extends to about six kilometers in length and with an average width of hundred meters. According to predictions it contains six million tons of heavy mineral sands with high radioactivity. Monazite is a mineral containing thorium which can be used instead of uranium for nuclear power generation and is common in pulmoddai mineral deposit. The objectives of this study was to quantify the rare earth element content in Pulmoddai based monazite and to identify the mineral composition of Pulmoddai sandy beach and to obtain the knowledge on physical properties of minerals. The samples were collected up to 50- 75cm in depth and were separated through gravitational and magnetic separations Monazite was purified using the optical microscopes. Rare earth elements analysis was done using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). According to the obtained results, Ilmenite, Garnet, Rutile, Zircon, Spinal, Silimanite and monazite were major heavy minerals present in the mineral sand deposit and their compositions were 833.14 g/kg, 46.38 g/kg, 24.75 g/kg, 21.02 g/kg, 14.03 g/kg, 24.19 g/kg and 13.82 g/kg respectively. The REE percentages contained in monazite were Cerium (~28%), Lanthanum (~15%), Neodymium (~10%), Promethium (~3%), Samarium (~2%), Gadolinium (~2%) and Yttrium (~1%). About 3.87g of cerium can be obtained by 1kg of Pulmoddai mineral sand. Due to the higher cerium composition, Pulmoddai monazite can be considered as economically more valuable mineral sand.

Keywords*: heavy minerals, monazite, Pulmoddai mineral deposit, radioactivity, Rare Earth Elements*

INTERPRETATION OF THREE GEOTHERMAL FIELDS SITUATED IN EASTERN PART OF SRI LANKA USING RESISTIVITY AND MAGNETIC METHODS.

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Geothermal fields can be introduced as space occupied by the installation of a geothermal system. Geothermal fields in Sri Lanka can be found within Vijayan and Highland, geological complexes boundary. The study was mainly focused on interpreting the near subsurface structure of Wahawa, Maduruoya and Kapurella geothermal fields using resistivity and magnetic surveying methods in order to find out any geothermal sources accommodated beneath the hot water springs. In resistivity survey, both one-dimensional (1-D) and two–dimensional (2-D) resistivity methods were employed using Schlumberger array. The 1-D Resistivity data has shown that all three areas contain relatively low resistive layer in depths up to about 10 metres as the first layer. The 2-D profiles in Kapurella and Maduruoya show a relatively low resistive layer as the first layer which could be interpreted as a mud cap and a high resistive layer in the middle which can be interpreted as country rock. In between these layers there were sub layers with low resistive values which may have occurred due to weathering of the bedrock. In Wahawa a thin low resistive, first layer was observed than previous two cases. Here the high resistive layer has spread in to the depth and no other layers were observed within high resistive layer as in previous two cases. In all three fields, no evidence for a shallow gradient fracture was found beneath the bedrock from the obtained resistivity values. Hence it can be concluded that the geothermal source should be accommodated in another place other than right beneath the springs. Magnetic surveys in three fields have shown relatively high negative anomaly values with compared to the obtained values for positive anomalies. High negative anomaly values hint out about fractures which may be situated around geothermal fields. In Kapurella a negative anomaly gradient which is extending to the southwest-north direction was observed in the prepared map. This feature could be interpreted as a fracture zone spreading to the mentioned direction.

Keywords*: Geothermal, Resistivity, Schlumberger, Bedrock, Subsurface fracture*

ACCESS CONTROLLING SOLUTION USING MOBILE PHONE SECURITY FEATURES

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In the modern world, people carry all kinds of gadgets including house keys, office keys, smart cards (plastic cards with built-in microprocessor), and smartphones. Those bulks are inconvenient to carry around easily forgetful. Near Field Communication (NFC) which allows short range wireless communication (Wi-Fi, Bluetooth, infrared, iBeacon, etc.) among electronic devises, can be used to solve the above issue by introducing a smart key system that use one smartphone. Contemporary systems such as biometric systems are expensive while others use separate devices or smart cards as keys. In this research, the authors describe a system which uses the NFC (13.56 MHz bandwidth) peer-to-peer feature which is inbuilt in smartphones. Therefore, the proposed system is highly extensible because smartphone features such as fingerprint, iris scanning, or face detection can be integrated to the existing system.

Keywords: Smartphone, Near Field Communication (NFC)

INTELLIGENT SYSTEM FOR HIGH RESOLUTION COMPUTED TOMOGRAPHY (HRCT) IMAGE ANALYSIS: A CONCEPT

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Respiratory system diseases have become more and more common in human beings with the increasing air pollution due to industrial growth. In order to ensure the wellbeing of the general population of a country, early detection of such diseases is crucial. Performing a High Resolution Computed Tomography (HRCT) imaging of the lungs is one of the key methodologies in diagnosing for such diseases. The accuracy of the diagnosis of a disease highly depends on the recognition of the number, specific combinations or patterns and the distribution of abnormal findings. Even with the increasing availability of such scanning modules, the limiting factor is the scarcity of medical experts who can identify all these artifacts and map them to the relevant disease. On top of the scarcity of such experts, this process is also tedious and time consuming, which reduces the number of patients one expert can cater for in a given period of time. This is more critical in developing countries such as Sri Lanka where medical facilities and experts are extremely limited. So to overcome all these drawbacks, we propose a remotely accessible intelligent system with Machine Learning (ML) capabilities to aid the medical experts to arrive with the diagnosis in a shorter period of time. The initial stage of the implementation of the proposed system will consist of a data collection process, where multiple medical experts will observe HRCT scan images and input the recognized abnormalities and their distribution to the system through a web interface, along with the diagnosis. Once sufficient amount of data sets are available, the proposed system will analyze the data and identify combinations and patterns, while linking them with probable list of diseases. One of the feasible learning algorithms would be a basic Naïve Bayes Classifier. The knowledge available in the textbooks related with the procedures of diagnosing can also be utilized to improve the above model. The output of the system will outline a set of most likely diseases along with their probabilities. The last phase of the implementation will consist of a set of image analysis algorithms to automate or facilitate the process of identifying the artifacts present in the HRCT images, while drastically reducing the time taken by an expert to make a diagnosis. Furthermore, a large collection of datasets from numerous of medical experts, will pave the way to perform data mining and discover correlative effects of some of the diseases with either the artifacts present in the images or the demographical data of the patients. Therefore it can be concluded that the future positive ramifications of such a system is extensive and crucial to the well-being of the population.

Keywords: *HRCT Image Analysis, Biomedical Imaging, Machine Learning*

TECHNICAL SESSIONS
ON
ENVIRONMENTAL SUSTAINABILITY, GREEN INNOVATION & NATURAL RESOURCES MANAGEMENT

MODELING OF WEEKLY RAINFALL USING CONFIDENCE INTERVAL APPROACH: A CASE STUDY

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The degree of uncertainty of atmospheric behavior has been increased from time to time. Rainfall is one of the key climatic variable for surviving the diverse set of human and natural systems in the world. Awareness about the pattern of rainfall is essential to mitigate effects derived from climate change which cause to sustainable development of the country. Modeling rainfall percentile is one of the successful technique that can be used to describe the rainfall characteristics and its behavior. The main goal of this study is to model weekly rainfall percentile in the context of confidence intervals by developing probability distribution functions. Daily rainfall data from 1960 to 2015 during the period of Second Inter Monsoon (October to November) in Colombo City were used. Preliminary analysis found that there was no trend in weekly series. Based on the best fitted probability distributions reliable rainfall percentiles and corresponding 95% confidence bands were computed. Three parameter Weibull distribution has been found most probable for many weeks in considered time span while the rest were well fitted with the two parameter Exponential and Largest Extreme Value distributions. Based on the analysis, the beginning of the Second Inter Monsoon showed low shower with a consistent pattern. Also, a similar pattern was identified with the withdrawal of the monsoon. However, it is noted that the Weeks 41-45 (08th October to 11th November) marked heavy rainfall with high variability result which caused high possibility to form extreme rainfall events. Out of the above weeks, the Week 42 (15th -21st October) has a much higher chance to occur extreme rainfall events during this monsoon period. A similar approach was carried out for weekly running totals during Second Inter Monsoon and found consistent result. This information would be very useful for various stakeholders to plan many activities which influence the intensity of rainfall.

Keywords*: Weekly Rainfall, Percentile, Confidence Intervals, Colombo, Distribution*

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ASSESMENT OF HEAVY METAL DISTRIBUTION IN WATER BODIES AROUND KARADIYANA SOLID WASTE LANDFILL SITE, SRI LANKA

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Chemical composition of leachate may vary from time to time and site to site due to variables such as waste composition, temperature, moisture content, climatic changes etc. This study focuses to understand the distribution of some of the selected heavy metals at the water bodies surrounding the Karadiyana landfill which directly has a connection to Weras Ganga. Leachate, surface water and ground water samples were collected and in order to assess the interaction of leachate with natural water bodies. Groundwater samples were collected from two monitoring wells each (5 feet deep) which were drilled at the landfills site. Surface water samples were collected from the water canal running close to the site. Selected seven sites were continuously monitored over a period of eight months. Water sampling was done monthly and was analyzed according to the Standard Methods for the Examination of Water and leachate analysis. Zn, Cu, Mn and Fe concentrations of ground water samples ranged in between 0.0178-0.0969, 0.1346-0.1949, 0.0121- 0.0619, 1.2258-3.4072 mg/L respectively. Concentrations of Zn, Cu, Mn, and Fe in leachate samples varied in the range of 0.0192-0.1625, 0.1263-0.1589, 0.2701-0.6023, and 2.7052- 5.8446 mg /L. High metal concentrations are observed in leachate samples rather than surface and ground water. For surface water samples Zn, Cu, Mn, Fe concentrations vary in the range of 0.0690-1.1502, 0.030-0.1789, 0.2007-0.5821, 0.2939-8.4901 mg/L. Cr levels in the samples were at non detectable level and it can be because the site does not accept industrial waste. High concentration of Fe in the leachate may be from Fe scraps dumped on the landfill. Concentrations of Zn may indicate the presence of fluorescent tubes, batteries and a variety of food wastes. Even though some heavy metals are present in trace concentrations, the potential risks of these contaminants cannot be ignored due to their adverse effects on ground water and plants. As it is very likely to be sequestered in the long-term proper treatment prior to disposal is recommended

Keywords*: Heavy metals, Humic acid, Landfill, Leachate, Solid Waste*

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MUNICIPAL SOLID WASTE COMPOST QUALITY ENHANCEMENT BY ADDING SAW DUST AS A BULKING AGENT

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Generation of municipal solid waste (MSW) has been increasing exponentially as consequences of population growth, urbanization and industrialization. This rate becomes a considerable issue mainly in urban areas because there may be number of environmental, social and health problems due to MSW. Composting is a method of managing and reducing organic waste to produce organic fertilizer for food production systems. When considering the properties such as low apparent specific gravity, high porosity, high water retention, moderate water drainage and the availability of material was reasoned to select saw dust for study. The main objective of this study was to improve the quality of composting by using saw dust as a bulking agent. The study also focused in determining the optimum saw dust ratio. Research was conducted under four treatments with three replicates. The four treatments were mixing saw dust and municipal solid waste at the ratios of T1-10:1, T2-10:2, T3-10:3 and T4 only MSW treatment on wet basis respectively. The different parameters that affects on compost process were measured daily (temperature) and weekly (EC, pH). Physical properties (moisture content (MC), bulk density, particle size analysis, coarseness index (CI)) and chemical properties (organic carbon, nitrogen, phosphorous, potassium and C: N ratio) of the final compost was measured. Observed data was compared with the standards to determine the effectiveness of the treatments. Treatment with 10:1 saw dust: municipal solid waste showed the best possible combination ratio which enhanced physical and chemical properties of the final compost. There were no significant changes of pH and EC during the process by adding bulking agent. Measured parameters of pH, EC, moisture content, organic carbon, bulk density, particle size analysis, coarseness index, nitrogen, phosphorous, potassium and C: N ratio for T1 were 8.15, 1.77 dS/m, 26.63 %, 37.87%, 525 kg/m^3, 33.98 %, 1.45 %, 0.668 %, 1.14,26 respectively.

Keywords*: bulking agent, compost, leachate, municipal solid waste, saw dust*

SPATIAL VARIATION OF SOIL NUTRIENTS IN PADDY LANDS; A CASE STUDY IN POLONNARUWA DISTRICT

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Soil nutrient variation and its impact on growth is important in proper fertilizer management in paddy. There is an issue of yield stagnation although farmers use recommended rates of fertilizer. In this research, spatial variation of soil nutrients is identified to overcome this problem and to recommend site specific plant nutrient management practices to avoid excessive use of fertilizers. This study was carried out in Ellewewa as a command area in Polonnaruwa district. Samples were collected from both top and sub soil layers and sampling points were recorded by using Global Positioning System (GPS). Soil samples were analyzed for pH, electrical conductivity, Na, K, P, Mg, Cu, Zn, Mn, Fe and soil organic matter. ArcGIS 10.1 was used to mapping and the Kriging tool used in interpolating the data to determine spatial variation. Results revealed that the most major nutrients (K, P, and Mg) were not in adequate and micronutrients such as Zn and Cu were deficient. Fe was in excess level for paddy cultivation, although this region belong to dry zone. Micronutrient Mn was adequately present. In almost all the area average Potassium (K) was below the threshold K level (<75 ppm). Therefore attention on K fertilization is important. The soil reaction was in fairly proper range but there was an evidence of development of acidity and alkalinity. Soil in the study area indicated very strongly acidic to slightly basic. Sub soil had a large area of developing alkalinity. Soil Phosphorus (P) was also below the adequate level. This may be the result of washed out from soil and soil may inherently low with Calcium (Ca), Magnesium (Mg) to form non soluble compounds with P. It is also below the productive level (<10 ppm).Considerable area had medium level of P fertility (10-20 ppm).Alternative seasonal P application is recommended. Best nutrient management practices are necessary to break yield stagnation. Site specific fertilizer application according to spatial variation of nutrients in soil will increase the yield and reduce the fertilizer costs while protecting the environment.

Keywords: *GIS, GPS, Paddy, Spatial variation, Soil fertility*

GREENER APPROACH TO REMOVE METHYLENE BLUE (MB) USING CALCIUM HYDROXIDE DERIVED FROM EGGSHELLS

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The use of raw egg shells and egg shell powder calcined at 900^{o}C as effective adsorbent materials for removal of dyes was studied. In order to understand the adsorption nature of these materials, methylene blue (MB) was used as the model dye. Though MB adsorption on to raw egg shell powder was previously recorded, a comparison on effective removal of dye using egg shell powder calcined at high temperature was not investigated. The two materials are inherently different as raw egg shell powder is mainly calcium carbonate while calcined egg shell powder is mostly calcium hydroxide. The kinetics of dye adsorption, type of adsorption mechanism and effect of light on adsorption process were compared for raw egg shell powder and calcined egg shell powder with sample containing dye only as the control. The results clearly showed that the enhanced efficiency of use of egg shell powder calcined at 900^{o}C over raw egg shell powder for removing MB from water. The reported efficiency for calcined egg shell powder was 83% after two hours while raw egg shell powder indicated efficiency was 21% during the same period. Kinetics of MB dye removal follows a pseudo second order kinetics with rate constant of 30 min^{-1}. Adsorption properties of MB on to calcined egg shells indicate type II adsorption isotherm. In conclusion, the study showed use of calcined egg powder is a greener approach as waste is reused to remove dye.

Keywords*: Egg-shell powder, Dye Removal, Methylene Blue, Eco friendly*

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ODOUR AND COLOUR REDUCTION IN THE LEACHATE GENERATED FROM THE LAND FILLING SITE AT KIRINDIWELA

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A strong leachate is produced in the sanitary land fill at Kirindiwela due to physiochemical and biological decomposition of solid waste and the percolation of rainwater through the waste layers. The site also operates a treatment facility to treat the leachate drained from the landfill before it is disposed out of the site. However, odour and turbidity reduction is low in the treatment facility. The objective of this study was to reduce the odour, turbidity and diluted substances in the treated leachate using locally available absorbents. Four different filter media were used in the study *viz.* acacia wood charcoal, boiler ash, clay and coconut shell charcoal. Completely randomized design with three replicates was used to evaluate filtering of different filter media. Treated leachate was filled into a common tank with the capacity of 200 L. Then it was transferred, under gravity, through four separate one inch diameter pipes and passed in to filter containers (four inches diameter, two feet height) with different filter media, against gravity. Three different leachate flow rates of $4.17Lh^{-1}$, $2.08Lh^{-1}$ and $1.67Lh^{-1}$ were used initially and the $1.67Lh^{-1}$ flow rate was selected for further studies due to its efficiency in the reduction of EC, pH and turbidity. Then EC, pH and turbidity were measured and a sensory evaluation was done for every 100 L filtration through each filter media. An EC level of 4 mS/cm was considered as the tolerance level to identify the saturation of filter media. Data was collected until each filter media reached the tolerance level. Acacia wood charcoal filter media reduced the colour significantly compared with other filter media. However, odour reduction was higher in the filters having coconut shell charcoal. The odour reduction by Acacia wood charcoal filter was slightly lower than coconut shell charcoal filters. Further, Acacia wood charcoal filter media recorded the lowest EC and turbidity value throughout the research. Therefore, it can be concluded that the Acacia wood charcoal filters can be used for the reduction of colour and odour of treated leachate in the landfill site at Kirindiwela.

Keywords: *leachate, filter media, flow rate, odour, colour*

OCCURRENCE OF MICROCYSTIN-LR PRODUCING TOXIGENIC CYANOBACTERIA ALONG WITH WATER QUALITY PARAMETERS IN BORALESGAMUWA LAKE

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Drinking and aesthetic water bodies of Sri Lanka, record intermittent occurrence of Microcystin-producing cyanobacteria species. The present study records the presence of Microcystin-LR (MC-LR) producing cyanobacteria with reference to some important water quality parameters of Boralesgamuwa Lake(6°51'0" N, 79°54'0" E). The study was carried out from 2015 to 2016 during both dry and wet seasons. Measured water quality parameters included: Water temperature, pH, dissolved oxygen (DO), Electric conductivity (EC), Nitrate-nitrogen ($N\text{-}NO_3^-$), Nitrite-nitrogen ($N\text{-}NO_2^-$), Total Phosphate ($T.PO_4^{-3}$), Chemical Oxygen Demand (COD), chlorophyll-*a*, cyanobacterial cell density and MC-LR concentration (µg/ml). Presence of toxin-producing *mcy* B, and *mcy* E genes were analyzed using cyanobacterial monocultures. Furthermore, Principle component analysis (PCA) and Pearson correlation coefficient (PCC) was calculated between each measured water quality parameter and MC-LR concentration.

The water temperature of the lake varied between 29.5 and 31.2^{o}C during dry season whereas in wet season between 28.0-30.3^{o}C. The pH values of water fluctuated from 7.1 to 9.0 during dry season and during wet season from 6.5 to 7.4. DO ranged from 2.13 mg/l to 4.6 mg/l in dry season and from 2.8mg/l to 5.6 mg/l in wet season. EC ranged between 237-567 µS/cm in dry season and 421-634 µS/cm in wet season. The $N\text{-}NO_3^-$ during dry season ranged between 0.05 and 0.06mg/land in wet season ranged between 0.03 and 0.05 mg/l. The $N\text{-}NO_2^-$ varied from 0.02 to 0.035mg/l during dry season while in wet season from 0.01 to 0.04mg/l. The total phosphate fluctuated from 0.2 to 0.5 mg/l during dry season and from 0.2 to 0.3 mg/l during wet season. The COD values recorded during dry and wet season ranged between 133.3-138.2 mg/l and 120.1-150.3 mg/l respectively. The chlorophyll-*a* ranged between 11-17.8 mg/l during dry season and between 9 - 10mg/l during wet season. Mean cell densities of cyanobacteria during dry and wet season were recorded 30,147±6.56 cells ml^{-1} and 8259±5.22 cells ml^{-1}respectively. *Microcystis* sp., *Anabaena* sp. and *Oscillatoria* sp. were detected in the lake as potential toxin producing cyanobacteria. *Microcystis* sp. was recorded dominant during dry season as well as in wet season. The MC-LR was detected only during dry season as 2.4±1.58 µg/ml.

Moreover, molecular studies confirmed the presence of microcystin-producing *mcy* B and E genes in the water body. The PCA analyzed between water quality parameters and MC-LR concentration confirmed water temperature, pH, $N\text{-}NO_3^-$, $T.PO_4^{3-}$, and cyanobacterial cell density clustered with MC-LR concentration during

the dry season. Furthermore, PCC confirmed that water temperature (p=0.000), pH (p=0.011), N-NO_3^-(p=0.003), T.PO_4^{3-}(p=0.001) and cyanobacterial cell density (p=0.02) had a strong positive correlation to the MC-LR concentration. Therefore, continuous monitoring of physico-chemical and biological parameters of the lake is an imperative tool to predict the outbreak of harmful levels of MC-LR in a particular water body.

Keywords*: Microcystin-LR, Physico-chemical parameters, Biological parameters, Toxin-producing cyanobacteria, Toxin producing genes, Principle component analysis (PCA) and Pearson correlation coefficient (PCC).*

LANDSLIDE HAZARD ASSESSMENT IN BULATHKOHUPITIYA DS DIVISION-KEGALLE DISTRICT

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Landslides play an important role in the evolution of landforms and represent a serious hazard in many areas of Sri Lanka. Therefore quantitative landslide risk analyses is essential to manage and mitigate landslide disasters. Bulathkohupitiya DS division is one of the landslide prone area in Kegalle District. Within this study, a new raster-based approach is developed to assess the landslide risk in Bulathkohupitiya DS division. Thus, all existent vector data are transferred into raster data using a resolution of 1 m×1 m. The specific attribute data are attributed to the grid cells, resulting in specific raster data layers for each input parameter. The calculation of the landslide risk follows a function of the input parameters hazard, damage potential of the elements at risk, vulnerability, probability of the spatial impact, probability of the temporal impact and probability of the seasonal occurrence. Finally, results are upscale to a resolution of 20 m×20 m and are presented as individual risk to life and object risk to life for each process. Within the quantitative landslide risk analysis the associated uncertainties are estimated qualitatively. The resultant maps show nine (09) GN Divisions (Gatiyamulla, Ambawakka, Alawathura, Ihala Nevusmiyar, Uduwa, Udapotha, Ambamalla and Lewal) are in high risk regions that is 11.89% of the total area. With compared the historical data most of landslide were not occurred in identified area. It can be conclude that due to rapid change of land-use pattern as well as rainfall intensities can be influenced to this change. It is found that 68.61% of the total DS land area are at moderate landslide risk. Most of the historical landslide were occurred in that region. Finally it can be conclude that landslide risk is vary with the temporal variability of land-use and rainfall intensities. Therefore it is recommended to always update the landslide risk maps.

Keywords*: Landslide Risk, Risk assessment, rainfall intensities, raster-based, vulnerable*

GREEN GROWTH AND SUSTAINABLE DEVELOPMENT IN SRI LANKA: STATUS, CHALLENGES AND WAY FORWARD

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Green growth aims to foster economic growth and development, while ensuring that natural assets are used sustainably, and continue to provide the resources and environmental services on which our well-being relies upon. It is growth that is efficient in its use of natural resources, minimises pollution and environmental impacts and resilient for natural hazards. It emphasizes environmentally sustainable economic progress to foster low-emission, socially inclusive development, essential for dealing with climate change, and it is closely related to the notion of green economy aiming for improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities.

Sri Lanka faces a large number environmental concerns which can be categorized into global, regional and local. Impacts of global environmental issues such as climate change and ozone depletion are heavily felt. Among the main local environmental issues deforestation and forest degradation, water pollution, air pollution, improper waste disposal, decrease of environmental health, degradation of coastal and marine ecosystems can be identified which needs priority action.

World trends as well as regional trends continue to influence Sri Lanka's prospects. The global community has made some progress in addressing poverty, but a mere continuation of current development strategies will not suffice to achieve sustainable development. Economic and social progress remains uneven, the global financial crisis has revealed the fragility of progress, and accelerating environmental degradation inflicts increasing challenges on societies – especially the poor. Environmental degradation has reached critical levels. Business as usual is therefore not an option, and sustainable development will require transformative change at the local, national and global levels, as recognized by the universal acceptance of the 17 SDG in 2015.

However, it is admirable to note that the country has shown determination to overcome these debacles through policy/strategy formulation. With the vision to achieve sustained economic growth that is socially equitable, ecologically sound with peace and stability, the country prepared the National Sustainable Development Strategy. As an extended effort to this with special attention to climate change adaptation and mitigation, the country through the Ministry of Mahaweli Development and Environment recently promoted the Blue Green Development Strategy for the sustainable development. The country is also preparing its sustainable vision for 2030 integrating the most relevant goals among 17 SDGs of the United Nations. However, on the face of numerous challenges outlined above, specific policies and efforts are needed to ensure that green growth is inclusive and that environmental sustainability is not achieved at the expense of greater equity and poverty alleviation.

Keywords: *Green Growth, sustainable development goals, SDG, Sri Lanka*

CHRONIC KIDNEY DISEASE UNIDENTIFIED (CKDU) IN SRI LANKA: CORPORATE SOCIAL RESPONSIBILITY OF AGRO-CHEMICAL COMPANIES AND HOW IT IS PERCEIVED BY THE VILLAGE LEVEL COMMUNITY LEADERS

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Starting in the mid 1990's, Chronic Kidney Disease of Unknown etiology (CKDu) was discovered among the rice paddy farmers in the North Central Province (NCP) of Sri Lanka with special reference to Anuradhapura and Polonnaruwa Districts. The disease is now found in the neighboring districts in the North Western, Eastern, and Uva as well as the Central and Northern Provinces. The CKDu prevalent area covers approximately 17,000 km with a predominantly rural population of 2.5 million (Chandrajith et al, 2011). There is growing evidence that the environmental abuse or degradation resulting from over use of agro-chemicals in agriculture is directly responsible for the emergence of the disease.

This study was conducted with the objective of investigating the Corporate Social Responsibility initiatives by the agro chemical industry to address the issue and to ascertain the perception of village level communities about the response of agro-chemical companies.

Selected villages in the Padaviya GN Division of the Anuradhapura District were selected as the representative sample. Data was gathered through secondary sources as well as primary sources including household surveys, target group discussions and key informant surveys. A cross section of personnel affected and not affected from the disease as well as religious leadership in the village, Grama Niladhari, School Principal and teachers etc. were also interviewed. Executives of leading agro-chemical companies were interviewed to obtain information as to their CSR activities.

The results thus obtained were as follows; the village leaders believed that profit maximization is the primary objective of agro-chemical companies. In their view, agro-chemical companies control the whole supply chain of agricultural inputs such as seeds, fertilizers, fungicides, and herbicides for their own benefit and not the benefit of the farmers. They also asserted that agro-chemical companies stood by and did nothing when ill-informed farmers were using agro-chemicals excessively. The excessive use of agro-chemicals is good business for the agro-chemicals and they looked the other way until the negative aspects began to be reported by the media and environmentalists. Their lived experience was that there is a relationship

between the CKDu disease and contamination of water sources, soil, and food with harmful metals and compounds from agro-chemicals.

The agro-chemical company executives interviewed for this study argued that there is no scientific evidence to show that the agro-chemicals, especially fertilizers and pesticides, they sell cause the CKDu disease in Sri Lanka. While the agro-chemical companies ranked ethical aspects as the most important in the spectrum of CSR activities, the customer was the most important stakeholder when business decisions are being made. As such, the agro-chemical companies undertake many CSR activities at the village level, such as establishing water filtering systems, donation of medical equipment to hospitals, training farmers in the proper use of agro-chemicals, training their dealers and distributers on proper storage, distribution, and sale of agro-chemicals, and issuing free safety gear for selected farmer organizations. They also stated that the media and the environmentalists have a hostile attitude towards them and they are not given a chance to air their part of the story through popular media.

In the final analysis, it was seen that farming communities have realized that agro-chemicals have ill effects but have fallen into a situation where they cannot survive without agro-chemicals. On the other hand, the agro-chemical companies are conducting their business without a major change into their core business activities and they are stuck in the narrower understanding of CSR.

Keywords: *CKDu, CSR, Agrochemicals*

KNOWLEDGE ABOUT PERSISTENT ORGANIC POLLUTANTS, ASSOCIATED HEALTH HAZARDS AND FACTORS AFFECTING THE KNOWLEDGE AMONG GRADE 10 STUDENTS IN NEGOMBO EDUCATION ZONE

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Persistent Organic Pollutants (POPs) are a small subset of organic chemicals whose characteristics of persistence in the environment, accumulation in biological organisms; and toxicity makes them priority pollutants and an environmental risk to humans and the ecosystems. Land filling and dumping of persistent hazardous compounds are a big challenge in developing countries like Sri Lanka. This study was used to assess the knowledge on POPs and its associated health hazards and factors affecting the knowledge among grade 10 students. A descriptive cross sectional study was conducted among students of grade 10, in a National School in Negombo. Data were collected using a self-administered questionnaire which contained 03 main sections. Ethical clearance was obtained from Ethics Review Committee, Faculty of Medicine, University of Colombo and data were analyzed using SPSS. Sample size was 150 and males were 107(71.3%) where majority of students (52.7%) were coming from semi urban areas. 43.3% had a family income of more than LKR. 60,000.00 per month and 73.3% had access to internet facilities. 53 students (35.3%) knew about the Central Environmental Authority (CEA) and only 08 (5.33%) students had heard about waste disposing methods recommended by the CEA. The knowledge about POPs among the students was very poor. Mean score was 4.8 out of 33. Comparatively students had some knowledge about the environmental pollutants/POPs associated health hazards where 25.3% students (38/150) scored more than 50% marks (5 or more out of 10 marks) for the questions which were based on knowledge about health hazards. There was no significant association with the knowledge and socio-demographic characteristics. The knowledge about POPs and associated health hazards among grade 10 students was inadequate and other contributory factors did not show any significant association with the knowledge. It is recommended to conduct similar studies with large population and to include information about POPs in the school syllabus after consulting educationalists. Specially improving knowledge and attitudes regarding waste disposing methods and waste management among students will be a great investment for the future.

Keywords: *Persistent organic pollutants**,** Statistical package for social science (SPSS)**,** Central Environmental Authority*

EXPLORING ENABLERS AND BARRIERS OF VERTICAL GREENERY IN SRI LANKAN BUILDINGS

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Rapid Increase of building stocks in the world today has created a significant negative impact to the natural environment. Construction of buildings and other civil engineering structures consumes the natural environment and contribute for the pollution in a considerable amount. In Sri Lankan context also this issue is developing gradually specially in urban areas and with the development of new cities. Designing the buildings to reduce the environmental impact by integrating different ecofriendly initiatives has been identified as a solution to mitigate the environmental impact of rapid urbanization. Vertical greenery can be identified as such ecofriendly initiative and it is worthwhile to study about the applicability of the concept. Therefore, study focuses on exploring enablers and barriers of vertical greenery in Sri Lankan context. A comprehensive literature review was carried out to explore the importance of the research area. Eventually, a set of enablers and barriers were identified for vertical greenery in Sri Lanka. A quantitative approach was adopted whereby thirty one questionnaires were distributed among property owners, facilities managers, architects, landscape designers, operational managers, constructors and members representing government body regarding vertical greenery in Sri Lanka. Collected data of the questionnaire survey was analyzed using one sample t-test in SPSS statistical software packages and Relative Importance Index (RII) technique to identify most significant enablers and most critical barriers of vertical greenery. Accordingly, the total number of ten enablers and total number of eleven barriers were identified. According to the analysis most significant enablers of vertical greenery have been identified as restoring the biodiversity into urban building and vertical greenery helps to reduce carbon dioxide while increasing oxygen to the environment. Further, lack of awareness of the benefits and performance of vertical greenery systems and lack of information on plants that will perform well on vertical facades in Sri Lanka have been identified as most critical barriers of vertical greenery.

***Keywords**: Vertical Greenery, Enablers, Barriers, Sri Lanka*

DEVELOPMENT OF LAND SELECTION TOOL IN CULTURAL RECOGNITION FOR ECOSYSTEM SERVICES PROVISION

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Land selection is an important factor that affects ecosystem services provision. However, interactions between land selection, ecological processes and ecosystem service provision are still not fully understood. Indicators can help to better understand these interactions and provide information for policy-makers to prioritize land selection interventions. In this paper a framework for the systematic selection of lands has been developed to assess the link between land selection and ecosystem services provision in cultural recognition. A new discipline known as Environmental Informatics is combined with research fields such as Artificial Intelligence. Further, functional and social indicators describe significant evidence of cultural recognition in ecosystem service provision. In this paper an intelligent land assessment tool has been presented in ecosystem service provision a sub field of architecture domain of land selection to come up with land classifications as physical, functional and social indicators. At the initial stage land selection is converted into a questionnaire. Removing dependencies among the questions are modeled using principal component analysis. Classification of the knowledge is processed through fuzzy logic module, which is constructed on the basis of principal components. Further explanations for classified knowledge are derived by expert system technology. The tool gained results by testing in 10 sites, of varying cognitive abilities and diagnoses of cultural heritage. The questionnaire has been constructed with 31 questions and the principal component analyzer detected 9 principal components in filtering process. The tool has been tested for Manthota Rajamaha Viharaya in term of physical, functional and social as 17%, 42 % and 41 % respectively. This shows significant contribution of functional and social indicators respectively. The land assessment tool is to be a reliable assessment tool for cultural recognition in Manthota Rajamaha Viharaya by showing significant contribution of cultural recognition in ecosystem service provision.

Keywords: *Land selection, ecosystem service provision. Cultural heritage, land assessment tool, Fuzzy logic*

TECHNICAL SESSIONS

ON

HEALTH SCIENCES & NUTRITION

STUDY ON ACCEPTABILITY OF BITTER GOURD-AMLA-LEMON FUNCTIONAL BEVERAGE AT AMBIENT TEMPERATURE

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The study was carried out on acceptability of bitter gourd-amla-lemon functional beverage. Different formulations of functional beverage (13:0:0, 8:2:3, 6:4:3 and 5:5:3) of bitter gourd: lemon: amla were evaluated for sensory and microbial properties for the period of two months storage at ambient temperature (30±20C). Results of sensory evaluation at 60 days indicated that scores for all sensory parameters were declined during storage. Findings of microbial study performed at monthly interval revealed there was no microbial growth up to two months of storage in all beverage formulations. Considering the results obtained from microbial analysis and organoleptic evaluation, it was concluded that functional beverage prepared with 6% bitter gourd juice+ 4% lemon juice+3% amla juice was found as most acceptable beverage formulation than other formulations with better retention of all sensory attributes and microbial qualities and it could be stored for two months at ambient temperature (30±20C) without any significant quality changes.

Keywords*: Functional beverage, bitter gourd, amla, lemon, microbial and sensorial parameters*

PERCEIVED ROAD SAFETY CHALLENGES AMONG OLDER PEOPLE AND PEOPLE LIVING WITH DISABILITIES IN COLOMBO DISTRICT, SRI LANKA

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The ability to move about in the community is a key contributor to health, quality of life and meaningful participation in society. With increased motorization and hazards in the built environment, older people and people living with disabilities are particularly vulnerable to real and perceived risks of road traffic injuries. Inequitable transport options and road safety risks lead these road user groups to social exclusion and threats to their well-being. The objective of this study was to describe individual and environmental challenges for safe transportation among older and disabled people in three Secretary Divisions of Colombo district in Sri Lanka. This was a qualitative health research study. Participants were vulnerable road users i.e. older (60 years and above) and disabled people (physical, sensory, learning or mobility impairment; 12 years and above). Eight focus group discussions (6-10 in each) were conducted among participants to explore the local and regional destinations that were most important to access, perceived risks related to road safety and their needs/suggestions for safe transportation. A photographic documentation was undertaken by participants (10) to illustrate the environmental barriers and facilitators for road safety. Photographic details are increasingly used as a valuable adjunct in qualitative research - a voice better heard and visualised. Important places visited by older people were identified as the hospital, temple, meeting hall and market. For disabled people this varied by age including special-needs-school, vocational training school and hospital. The travel modes commonly used were public bus, three-wheeler or walking. Thematic analysis of data showed poor road conditions, lack of disability-friendly transportation options, harassment and negative attitudes of public as transportation barriers. Disabled people found accessibility to public transport and embarrassment as major barriers. These perspectives were supported by photographs. Suggestions for improvement included improved road infrastructure, user-friendly transportation modes, awareness programs for service providers and public and effective law enforcement. In conclusion, the findings show the need for improving road conditions and modes of transportation, rigorous legislative implementations alongside fostering favourable societal attitudes towards older and disabled people to allow them equitable opportunities for social participation and positive wellbeing.

Keywords*: ageing, disabled-persons, transportation, challenges, injury*

KNOWLEDGE ATTITUDES AND PRACTICES OF NURSES ON BLOOD SAMPLE COLLECTION: A CROSS SECTIONAL STUDY

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Laboratory errors pose a great impact on patient care and safety. About 70% of laboratory errors occur during pre-analytical phase where sample collection takes place. Nurses often assume the responsibility of specimen collection in healthcare setting in Sri Lanka. It is of paramount importance to study about knowledge, attitudes and practices of nurses on blood sample collection in order to see whether these aspects demand improvements. Objective of this research was to assess knowledge, attitudes and practice of nurseson blood sample collection in Teaching Hospital, Karapitiya (THK). A pre-tested, self-administered questionnaire was used to collect data from 200 nurses. Factors affecting the knowledge scores were also studied. Data were analyzed using SPSS. Participants whose knowledge score was below 50% were ranked into poor level, between 50% to 70% into average level, between 70% to 85% into good level and above 85% into excellent level. Mean knowledge score was 66.79 (SD±12.77). Among the participants only 5.5% (n=11) were in the excellent level, 38% (n=76) in the good level, 43% (n=86) in the average level and 13.5% (n=27) in the poor level. The knowledge score was significantly higher in undergraduates (75.17±12.96) compared to diploma holders (66.09±12.58, p=0.008). Knowledge score was significantly higher in nurses at ETU (72.83±11.18) compared to that of the medical (66.30±10.59, p=0.016), surgical (65.23±13.10, p=0.006) and pediatrics wards (65.02±16.16). Knowledge scores of the nurses were not significantly different with respect to their age, gender or work experiences. Nurses' attitudes on blood sample collection were positive. However, several lapses in the practice on the same aspect were observed. Study concluded that although overall knowledge of the nurses in THK was satisfactory regarding blood sample collection, knowledge on correct volume of blood needed for specific investigations, choosing of suitable sites for blood drawing and practices such as provision of duly filled investigation forms and label are to be improved. The value of educational and training programs for nurses in order to enhance the quality of blood sample collection and evaluation of their effectiveness is emphasized.

Keywords: *Knowledge, Attitudes, Practices, Nurses, Blood sample collection*

IDENTIFICATION OF POTENTIAL INHIBITORS OF ACETYLCHOLINESTERASE USING PHARMACOPHORE-QSAR MODELING AND MOLECULAR DOCKING BASED VIRTUAL SCREENING FOR TREATMENT OF ALZEIHMER DISEASE

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Alzeihmer's is a chronic neurodegenerative disease associated with memory loss and behavioural changes. The cholinergic pathways important for cell to cell communication present in brain are known to be compromised in Alzeihmer's Disease (AD). The levels of acetylcholine, an important neurotransmitter for memory, are known to be low in the brains of persons with AD. Upregulation of the enzyme Acetylcholinesterase (AchE) is the major stimulant for increased breakdown of acetylcholine, leading to decreased levels of acetylcholine in the brain. The inhibition of this enzyme will increase the available acetylcholine for communication between brain cells. AchE is hence, an important drug target for the treatment of Alzheimer's disease. The aim of this work was to identify a novel small molecule which would inhibit AchE activity. We employed a dual pronged approach by integrating (i) ligand based 3D-pharmacophore & quantitative structure-activity relationship (QSAR) modeling approach to identify the potential hits and (ii) receptor's structure based molecular docking to calculate the potential binding mode and binding affinity of the hits. The pharmacophore based screening will help to reduce the false positives during molecular docking based screening since pharmacophore screening will initially elucidate the essential structural features required for the ligand recognition and inhibition of AchE. The best pharmacophore model was employed as a 3-D search query to screen Maybridge and LigCAP compound libraries having only Lipinski's compliant molecules to find hits. The obtained hits with the required pharmacophoric features were docked into the binding site of AchE to predict their binding mode and binding strength based on empirical scoring function. This pharmacophore-QSAR based modeling combined with a docking-based comparative approach led to identification of intermolecular contacts and detailed insights into the contribution of the structural moieties of the compounds towards their activity. We identified the best hits in terms of higher binding affinity as well as interactions with AchE. These compounds are potential inhibitors of AchE and can be a good drug lead. Hence, this work can provide the way forward for the development of drugs against Alzheimer's disease.

Keywords: *Acetylcholinesterase, Alzheimer's disease, AchE inhibitor, Pharmacophore, 3-D QSAR, Molecular Docking, Scoring Function.*

COMMUNITY PERCEPTION ON THE USE OF PARACETAMOL (ACETAMINOPHEN) IN A SELECTED SRI LANKAN POPULATION

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Paracetamol is a commonly used over the counter drug which taken in overdose can lead to acute poisoning. It is the single most commonly taken drug in overdoses that leads to hospital presentation and admission. This study was conducted to investigate community perception regarding paracetamol in a selected Sri Lankan population. This descriptive cross-sectional study was conducted at Nelumvila grama niladhari area (rural) in Anuradhapura district and Southern Horagolla grama niladhari area (urban) in Puttalum district, Sri Lanka. Volunteers (n=400; age 18 - 60 years) were selected by random sampling. An interviewer-administered questionnaire was used to collect data. Study population had adequate knowledge of paracetamol as a drug and 90% of the participants were aware of paracetamol as a suicidal agent in overdose. Knowledge about paracetamol in rural area (n=166, 83%) was higher compared to urban area (n=114, 57%). Knowledge about paracetamol was associated with area ($P < 0.0001$), age ($P=0.0009$) and educational status ($P=0.0009$), and was not associated with gender ($P =0.2609$). Most of the study participants (n=392, 98%) used to have one brand of paracetamol at all times and there was a statistically significant association between area and having one particular brand of paracetamol ($P=0.0001$). The majority of the participants (n=364, 91%) had paracetamol readily available at home. Usage of paracetamol within last three months showed a significant difference with area and gender ($P =0.0001$). Usage of paracetamol was more in rural area and female to male ratio was 2:1 in the study population. The study population has adequate knowledge regarding paracetamol and it varied with age. There is high availability of paracetamol at home which highlight the practice of storing the drug. Therefore reduction of the availability & advice on proper usage may be beneficial in reducing paracetamol overdose/poisoning in Sri Lanka.

Keywords*: paracetamol, knowledge, availability, usage, overdose*

ANALYSIS OF SUGAR CONTENT IN CARBONATED BEVERAGES IN SRI LANKA

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Carbonated beverages are popular among children and adults in Sri Lanka. Sugar is added to beverages as major quality attributes. There were reported cases with high amount of sugar level than recommended level in some soft drinks. World Health Organization has recommended <10 percent daily calories from free sugar in line with controlling the escalating non communicable diseases. In line with that Ministry of Health has recommended 6 teaspoons (25 grams) of sugar per day for adults in Sri Lanka. Government also passed a regulation to display color codes (Red, Amber and Green) in beverage bottles according to the specified sugar levels. If sugar levels below 2g/100ml-Green, 2-11g/100ml-Amber and above 11g/100ml-Red color codes should be displayed. Objectives of this study was to quantify the sugar content of carbonated beverages available in Sri Lanka and to compare with colour codes appeared in the bottles. Ten brands and in each brand, 5 samples with different batches from Colombo district were analyzed and the mean value was taken as final. Sugar content was analyzed quantitatively using refractometry. Validation was done using Lane and Eynon method for all the samples. According to the analysis results, the sugar content was from 8.3 ± 0.1 g/100ml to 14.2 ± 0.1 g/ 100ml. The test results of the sugar content investigated were within the range of the colour codes displayed in the labels. In conclusion, all the analyzed brands of carbonated beverages contain high sugar level falling into either red or amber color code. Need awareness programmes for consumers for better choices and producers to consider reformulation of beverages to suit the recommendation of World Health Organization.

Keywords: *Refractometry, carbonated beverages, Lane & Eynon method, Sucrose.*

FORMULATION OF A COOKIE USING COMPOSITE FLOUR MIXTURE

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The modern consumers are demanding foods that show two main properties, namely the convenience and traditional nutritional aspects of the food. This study seeks to investigate the potential of flours of cowpea, raw red rice, kithul, atta and wheat blends along with black seed oil in cookie making which could be used as a meal replacement. Initially four trials were carried out to find out the best combination of composite flour mixture. By considering the nutritional values, cowpea and kitul flour amounts were considered as variables while rest of the flour amounts were kept constant to maintain the standard texture and nature of cookies. The results of sensory evaluation of four treatments results were analysed using Friedman test. The results revealed that highest sum of rank for colour (108.0), texture (97.0), odour (104.5), mouth feel (107.5) and overall acceptability (110.5) was shown by the selected formulation by the sensory evaluation. The statistical findings signified that adding 25g of kitul flour and 5g of cowpea flour was the most preferred composition for composite flour mix. Selected formulation by the sensory evaluation was used to carry out the proximate and microbiological analysis where 25g kitul flour, 5g cowpea flour, 50g red rice flour, 15g wheat flour, 25 g atta flour, 50g sugar, 1 egg and 2.5 ml black seed oil were used as highly nutritious cereals and pulses. the chemical analysis revealed that the selected composition has 1.2% of moisture content, 6.8% of protein, 5.4% of total fat, 80.4% of carbohydrate, 3.2% of fibre and an energy content of 398 kcal/g. yeast and mould count of the tested sample were lower than the spoilage level (1.0×10^1 g^{-1}). The formula developed in this study could be used to produce a new variety of nutritionally rich cookie to the local market.

Keywords*: Composite, Kitul flour, Black seed oil, Cookie*

EXTENT OF PARTICIPATION, KNOWLEDGE AND BARRIERS IN ATTENDING ANTENATAL EDUCATION AMONG MALE PARTNERS: FINDINGS FROM A MEDICAL OFFICER OF HEALTH AREA IN ANURADHAPURA DISTRICT

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In order to improve maternal wellbeing, since 2014 the circulars issued by FHB announced that every couple should participate to three antenatal classes. However, the participation of male partners seems very low. Our aim was to explore the extent of participation, knowledge and barriers in attending antenatal sessions among male partners. A cross sectional descriptive study was done among 213 male partners in Ippollagama Medical Officer of Health (MOH) area in Anuradhapura district. An interviewer administered questionnaire was used to collect data and data were analyzed using SPSS software package. Majority of participants were between 30 to 39 years (53.5%), Sinhalese (93.9 %) and Buddhists and were educated up to Ordinary level (42.3%). Most were married between 1-5 years (44%) and were employed in skill and agriculture (56%). Majority of participants did not participate in antenatal sessions (67.1%). Less than half (44%) had good knowledge in antenatal care and mean knowledge score was 65.66±7.742SD. Knowledge on antenatal clinic registration was very good (85%). Majority had good knowledge on immunization and supplements (> 70%), were aware about the importance of oral hygiene in the pregnancy period (97%) and were knowledgeable about risk conditions and regarding breast feeding (69%). However most were unaware about worm treatment during pregnancy (68%). Level of knowledge was not significant with any of selected socio demographic characteristics ($p>0.05$). Majority stated that the main barrier in participating antenatal classes was their responsibility towards employer and inability to take leave. Extent of participation of male partners is relatively low (32.9%). Only 44% had good knowledge on antenatal care and child birth. Male partners should be given at least half day leave to participate antenatal sessions with their wives.

Keywords*: Male partners, Extent of participation, Antenatal education, knowledge, Barriers*

IDENTIFICATION OF MODIFIABLE RISK FACTORS OF NON–COMMUNICABLE DISEASES AMONG SRI LANKAN POLICE OFFICERS IN SELECTED POLICE STATIONS OF COLOMBO DISTRICT

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There are some occupations which affect the employee's health directly or indirectly giving rise to various complications later in their lives. Police force always makes the top of the above list especially due to the high stress levels involved in the line of duty. Majority of officers tend to practice lot of unhealthy coping mechanisms to keep up with their jobs which ultimately lead them to develop non communicable diseases (NCDs). This study was conducted to determine the prevalence of modifiable risk factors for NCDs among Sri Lankan police officers in selected police stations of Colombo District. Randomly selected 420 police officers were included in this descriptive cross sectional study. Of them 393 were male officers. According to Body mass index (BMI) 46.9% was overweight and 5.24% were obese. Blood pressure measurements identified 15.5 % with pre hypertension and 18.8% within hypertensive range. Furthermore, 62 participants were diagnosed hypertensive patients. However, only 29 had taken their medication regularly. Out of 27 female officers, 21 had high waist circumference (≥80 cm). Out of 393 male officers, 58% had high waist circumference (≥90 cm). Prevalence of smoking was 29.4%. Regarding alcohol consumption, 93.2% had consumed alcohol within past 12 months, and 82.3% within past 30 days. Moreover, 7.3% admitted that they consume high amount of salt with the diet. In male population, 22% with healthy waist circumference and 45% with high waist circumference were identified with hypertension ($p=0.000<0.05$). In addition, 20% of normal BMI and 40% of high BMI had hypertension ($p=0.000<0.05$). In conclusion, this study found that there is high prevalence of overweight and obesity among Sri Lankan police officers. Similarly, high prevalence of smoking and alcohol consumption were also found. Out of all the other risk factors, high waist circumference was most prevalent. Findings indicated that majority of participants are at higher risk of developing NCDs in near future.

Keywords: *Prevalence, Blood pressure, Body Mass Index, Smoking, Alcohol*

IDENTIFICATION OF SYNTHETIC DYES IN SELECTED CONFECTIONARIES AND BEVERAGES IN JAFFNA DISTRICT

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Food dyes are commonly used in foods and beverages to improve appearance, enhance the appetizing value and consumer's acceptance. Recently synthetic food dyes have been increasingly used than natural food dyes by food manufactures to attain certain properties such as low cost, more stability, high colour intensity, *etc*. Varied foods and beverages available in the market may contain some non-permitted synthetic dyes and high level of permitted synthetic dyes, which lead to severe health problems such as mutation, cancer, reduced hemoglobin concentration, allergic reactions, irritability, restlessness and damaging body organs. Therefore, Ministry of Health in Sri Lanka made regulations to restrict adulteration of non-permitted synthetic dyes as food colourants under Extraordinary Gazette 2011, Food Act No. 26 of 1980. It states only nine synthetic food dyes are permitted and colour composition cannot exceed 100ppm as a single component or in combination. This study was conducted for the identification of synthetic dyes in most consumable confectionaries and beverages available in Jaffna district. A total of 110 samples were collected from retail shops in each Medical Officer's of Health (MOH) areas in Jaffna district. Samples were analyzed by preliminary treatment, wool extraction, Thin Layer Chromatography (TLC), and UV-Visible Spectrophotometry with permitted synthetic colour standards mentioned in food act, Sri Lanka. The results of the study found that all beverages (100%) and majority of confectionaries (85%) contained only permitted synthetic food dyes. Few confectionaries (7%) did not contain any synthetic food dye and some confectionaries (Instant red jelly) (8%) contained non-permitted dyes which was not complied with any of permitted synthetic food dyes according to the food act Sri Lanka. Tartrazine (41%) was the most used synthetic food dye among both confectionaries and beverages. According to the results, usage of synthetic food dyes is high among confectionaries and beverages and some unidentified dyes were found in some confectionaries in the Jaffna district.

Keywords: *Synthetic food dyes, Non-permitted dyes, Thin Layer Chromatography, UV-Visible Spectrophotometry*

In vitro EVALUATION OF OSTEOBLAST RESPONSE TO HYDROXYAPATITE NANO-PARTICLES DEPOSITED ON SELF-FORMED TiO_2 THIN LAYER ON Ti SURFACES

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Synthetic hydroxyapatite HA nanoparticles (nHA), that mimic natural hydroxyapatite, are widely used as coatings on materials used in orthopaedic prostheses. However, as a developing country accessibility of these materials are limited due to high cost. Therefore, Wijesinghe *et al.* (2014), has prepared Sri Lankan origin nHA through a novel technique; atomized spray pyrolysis and successfully prepared Ti surfaces with a binder TiO_2 layer coated with nHA layer which makes the overall production process of bone-implant of high economic value, novel and simple. The materials were evaluated for cytotoxicity using MTT assay while proliferation of cells in contact with the materials was determined by Alamar blue assay, quantifying total DNA and total protein contents using human osteosarcoma cells (ATCC, CRL-1543), seeded at 2×10^5 cells/ml on sample surfaces and were evaluated for 35 days. The results of this preliminary study demonstrated that the test samples did not elicit any deleterious effects to cells and showed a significant difference to that of the toxic positive control ($p<0.05$). Furthermore, the materials encouraged initial cell adhesion and long term cell proliferation as results showed a consistent increase in proliferation up to day 14, which reached the maxima by day 28 which was compatible with that of the negative control (Thermanox). Further investigations are being carried out to evaluate the biocompatibility of the materials to be utilized in orthopaedic applications.

***Keywords**: biocompatibility, Hydroxyapatite, Osteoblasts, orthopaedic prostheses*

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BODY MASS INDEX AND COGNITIVE FUNCTIONS AMONG YOUNG ADULTS IN TWO SELECTED MOH AREAS IN COLOMBO DISTRICT, SRI LANKA

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Recent studies have shown that obesity is a risk factor for poor cognitive performance. The cognitive functions (CFs) are the collection of intellectual process, such as perception, thinking, reasoning and remembering for goal directed behaviours. Impairment of CFs has been associated with academic and behavioural problems in young adulthood. This study was conducted to determine association between body mass index (BMI) and cognitive functions in a sample of young adults (21-25 yrs) living in two selected Medical Officer of Health (MOH) divisions (Ratmalana & Piliyandala) in Colombo District, by simple random sampling, using electorate register of each Grama Niladari (GN) divisions . WHO cutoff values for Asian were taken as BMI cutoff values. CFs were assessed via validated Wechsler Adult Intelligence Scale-IV (WAIS-IV) which consists four domains; verbal comprehension (VCI), perceptual reasoning (PRI), working memory (WMI) and processing speed (PSI) and composite score in each task was calculated to determine the level of cognition. Differences in mean scores and correlations were assessed through ANOVA and spearmen correlation coefficient and significant level was taken as $p<0.05$. Study sample consists of 100 young adults of which 51% were females. Mean (SD) age was 23.42yrs±1.5. Mean BMI (SD) was 26.13 Kg/m2±5.4, of which 35% and 32% were overweight and obese respectively. A decrease in the VCI, PRI, WMI, PSI and full score of IQ (FSIQ) composite scores, were observed amongst the overweight and obese groups when compared with the normal weight group ($p<0.05$). Furthermore, a negative significant correlation coefficient was observed in WMI, PSI and FSIQ domains of the WAIS-IV with BMI (WMI r= -0.632 PSI r= -0.611 & FSIQ r= -0.578; $p<0.01$). However, age, gender and educational status weren't statistically significant between normal, overweight and obese groups ($p>0.05$). It is concluded that overweight/obese young adults in this sample have poorer cognitive functions when compared to the normal weight. Therefore, we recommend that urgent measures need to be taken to overcome obesity for preventing cognitive impairment amongst the young adult population.

Keywords: *Cognitive functions, BMI, WAIS-IV & Young adults*

NUTRITIONAL AND SENSORY PROPERTIES OF FINGER MILLET (*Eleusine coracana*) FLOUR INCORPORATED BISCUITS

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Among ready-to-eat snacks, biscuits hold an important position. Majority of biscuits are high in carbohydrate, fat and calorie, while low in dietary fiber and have become unhealthy snacks for daily consumption. Alternating the ingredients used in biscuits with potential nutritive ingredients would be beneficial to improve the nutritional quality of biscuits. Our previous studies confirmed that locally grown finger millet (*Eleusine coracana*) varieties are good sources of dietary fiber, micronutrients and antioxidants compared to commonly consumed cereals including rice and wheat. Due to popularity and large diffusion, biscuits have been frequently considered as a vehicle for healthy substances. This study was conducted to formulate biscuits by replacing refined wheat flour (RWF) with finger millet flour (FMF) and to study nutritional and sensory properties of those biscuits. Locally grown Oshadha finger millet variety was used for the study. Four biscuit samples were formulated replacing different percentages of RWF with FMF and physicochemical and microbiological properties were determined. Sensory attributes of biscuits were evaluated and data were statistically analysed using Kruskal-Wallis non parametric ANOVA and the best product was selected. Proximate composition and *in vitro* antioxidant properties of the selected FMF incorporated biscuit (FMB) were determined and compared with a control biscuit (CB) prepared using RWF. Data of each experiment were statistically analysed. FMF incorporated biscuits are complying with SLS specification for biscuits. According to results of sensory evaluation, biscuit sample produced by adding 50% FMF was selected as the most preferable biscuit among tested products. Total dietary fiber (TDF) and minerals contents of FMB are significantly ($p<0.05$) higher than those of CB. FMB exhibits significantly high ($P<0.05$) antioxidant activities for all the investigated antioxidant properties, when comparing with CB. Replacement of RWF with FMF in biscuit formulation enhances the nutritional properties of biscuits, including TDF, minerals and antioxidants contents, without affecting the sensory properties and converts them to healthy choices for daily consumption. Therefore, introducing finger millet flour incorporated biscuit in daily diet may play an important role in prevention and dietary management of diet-related and oxidative stress associated chronic diseases.

Keywords: *Antioxidants, Biscuits, Dietary fiber, Finger millet, Functional foods*

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IMPACT OF TRAINING CARDIO-PULMONARY FITNESS OF SRI LANKAN NATIONAL LEVEL ATHLETES ENGAGED IN RUNNING EVENTS

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Most Sri Lankan national level athletes do regular training at high intensity for about five to six days per week. Even with a high level of training their performance at local and international competitions is poor. Cardio pulmonary fitness assessment (CPET) of athletes is important to improve and monitor their sports performance and health status. The study aimed to determine the cardiopulmonary fitness parameters of athletes engaged in running events and the effect of training on cardiopulmonary fitness. National running athletes (n = 62; male= 40, female= 22) were studied. Cardiopulmonary fitness parameters; maximum O_2 uptake (VO_{2peak}), exercise duration ($VO_{2max\ time}$), anaerobic threshold (VO_{2AT}), exercise capacity(METs), peak heart rate (HR_{peak}), heart rate at VO_{2AT} (HR_{at}), heart rate after 3minutes of exercise (HR_{3min}), peripheral oxygen saturation (SpO_2), maximum energy expenditure (EE) and maximal load (W) were assessed by a cardiopulmonary exercise testing machine with a cycle ergometer (COSMED Inc.). The cardiopulmonary fitness parameters were compared with age, height, weight and gender matched controls not engaged in regular sports training (n= 60; male= 30, Female=30). Data were analyzed using SPSS-16 statistical package. In male athletes VO_{2max}, $VO_{2max\ time}$, MET, W and in female athletes VO_{2max}, HR_{peak}, HR_{at}, HR_{3min}, MET and EE were significantly improved when compared to controls ($p<0.05$). The correlation between cardiopulmonary functions of male athletes was not significant with training duration. Female athletes had a positive correlation of SpO_2 and a negative correlation with HR_{peak}, HR_{at} with training duration. The association between improvement in VO_{2max} with the duration of training was poor ($p>0.05$). Improvement of VO_{2max} along with other parameters enhances performance. In conclusion; the training schedules of the national level male and female running athletes should be re-evaluated and fine tune to achieve more precise cardiopulmonary fitness and performance outcomes.

Keywords: *national athletes, cardiopulmonary exercise fitness, training duration*

ASSESSMENT OF DIETARY MACRONUTRIENT AND ENERGY INTAKE, BODY MASS INDEX AND BODY FAT PERCENTAGE AMONG RURAL FEMALE SUBJECTS WITH OR WITHOUT TYPE 2 DIABETES MELLITUS IN SRI LANKA

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Goal of dietary management of diabetes subjects is to maintain and reach optimal metabolic and physiological outcomes including maintenance of near normal blood glucose levels, management of weight, dyslipidemia and hypertension. When a diet which is designed for diabetic subject is concerned, protein intake should be maintained ≤1 g/kg body weight. Total fat intake should be <35% of energy intake and total carbohydrate should be in between 45–60% of energy intake. Objective of the current study was to assess the dietary macronutrient and energy intake, BMI (body mass index) and BF% (body fat percentage) among a population of rural type 2 diabetic and non-diabetic females in Sri Lanka. Thirty female diabetic and 30 non-diabetic subjects were recruited. A validated food frequency questionnaire was administered and daily macronutrient intake was calculated using "NutriSurvey" software. Body mass index (BMI) and body fat percentage (BF%) of subjects were taken using anthropometry and bio impedance analysis methods respectively. Mean BMI and BF% of both groups have exceeded the cutoff value for over-weight category [$BMI_{Non\text{-}Diabetic}$ =23.81 (±3.89), $BMI_{Diabetic}$ = 25.10(±3.08), $BF\%_{Non\text{-}Diabetic}$= 33.12 (±4.37), $BF\%_{Diabetic}$= 34.37(±2.82)]. Daily Energy, protein, fat, and carbohydrate intakes of diabetic subjects were significantly lower compared to the non-diabetic group [Energy intake (kcal/day) = 2032.34(±596.96), 1478.58(±489.20) P=0.00, protein intake (g/day) = 51.52(±23.90), 38.02(±19.96), P=0.00, fat intake (g/day) = 39.27(±14.29), 29.85(±13.39), P=0.01, carbohydrate intake (g/day) = 382.55(±113.57), 270.81 (±86.91), P=0.00 respectively among non-diabetic and diabetic subjects]. Both diabetic and non-diabetic subjects have maintained recommended protein intake and was significantly higher in non-diabetic group [(P=0.00) [0.66(±0.41) g/kg body weight, 0.93(±0.55) g/kg body weight respectively among diabetics and non-diabetics]. Percentage energy intakes from carbohydrate were higher than the recommended in both groups [non-diabetic 80.31(±2.95), diabetic 77.23 (±6.31), P= 0.05]. Results of the current study indicate that it is important to increase the awareness of the concept of balanced diet not only among diabetic subjects but also among non-diabetic subjects in order to improve their quality of life since both diabetics and non-diabetic groups were not following balanced diet and were unable to maintain ideal BMI and BF%.

***Keywords**: Diabetes, macronutrient, carbohydrate, protein, fat*

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KNOWLEDGE OF SUBFERTILITY AND SOCIO-CULTURAL INFLUENCE ON WOMEN WITH SUBFERTILITY IN CASTLE STREET HOSPITAL FOR WOMEN, SRI LANKA

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Subfertility is a major concern among women. Having a child is an essential part to complete a family therefore without a child is a serious issue to the family as well as to the society. In comparison to other countries, Sri Lankan population also more concerning on social, cultural, religious, spiritual content regarding subfertility, however, there are limited available research evidence regarding the impact of knowledge and socio-cultural influences such as perception, social discrimination and psychological status on women with subfertile in Sri Lanka. Therefore this study was aimed to identify the knowledge of subfertility, and according to socio-cultural influences, to determine perception, to describe the experience of the social discrimination and psychological status of women with subfertility who are attending subfertility clinics in Castle Street Hospital for Women (CSHW) Sri Lanka. A descriptive cross-sectional study was carried out in a purposively selected participants (n=200) of who are attending in subfertility clinic CSHW. Data was collected to through pre-tested interview-administered questionnaire. Data analysis was conducted using descriptive statistics. Ethical approval was obtained from the ethics review committee of CSHW. Findings revealed that nearly half (41%) of participants was in 30-34 age range and 8.5% of them were in more than 40 age. Majority of participants (86%) were Sinhala and more than half of them (53.5%) educated up to Advanced Level. More than half of them (56%) were unoccupied. Majority of participants had adequate knowledge about subfertility. Almost all of the participants (98%) knew that subfertility should be treated medically. According to the socio-cultural influences more than half of participants (78.5%) percept that have a test-tube baby and medicine for subfertility are socially acceptable. More than half of the participants (66%) have experienced social discriminations due to their subfertility. Nearly one third (74%) of women blamed by the society and 40% of them expressed limited participation to social functions. Majority were suffering from psychological discomfort and 34% have interfered that subfertility problem with their day-to-day life. Half of them (49.5%) said that they cannot move ahead without a child. Further studies are needed to explore this phenomenon in Sri Lanka.

***Keywords**: Quantitative, Subfertility, Women, Social cultural context, Sri Lanka*

CHALLENGES FACED BY NURSES FOR IMPLEMENTATION OF NURSING PROCESS IN SPECIAL UNITS AT TEACHING HOSPITAL JAFFNA

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The nursing process is a systematic problem-solving approach used to identify, prevent and treat actual or potential health problems and promote wellness. Application of nursing process will improve the quality of care. The majority of nurses have knowledge on nursing process but they don't apply in practice. Implementation of nursing process will improve the patient care and decreases morbidity rate and hospital stay. In Teaching Hospital Jaffna, rate of morbidity and hospital stay are increased because of less consideration on application of nursing process. Therefore it was decided to conduct a study to assess the nurses' knowledge on nursing process and to identify the factors impact on implementation of nursing process in special units at Teaching Hospital, Jaffna. Descriptive cross-sectional study was conducted among 100 nurses working in special units at Teaching Hospital, Jaffna. Convenient sampling method was used. Nurses who were willing to participate and available during the study period were included as respondents and who were on leave were excluded from the study. Data were collected by using structured self-administrated questionnaire which included questions regarding socio-demographic details, nurses' knowledge on nursing process, personal factors & institutional factors that influence to implement the nursing process. The questionnaire was generated by conceptual frame works that results from review of literatures, experts' opinions and personal observations. The content validity of questionnaire was assured by referring to subject experts, relevant books and by searching web engines. Reliability and readability of questionnaire was assured by a pre-test. Ethical clearance was obtained from Ethics Review Committee of Faculty of Medicine, Jaffna. Pilot study was carried out among 5 nurses from Base Hospital, Tellipalai. Permission was obtained from obtained from Matron, Base Hospital, Thellipalai and from Director, Teaching Hospital, Jaffna. Director, Teaching Hospital, Jaffna to conduct both pilot and main study. Data were analyzed by using SPSS19 statistical software in descriptive statistical method to assess the knowledge regarding nursing process and to identify the factors impact on practicing nursing process. Among the participants 63% were females; 60% were under the age group of less than 30 years; 76% were Tamils; 64% were Hindus, 46% nurses had 3-6 years working experience; 31% of participants from Medical Intensive Care Unit (MICU). Results show that 17% of nurses had enough knowledge about nursing process. 88% and 69.8% of nurses reported that not enough time and workload are the major personnel factors as barriers for implementing nursing process respectively. All participants reported that they are suffering from physical and mental stress, such as back pain, work load

and time management problems. Lack of theoretical knowledge, shortage of nursing staff and unavailability of materials were the institutional factors mainly influencing in application of nursing process. Hence, implementation of nursing process is affected by various factors, if nurses have adequate knowledge, they can apply easily. Institutional factors took the greatest part for lack of implementation of nursing process. Government must reemphasize on the provision of adequate resources to improve the practice of nursing process.

Keywords: *Challenges, Factors, Nurses, Nursing process, Teaching Hospital*

COULD A WARD-BASED CLINICAL PHARMACIST SERVICE IMPROVE PATIENTS' PERCEPTION ON MEDICATION INFORMATION EXCHANGED BETWEEN HEALTHCARE PROFESSIONALS DURING HOSPITALIZATION?

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Inadequate communication between healthcare professionals and patients during hospital stay is a global issue. The objective of this study was to assess the patients' perception about ward-based clinical pharmacy service (CPS) on medication information exchanged between healthcare professionals and patients during their hospital stay. This was a part of a non-randomized controlled clinical trial conducted in a tertiary care hospital in Sri Lanka involving in-patients with non-communicable chronic diseases. The control group (CG) received standard care. The intervention group (IG) received CPS in addition to the standard care. The CPS included a medication history, prospective medication review, making recommendations to the healthcare team and patients when drug-related problems were identified, and patient education about medicines at discharge. A structured interview was performed by telephone on the 6th day after discharge to identify patients' perceptions regarding the medication information exchanged during the index hospital admission. 334 and 311 patients in the IG and CG respectively were contacted. Significantly larger percentage of patients in the IG recalled being asked about their pre-admission medications (IG = 97%, CG = 92%; P = 0.002) and past history of allergies (IG = 91%, CG = 83%; P = 0.002). A significantly larger percentage of patients in CG reported that they did not receive adequate information about their medicines during hospitalization (CG = 60.8%, IG = 1.5%; P <0.001). Both IG (100%) and CG (97.7%) recalled that they received information on dose and frequency of medicine whereas the indication was explained to significantly small percentage of CG (IG = 98.2%, CG = 29.3%; P < 0.001). A smaller proportion of intervention patients (IG -1.8%, CG – 25 %; P<0.001) had problems to clarify at discharge and of them 83.3% (5/6) received a chance to discuss them prior to discharge. Only 9% of patients in the CG (7/78) received this opportunity (P <0.001). More than 90% (312/334) of patients in the IG reported that they received medicine related information from the ward pharmacist. The study shows that the medication information exchanged between patient and healthcare professionals was better in IG. Large majority of patients in the IG reported that the ward-based clinical pharmacist was their main drug information source. This study demonstrates the positive contribution of the ward-based clinical pharmacist as a medication information resource.

***Keywords**: Clinical pharmacy service, Medication information, Hospitalization*

A METHOD TO DEVELOP A MEDIAL PROTOCOL: PROTOCOL FOR MEDICO LEGAL EXAMINATION, REPORTING AND MANAGEMENT OF FEMALE SURVIVORS OF INTIMATE PARTNER VIOLENCE IN SRI LANKA

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Although, Asian women play a major role within their family life, they have been victimized for physical, sexual and psychological violence mainly by their partner. However, there is no specific protocol or national guideline to medico legal management of female survivors of intimate partner violence in Sri Lanka. The main objective of this study was to develop a protocol for medico legal reporting and management of female survivors of intimate partner violence (FSIPV). Firstly, we drafted a protocol based on available literature and past experiences. Then, volunteered experts among the field of Forensic Medicine (Fifteen Consultants Forensic Pathologists) were communicated; Delphi rounds were carried out to gather expert opinion to design the components of the protocol. Subsequently, experts were given a draft protocol and requested them to provide their opinion on each component of the protocol. Finally, individual opinions were analyzed in a sequential manner. The threshold criterion was taken as 75% for reaching consensus level of agreement on the items in the drafted protocol. During the first round, only 8.1% were less than the threshold criteria. In second round, all conflicts of the first round were rectified; all points in the questionnaire 100% were within the threshold criteria of in or exclusion. This developed protocol was tested at the Judicial Medical Office, Colombo South Teaching Hospital by the Judicial Medical Officers. The inclusion criteria were FSIPV reported to Judicial Medical Office, Colombo South Teaching Hospital. The Judicial Medical Officers attached to the centre were given the protocol to during the medico legal management cases of female survivors of intimate partner violence. Out of fifty women 37(74%) were between 21-40years. The reporting of violence is diminishing with their level of professionalism; highest (19, 38%) being unemployed whereas lowest (1, 2%) being a professional. Forty two, (84%) were physically abused while 11(22%) were sexually abused and 14(28%) were psychologically abused by their partner. Out of physically assaulted forty two, 39(92.9%) were assaulted with hand by their partner and 10(23.8%) were assaulted with feet. Eleven (26.2%) were assaulted with house hold blunt weapons such as broom stick/club. The highest number of injuries were clustered within head and face 44(88%), and about 15 (30%) all the other areas and least number was around pelvic area (1, 2%). In conclusion, above method was found to be an effective way in developing a medial protocol.

Keywords*: Intimate Partner Violence (IPV), Protocol for medico legal examination, Female Survivors of Intimate Partner Violence (FSIPV)*

ASSESSMENT OF SAFETY ATTRIBUTES OF POTENTIALLY PROBIOTIC LACTIC ACID BACTERIA (LAB) OF SRI LANKAN DAIRY ORIGIN FOR FUTURE FOOD APPLICATIONS

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The use of lactic acid bacteria (LAB) as probiotics has now been extended due to their well-known beneficial properties on general health and wellbeing. Documented associations between adverse events and probiotic consumption are few compared to their widespread use. However, the use of new strains for probiotic use requires more detailed evidence of their safe use. Therefore, this study was to evaluate the safe use of LABs, isolated from dairy sources of Sri Lanka, to determine their suitability to use as either probiotics or as starter cultures in local food industries. Thirty eight LABs with probiotic affinities; including *Lactobacillus pentosus*, *Lactobacillus plantarum*, *Lactobacillus fermentum*, Lactobacillus *paracasei*, and *Lactobacillus rhamnosus* were assessed in this study. DNase test, Gelatinase production and Bile-esculin test were performed as screening assays. Haemolytic activity was determined by streaking onto Columbia blood agar plates, containing 7% human blood and were observed for β, α and γ haemolysis. Antibiotic susceptibility was determined following the modified standard Kirby-Bauer procedure as used by Rojo-Bezares *et al* 2006 for 12 antibiotics (Oxoid, UK). A microorganism should not produce gelatinase or DNase enzymes so as to be used as a probiotic, and none of the strains studied produced those two enzymes. Around 15 (39.5%) isolates may belong to *Enterococcus* category though isolated from dairy sources and 11 (28.9%) were not suitable for live consumption due to haemolytic activities. One isolate of *Lactobacillus plantarum* strain HL-20, and another of *Lactobacillus paracasei* strain 4SY1 produced clear zones around colonies (β-haemolytic) and the remaining isolates produced green zones (α-haemolytic). Rest of the isolates did not produce green or clear zones on human blood agar plates (γ-haemolytic) and those could be considered as safe for human consumption. The non haemolytic isolates were resistant only to vancomycin and norfloxacin and susceptible to rest of the antibiotics. Therefore, majority of the LABs screened were likely to be safe for human use, though need further *in vivo* evaluations.

Keywords *: Lactobacillus,* probiotic, safety assessment, antibiotic resistance, haemolytic activity

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INVESTIGATING THE AWARENESS AND KNOWLEDGE REGARDING PREVENTION OF RISK FACTORS RELATED TO HYPERTENSION AMONG A VILLAGE POPULATION IN 78E, HINGURUGAMUWA GRAMA NILADARI DEVISION, BADULLA, SRI LANKA

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All around the world hypertension can be considered as one of the most important causes of cardiovascular morbidity and mortality in the elderly. With the increase in the number of elderly population in Sri Lanka, hypertension is considered as an important public health problem. The objective was to investigate the awareness and prevention of risk factors associated with hypertension among a village population. A cross sectional study was conducted in 78E Hingurugamuwa, Badulla district with the use of a self-administered questionnaire on different domains of hypertension such as prevalence, awareness of blood pressure levels, risk factors and prevention as well as sources of information. This study compared the variations in prevalence, risk factors and prevention factors according to socio-demographic characteristics. The data was analyzed by SPSS 16 and using chi square and cross tabulation tests. Out of 333 participants between age 35-70 years old, 198(59.5%) participants were males and 135(40.5%) were females (P valve=0.0000). The overall prevalence of hypertension was 26.4%, which did not vary with sex but significantly increased with age. The government, non-government and retired respondents and more literate subjects had a higher prevalence rate. More than half of the participants (53.2%) were aware about normal blood pressure level and 39.9% respondents were aware about high blood pressure level. The most known risk factor was overweight (90.8%) while out of fifteen risk factors 47.4% of subjects were aware of ≥11 risk factors, 31.5% of subjects were aware of 6-10 and 21% of participants were aware of ≤5 risk factors. Regarding the prevention, majority of respondents (66.6%) were aware of >5 preventing factors out of seven while only 9% of respondents were aware of ≤2.Most of the participants (54.7%), reported TV programs and clinics (53.5%) as their information source. The study shows overall, average awareness in all domains with some gaps noted in domains such as awareness of blood pressure levels and some of the risk factors, whereas awareness of preventive factors were comparatively good.

Keywords: *Hypertension, Risk factors, Prevention, Life style modifications, Pressure*

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ANTIOXIDANT ACTIVITY OF *Gracilaria edulis* (RHODOPHYSEAE)

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Recently marine seaweeds especially *Gracilaria edulis* are being used to produce new drugs as well as healthy and delicious low calorie foods. These are known as primary sources of secondary metabolites and are also used as natural antioxidants and antimicrobials. The purpose of the research was to determine the antioxidant activity of *G.edulis*. Different concentrations such as 5, 10, 15, 20, 25 and 30 µg/ml of the methanol extract of *G.edulis* and other aromatic compounds such as 2, 4 dinitro phenyl hydrazine and Aniline derivatives were prepared to determine antioxidant activities by hydrogen peroxide scavenging assays on absorbance at 230 nm. The methanol extract at the concentration of 5µg/ml recorded the highest total antioxidant activity ($p<0.05$) compared with other *G.edulis* sample concentration. Steady state antioxidant activities of methanol extract of *G.edulis* were exhibited at its 15ug/ml. In IBM SPSS package 2010, Chi squared test and paired test were clearly shown the absorbance, inhibition or percentage scavenging of hydrogen peroxide depend on the concentration of the *G.edulis* methanol extract. These two statistical tests exhibit the relationship between the concentration of the methanol extract of the *G.edulis* ($p<0.05$) and antioxidant activity. When methanol extract of *G.edulis* concentration increased, Hydrogen peroxide absorbance was decreased and percentage scavenging of hydrogen peroxide or antioxidant activity was increased. Aniline compounds were more active than other tested aromatic compounds. Antioxidant activity of these tested compounds depends on presence of active groups and its position and number. The OH and NH_2 were highly active when present in ortho followed by para and meta positions. The NH_2 electron donor substitution group gives positive effect to antioxidant activity. And the NO_2 electron withdrawing group gives negative effects. Antioxidant activity was high in *G.edulis*, followed by aniline, 2,4 dinitro phenyl hydrazine and 2,4 dinitro aniline. Finally *G.edulis* showed prominent antioxidant activity. This study is used in future for bakery products development.

Keywords: *Marine Sea weed, Hydrogen Peroxide Scavenging, Methanol Extracts, Antioxidant*

AWARENESS OF BASIC SPORT NUTRITION PRINCIPLES AMONG ATHLETES AND SUPPORTIVE STAFF IN ATHLETIC ASSOCIATION OF SRI LANKA

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Sport nutrition plays a key role in enhancing athlete performance. The knowledge on sport nutrition is important to athletes and supportive staff includes coaches, strength and condition specialist (SCSs) to enhance athlete's performance. The Inadequate sport nutrition knowledge is the main barrier to gain proper nutrition. The main purpose of this study was to determine sport nutrition knowledge among athletes, coaches and SCSs. The Minor research objective of this study was to identify sources of nutrition that available for all group and to identify the main three nutritional sources that are recommended for athletes. The survey method research design used to conduct the study. Data collected by the structured questionnaire directly deliver to the participants. One hundred participants were considered as a sample include n=51 athletes, n= 24 coaches, n=25 strength and condition specialist. The questionnaire consists of both demographic information and sport nutrition information. Part 1 focused on demographic information. Part 2 made on the main sport nutrition sources. Part 3 focused on Sport nutrition questions based on twenty multiple choices questions. Part 4 included feeling towards sport nutrition statements. Data analysis was done by SPSS version21. The result of this study, overall participants were inadequate sport nutrition knowledge only one participant received adequate sport nutrition knowledge. 70.6% of athletes do not assess dieticians. The best-recommended sport nutrition sources for athletes were nutrition related courses, nutrition, and the physicians. 60.8% Participant agrees with having nutritionist would help in improving their performance. The most used nutrition sources for athletes, coaches, and SCSs was nutrition releted courses. Small sample size is the largest limitation of this study. Suggestion for increases sport nutrition knowledge was given an educational requirement for all group and the conduct nutrition related courses, and the improved availability of nutrient/ dietitian position for gain nutritional information for athletes.

Keywords*: Sport nutrition, Nutrition principles, Athlete, Sport officials, Sri Lankan Athletic Association*

ASSOCIATION BETWEEN NEUROCOGNITIVE TEST SCORES AND SCHOOL TEST PERFORMANCE; RESULTS FROM A SRI LANKAN SETTING

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Adolescents undergo rapid physical and cognitive growth soon after puberty. Cognitive abilities are essential for learning and scholastic achievement. A significant number of school children in Sri Lanka have various learning disabilities especially in reading, mathematics and nonverbal learning. This study aimed to investigate the association between the neurocognitive test scores and subject performance of early female adolescents living in Galle municipal area. A school based descriptive cross - sectional study was conducted on 218 female adolescents aged between 11 - 14 years. Cognitive functions were assessed with eight subtests of Wechsler Intelligence Tests for Children (WISC), Test of Non Verbal Intelligence (TONI) and two computer based executive function tests; Inhibition Task and Visuo- Spatial Working Memory. Term test marks obtained for mathematics, science and Sinhala language were taken from the school records to assess subject performances. Data were analyzed using SPSS statistical package. Mean Verbal comprehension index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI) and Estimated Full Scale Intelligence Quota (EFSIQ) were, 77.45 (±12.69), 69.71 (±9.27), 96 (±34.71) and 78.78 (±10.21) respectively. Mathematics test score is significantly correlated with EFSIQ (r=0.46), VCI(r=0.43), WMI (r=0.38) and Non Verbal Intelligence Test scores (r=0.35). The Language score is correlated with EFSIQ (r=0.43) and VCI (r=0.49), science test score correlated with EFSIQ (r=0.49) and VCI (r=0.48). In conclusion verbal comprehension index, working memory index and estimated full scale IQ are correlate best with mathematics scores. VCI and Estimated full scale IQ are correlate best with Science and Sinhala language test scores.PRI and PSI showed weak correlations with all subject performances. However executive functions test performances were weakly correlate with mathematics and sinhala subject scores and not correlate with science score. Reforming the education system by incorporating cognitive (WM) training programme at school setting would be beneficial for students to improve academic success.

Keywords: *Neurocognitive test, School test, Sri Lanka*

ANALYSIS OF MICROBIOLOGICAL QUALITY OF POWDERED MILK AND PASTEURIZED MILK IN COLOMBO AND GAMPAHA DISTRICTS - A CASE STUDY

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The study was performed to identify microbial quality of full cream milk powder (FCMP) and Pasteurized milk (PM) in Colombo and Gampaha districts. Five samples from each four brands of FCMP (Imported-A, B Local-C, D) and three brands of PM (E, F, G) were purchased from local market. Total coliform count (TCC) was determined as Most probable number (MPN) and Indol, Methyl red, Voges-Proskauer reactive compounds and Citrate utilizing (IMViC) tests were performed to group the present coliform bacteria. Coliform organisms were detected in one sample of imported brand (B) and all brands of PM. Coliforms were not enumerated in remaining samples of FCMP brands. In B TCC is 1/g which is within the acceptable level. One sample of E was positive for the TCC test and count was detected as 36/100 ml which is within the acceptable level. Present bacteria may be *Citrobacter* sp. In E four samples free from coliform. Three samples of F contaminated with coliform and count was <3-240 per 100 ml and other two samples of F free from coliform. Presence of E.coli was recorded in two samples in same batch of F. Third sample in another batch may be contaminated with *Citrobacter* sp. All the tested samples of G contaminated with coliform. TCC recorded as >1100 per 100 ml. E. coli was recorded in four samples of G in same batch and *Enterobacter* sp or *Klebsiella* sp may be present in one sample of another batch. Microbial quality of all tested FCMP and PM brand E is within the acceptable level however microbial quality of tested batches of F and G PM brands were poor in hygienic standards. Therefore there is a need to improve the microbial quality of the milk products without harming the nutritional value and to ensure the food safety of Sri Lankans.

Keywords*: Coliform, E. coli, Pasteurized milk, Powder milk, Sri Lanka*

MICROBIAL CONTAMINATION OF SELECTED NON-STERILE PHARMACETICALS IN OPD PHARMACY OF A TEACHING HOSPITAL

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A pharmaceutical product must be effective, safe and should be of good quality to assure their sustainability in the competitive pharmaceutical industry. The quality of the pharmaceutical products can be influenced by the presence of microorganisms (MO). According to British Pharmacopeia (BP) Non-sterile pharmaceuticals (NSP) may contain MOs within a certain limit. If a NSP product exceeds the total viable count of bacteria and fungi or if the presence of the pathogenic species, it is pronounced to be contaminated. Contamination of NSP with microorganisms may cause hazardous effects on human beings as well as change the physical, chemical and organoleptic properties of a drug. Microbial toxins have severe consequences to the patients even when the toxins are produced in very low amounts. All these consequences increase health care cost of a country due to readmission to hospitals. Therefore the objective of this study was to investigate the contamination of MOs of NSPs. The study was carried in an OPD of a teaching hospital, Sri Lanka. The protocol of the study involved random selection of five drug samples out of bulk opened containers. The bulk containers are kept open for days and they are kept in the room temperature. 10g of each drug sample was collected in aseptic manner and they were transported to the laboratory in sealed packs, which were also sterilized with 70% ethanol. Microbial contaminations of these samples were tested according to the method specified in the BP 2013. A dilution series was prepared using the drug samples. The prepared dilution series was inoculated in the specified media in the BP using spread plate method. The Total Aerobic Microbial Count (TAMC) and Total Yeast Mould Count (TYMC) was taken and checked with the specified limits in BP. According to the BP for Non aqueous preparations for oral use the TAMC should be below 10^3 CFU/g or CFU/ml and TYMC should be below 10^2 CFU/g or CFU/ml and they should be free from *Escherichia coli*. The contaminated microorganisms were identified using microbial identification methods. The results showed that 1/5 (20%) of the tested samples were contaminated with microorganisms and 4/5 (80%) of the samples were free from contamination. The identified microorganisms were *Aspergillus* species, Gram negative Spore forming Bacilli and *Staphylococcus aureus*. Furthermore the total CFU count did not exceed the maximum CFU limit specified in the BP. Therefore it complies with the standards specified in the BP. This is a preliminary study. For the confirmation of whether there is a risk of getting contaminated during the handling and storage procedure, it is necessary to conduct further studies comprising of more sample. Also it is needed to identify the source of contamination.

Keywords*: Microbial contaminations, Non Sterile Pharmaceuticals, Teaching Hospital, Sri Lanka, Total Microbial Count*

KNOWLEDGE AND AWARENESS OF OSTEOPOROSIS AMONG POST- MENOPAUSAL IN-DOOR FEMALE PATIENTS IN TEACHING HOSPITAL, KARAPITIYA

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Osteoporosis and fragility fractures have now been identified as an increasing global health concern with increasing worldwide elderly population, which could result in mortalities and poor quality of life especially in elderly women. Early identification of risk factors and encouragement of preventive practices with regard to osteoporosis in women is thus important. This cross sectional study aimed to assess the awareness, knowledge and preventive measures of osteoporosis among postmenopausal female patients in teaching hospital, Karapitiya, Galle. An interviewer-administered questionnaire was applied among 200 post-menopausal in-door female patients aged above 50years. Data was analyzed by using Microsoft excel and Statistical package for Social Sciences (SPSS). The age range was 50-74 years and 74.5% were housewives from poor socioeconomic background. About 82.5% of the participants had heard of osteoporosis and 32.1% reported it as a bone disease whereas 57% reported it as a curable disease. Around 71% of women did not have knowledge regarding long-term corticosteroid medications as a risk factor for osteoporosis. Only 06% had heard about medications used in osteoporosis but most of them named calcium tablets. 28.5% knew about bone density scan or DXA scan for diagnosis of osteoporosis, whereas 40% did not have any knowledge of any of the available osteoporosis diagnostic tests. The knowledge regarding regular exercise and nutritional factors such as dairy products and green leafy vegetables for osteoporosis prevention was good. The mean knowledge score was 56.6% and television was the main source of information. The knowledge of the women positively correlated with educational level ($r2=0.308$; $p<0.0001$) and economic status ($r2=0.253$; $p<0.001$). The study shows that the knowledge on osteoporosis among post-menopausal female patients regarding risk factors, diagnostic methods and preventive measures has to be further enhanced according to their education level and economic level to improve osteoporosis knowledge for motivating healthy behaviors.

***Keywords**: Knowledge, attitude, osteoporosis, post-menopausal female patients*

KNOWLEDGE, ATTITUDES AND PRACTICES ON PREVENTIVE MEASURES ON DIABETIC FOOT ULCERS AMONG DIABETIC PATIENTS ATTENDING PRIMARY MEDICAL CARE UNIT IN YATIYANA, MATARA

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Diabetes mellitus is a major non-communicable metabolic disorder worldwide. With the sedentary life style, prevalence of diabetes is rapidly increasing. Diabetic foot ulcer is a major chronic complication of diabetes. Although Diabetic foot ulceration is a burning problem on the patient and the healthcare system, there is little attention on it. People are not much aware on foot care practices which can be easily prevented with proper knowledge; proper preventive measure. This research will help to assess knowledge, attitude and practices on preventive measures of foot care among the diabetic patients attending the Primary Medical Care Unit in Yatiyana area. A descriptive cross sectional, study was carried out in Primary medical Care Unit in Yatiyana, Matara. Study sample consisted of 330 patients who suffer from diabetes mellitus for more than 2 years without diabetic foot ulcer. Knowledge, attitude and practices on preventive measures on diabetic foot ulcers were assessed using pretested interviewer administrated questionnaire. Questionnaire consisted of ten questions on knowledge of diabetic foot ulcers, six questions for attitude and eleven questions for the foot care practices. Those who scored 75% and above were considered as good, those with a score 50-75% moderate and those who scored less than 50% considered as poor. The mean age were 66.45±11.92 years with majority being more than 60 years old. Majority of study population (57.3%) were females, married (75.8%) and were unemployed (51.8%). Of 330 participants 197 (59.7%) had moderate level of knowledge; 194 (58.8%) had good attitude; but only 131 (39.7%) of study sample (60.3%) had poor foot care practices. This study has highlighted the gaps in the knowledge; attitude and practice of foot care in Diabetic patients and reveals the need for an educational programme to minimize diabetic foot ulcer related complications in future.

Keywords*: Diabetic foot ulcer, knowledge, attitudes, foot care practices, Diabetic Mellitus*

DEVELOPMENT OF JACKFRUIT (*Artocarpus heterophyllus*) CORE AS A PROCESSED CANNED PRODUCT

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Ready to Eat (RTE) Jackfruit core curry (Abulthial curry) is a new intervention which was prepared and processed by using steam air with the pressure of 15 psi. Eight formulas of jackfruit core curry was prepared according to 'Thaguchi' method, using different piece sizes of jackfruit core, different durations of cooking time as well as different percentages of garlic and *Garcinia Cambodia* with constant level of salt. The prepared jack fruit core curry was stored under ambient temperature (27 - 30°C). The samples were taken off from the canned product at two months intervals to check the desired sensory, textural, chemical, microbiological and physical characteristics of the processed product. The formula composed of large cube sizes of jackfruit core (3x3x2 cm), 18.0% *Garcinia cambodia*, 12.0% of garlic with 05 minutes cooking time was founded as the most acceptable formulation during five months storage time. The hardness of the tender jack fruit was reduced from 475 g to 255g at blanching and 30 - 40g at retort processing due to heat induced softening of tissue. Further significant changes were observed in acidity and total soluble solids during storage. However, the nutritional composition or microbial sterility of the canned product was not changed during 5 months time period.

Keywords: *Jackfruit core, canned product*

KNOWLEDGE ON PRIMARY AND SECONDARY PREVENTION OF LEPTOSPIROSIS AMONG NURSING OFFICERS IN GH HAMBANTOTA

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In Sri Lanka nearly 3000-4000 cases of Leptospirosis are reported each year and the annual death toll is over 100. Knowledge among Nursing Officers (NO's) on preventive measures plays an important role in decreasing death toll. This was conducted to describe knowledge regarding primary and secondary prevention of Leptospirosis and factors associated among NO's in General Hospital Hambantota.
A descriptive cross sectional study was done involving all NO's, work in GH Hambantota. A pretested structured self-administered questionnaire was used. Variables were selected by reviewing text books, curricula of basic training of NO's and obtaining expert comments. List of all NO's was obtained and was used as the sampling frame. Research assistants visited each ward during shift breaks and administered the questionnaires. Knowledge score was developed by allocating two marks for correct answer while no marks were given for incorrect and 'don't know' responses. Twelve was considered as the average level. Then it was compared with selected socio demographic and professional characteristics by applying t test. Certain categories were dichotomized for the convenience of analysis. Ethical approval was obtained from Ethics Review Committee, Ragama. Total number of 231 questionnaires were taken for analysis with non-response rate of 8.7%. Majority (90.5 %) was females and mean age was 33.66 (SD 4.86) years. Study population had a mean work experience of 8.74 (SD 4.84) years and most of them passed out from NTS Galle (39.0 %). Mean knowledge score was 13.28 (SD 2.5). Males (t 4.071, p <0.001), those who were less than 35 years (t 7.294, p <0.001) and who had work experience of less than 10 years (t 3.052, p 0.003) had shown significantly higher level of knowledge. Overall knowledge was at average level. Training program focusing deficient areas of knowledge is warranted for the nursing staff. More attention should be paid on female nurses and those who are above 35 years.

***Keywords**: Leptospirosis, Primary and Secondary prevention, Nursing Officers*

FEEDING PRACTICES OF CHILDREN ADMITTED WITH ACUTE GASTROENTERITIS TO TEACHING HOSPITAL, KARAPITIYA

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Feeding practices during an episode of gastroenteritis is important as proper feeding helps in preventing both short and long term outcomes of a diarrheal illness. Though awareness is done still we see improper practices leading to adverse outcomes. This study was intended to assess the status of feeding practices of children admitted with gastroenteritis to Teaching Hospital, Karapitiya and reasons behind. Study consisted of 2 components; a descriptive cross sectional study to assess the status of feeding practices and a qualitative study (using in depth interviews), to find the reasons behind. A pair of mother and child, which the child is diagnosed to have acute gastroenteritis was considered as a study unit. A pretested interviewer administered questionnaire was used for first component while an interviewer guide was prepared for the interview Items were prepared after a literature search and obtaining opinion from several experts. Feeding practices related to fluid intake, solid diet and breast feeding were separately enumerated.
Altogether 394 mother – baby pairs were included for study In study population mean age for mothers was 31.2 (SD 6.4) years, while majority (38.3%) of babies were below 1 year. It was apparent that most of mothers gave more than routine amount of fluid during diarrhea (91.1%) but for solid foods, it was vice versa (82.7% gave less than normal). A large proportion of mothers refrained from giving fish, meat and eggs while canji and soup was the commonest food given. Majority (92.4%) of mothers acknowledged that they gave oral rehydration solution to the child and majority (96.2%) of mothers continued breast feeding even during diarrhea. Believing that inability of digestion and worsening the diarrhea were the main reasons behind restriction of solid foods. Most of mothers gave adequate fluids during diarrheal episodes but restricted solid foods. Giving ORS and continuing breast feeding was satisfactory. Avoiding solid foods and certain high protein food items were few of the wrong believes.

Keywords*: Feeding practices, Acute Gastroenteritis, Teaching Hospital, Karapitiya*

IRON ANALYSIS IN SELECTED IRON FORTIFIED FOOD PRODUCTS

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Iron deficiency is a major public health problem throughout the world. According to early studies, children, adolescent girls and pregnant women are the vulnerable groups with iron deficiencies. Iron fortification is an effective solution for this problem. As a result, iron fortified foods are widely available in the Sri Lankan market. However the quantification of iron in iron fortified foods available in local market is not under the regulation of the food authorities in Sri Lanka. Therefore, this study intends to quantify the concentration of iron in selected iron fortified foods available in the local market. In this study, five brands of powdered milk (n=15) and three brands of breakfast cereals (n=9) were randomly selected from the local retail shops and supermarkets in Sri Lanka. The concentration levels of iron in these brands of iron fortified powdered milk and breakfast cereals were determined using Atomic Absorption Spectroscopy. According to the results, the mean concentration of iron in the five brands of powdered milk studied was 18.1±9.5 mg/100g and it contributes approximately 52, 27.8 and 23.1 percent for 11-13, 14-18 and 19 years old adolescent girls respectively to the recommended daily allowance (RDA) per serving (23g of powdered milk). The mean concentration of iron in the three brands of breakfast cereals studied was 18.5±8.0mg/100g and it contributes approximately 80.9, 43.2 and 36 percent for 11-13, 14-18 and 19 years old adolescent girls respectively to the RDA per serving (35g of breakfast cereals). Three brands of powdered milk and one brand of breakfast cereal studied have the compatible concentrations of iron with the labeled value. In conclusion, vulnerable populations such as adolescent girls obtain one fourth to half the requirement of iron from the iron fortified food in the local market.

Keywords: *Iron fortified food, recommended daily allowance, Adolescent girls, Iron deficiency*

FACTORS AFFECTING ADHERENCE TO INSULIN THERAPY AMONG PATIENTS WITH TYPE 2 DIABETES MELLITUS IN A TEACHING HOSPITAL, SRI LANKA

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Globally diabetes is a major public health problem. The prevalence of diabetes in Asian countries has been increasing over the past few decades. Life style modification strategies such as diet control and regular exercise are the major considerations of diabetes. When these strategies are unable to control glycemic levels, pharmacological management need to be used. Insulin therapy is an important component of pharmacological management of type 2 diabetes mellitus (T2DM). However, there is limited data available on factors affecting adherence to insulin therapy among patients with T2DM in Sri Lanka. Therefore the aim of this study was to determine factors that affecting adherence to insulin therapy among patients with T2DM in a tertiary care hospital, Sri Lanka. A descriptive cross sectional study was conducted among purposively selected patients with T2DM(n=252). A pretested, interviewer administered questionnaire and eight item Morisky medication adherence scale were used to collect data. Descriptive statistics were used to analyze the data. Ethical approval was obtained from the Ethics Review Committees of Faculty of Medical Sciences, University of Sri Jayawardenapura and Colombo South Teaching Hospital. Findings of this study revealed that majority of the participants (70.6%) were diagnosed with T2DM for 2-15 years. Most of the participants (85.7%) have been taking insulin as their medication treatment for 1-5 years. The overall adherence rate was found to be 107(42.5%). Among adherent participants 68(63.6%) were males and 39 (36.4%) were females. The majority of the participants 89 (83.2%) are aware of complications. Ninety one (85%) participants did not have financial problems to buy medication. In addition, 89(83.2%) participants do not have stress or emotional problems, 35(32.7%) have not physical disability or other chronic diseases, while 66(61.7%) do not think taken insulin at same time every day as a challenge, 76(71%) take meals on time. Adherence to insulin therapy among participants was less due to inadequate knowledge and awareness about the complications. Patients' knowledge regarding diabetes management could improve their medication adherence, therefore, health care providers should provide more effective health education to maintain and enhance their adherence to insulin therapy.

Keywords: *Type 2 diabetes, Glycemic control, Insulin Adherence, factors affecting, Sri Lanka*

EVALUATION OF THE SIZE DISTRIBUTION OF PILLS (*Deshiya Guli*) BASED ON *Vatikāprakaranaya* - A LITERATURE STUDY

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Vatikāprakaranaya is the most famous text book among traditional medical practitioners in Sri Lanka for their pharmaceutical preparations which are mostly having native formulas. Various types of pills (*Guli*) and pastes *(Kalka*) are mentioned in this text. They were prepared according to the methods prescribed differently for each formula. The size of the pill is an important part of the traditional medicine and it varies according to the ingredients in the formula while the number of pills prescribed for a dosage is depending on the condition of the disease. This study was carried out to evaluate the size distribution of the pills mentioned in *Vatikāprakaranaya* and demonstrated the singularities of the pills. The primary source used for this study is *Vatikāprakaranaya* published in 1948 which describes 309 pills (*Guli*), 23 pastes (*Kalka*) and 1 powder (*choorna*) with 5293 verses. 309 preparations of pills were reviewed out of the total number (333) of preparations in *Vatikāprakaranaya.* Out of the total number of reviewed preparations include 35 different sizes of pills as *mun eta*, *Imbhul eta*, *gammiris eta*, *Olinda eta* among which the most used size is *mun eta* that had been applied in 88 preparations. Size of *Imbhul eta* was mentioned in 83 formulas, *Gammiris eta* was mentioned in 43 formulas and 19 pill sizes were exclusive. Size of pearl *(Muthu)* also had been used as a size of pill other than seeds of herbs. In some preparations different size of pills had been prepared from one formula. The highest number of sizes used in one formula is 07 as recorded in *Jēwaka ankusha Guliya* and second highest (3) is in three formulas named as *Ranahansa raja guliya*, *Kola ashtangaya* and *Maha kola ashtangaya* while the third highest (2) is in five preparations. Some pills were divided into the normal dosage (*pathya pangu*) and purgative dosage *(vireka pangu)* respectively as recorded in 17 preparations. The pills preparations found in popular indigenous medical literature as in *Vatikāprakaranaya* are diversified in size that can be used for multi-ailments and potential research area to be disclosed in future.

Keywords*: Size distribution, Vatikāprakaranaya, Deshiya Guli*

KNOWLEDGE AND PRACTICE REGARDING COAGULATION STUDIES AMONG NURSING OFFICERS IN TWO TEACHING HOSPITALS AND A BASE HOSPITAL

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This was a descriptive cross sectional study in assessing knowledge among a randomly selected sample of 343 research participants and practice regarding coagulation studies assessed in 128 research participants. Research participants had completed their nursing education in 15 different nursing institutions. 77.3% participants knew the correct anticoagulant (Sodium Citrate) used in coagulation studies. Only 21.3% (n-73) knew tourniquet can only be applied for less than one minute.56% participants (n-192) knew correct ratio between Blood and Anticoagulant. Correct gauge of a needle for coagulation studies are 21 and 22, only 36.4% answered as 21 Gauge and 21.3% answered as 22 gauge. Only 105 participants (30.6%) know that anticoagulant volume should change according to the pack cell volume. 87.2% said that blood shouldn't be taken from the indwelling lines for coagulation studies. Observational check list was filled by observing collection of 128 samples. Only 82.8% samples had correct volume. Other samples were under filled or overfilled with blood. All the samples (n-128) were collected into INR tubes. 35.2% time participants applied tourniquet for more than 1 minute. There was a correlation between knowledge level and the nursing institution of the participants. Correlation is significant at the 0.01 level. There was no significant correlation between knowledge level of coagulation studies with level of nursing education. There was a correlation between total work experience and knowledge level of coagulation studies. Correlation is significant at the 0.05 level (2-tailed). There was a relationship between ICU setup and sample taken from IV lines/heparinized lines although the majority in the study population was aware of the coagulation studies, the results indicate lack of knowledge and good practices on this subject. Special thing identified was there was no significant relationship between practice for coagulation studies with work experience and practice for coagulation studies with nursing education.

Keywords*: Coagulation, Anticoagulant, Nursing, Blood, Samples*

VITAMIN D STATUS OF A COHORT OF BREAST FEEDING MOTHERS AND THEIR OFFSPRING IN SRI LANKA- A PRELIMINARY STUDY

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Studies conducted in Southeast Asian region have shown that vitamin D deficiency is seen among all age groups. Vitamin D deficiency exists especially among breast feeding mothers due to increased requirement. This is true for even in regions with abundant sunlight. However, to the best of our knowledge there is no evidence showing vitamin D status of breast feeding mothers and their offspring in Sri Lanka. Thus, aim of this study was to assess adequacy of vitamin D among a selected population of breast feeding mothers and their infants. Mothers who are attending well baby clinic of Colombo South Teaching Hospital (CSTH) were recruited. Although they have been prescribed 300 mg of calcium lactate throughout pregnancy and breastfeeding 3% haven't complied. Blood samples were collected from mothers and newborn babies at one month of age for Vitamin 25(OH)D, calcium, phosphate and alkaline phosphatase (ALP). Data were analyzed using SPSS version 15., Majority (98.7%) of infants were exclusively breast fed. Mean±SD vitamin D, calcium, phosphate and ALP of mothers were 19.7±7.0 ng/mL, 2.2±0.1mmol/l, 1.3±0.2 mmol/l and 121.5±26.9 IU/L respectively. Mean±SD vitamin D, calcium, phosphate and ALP of infants were 11.0±5.3 ng/mL, 2.5±0.1 mmol/L, 2.1±0.2 mmol/L and 411.5±109.8 IU/L respectively. Vitamin D deficiency (<20ng/mL) among mothers and infants were 68% and 89.3% respectively. Only 8% of mothers and none of the infants had sufficient level (>30 ng/mL) of Vitamin D. However, corrected calcium levels were within the normal range in both mothers and babies. Deficient mothers had significantly higher proportion of deficient infants (p=0.019). In conclusion, high levels of vitamin D deficiency were found among breast feeding mothers and infants. Maternal deficiency increases risk of neonatal vitamin D deficiency. This study suggests that supplementation of mothers and infants with vitamin D are important.

***Keywords**: breast feeding, infants, vitamin D deficiency*

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PERCEIVED STRESS AMONG FIRST YEAR NURSING STUDENTS AT NURSES TRAINING SCHOOL, HAMBANTOTA

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Basic training of medical professions makes an enormous stress. In comparing with most of other diploma courses, the diploma of nursing has high degree of demand for skills and knowledge, which invariably put students at greater stress. Therefore measuring stress among nurses is important because their well-being has implications for stability in the healthcare work. This study was done to evaluate the perceived stress among nursing students at Nurses Training School, Hambantota.
Descriptive cross sectional study was done at Nurses Training School (NTS), Hambantota. All first year nursing students were included. The Perceived Stress Scale (PSS), a well-recognized tool to assess the perception of stress was used. Opinion from local experts was obtained to ensure appropriateness of certain items to the particular setting. List of names of first year students currently in the NTS were obtained and used as sampling frame. Students were reached during lunch break and questionnaires were distributed without interrupting routine studies. Descriptive statistics were calculated and appropriate significant tests were done to determine association with the use of SPSS. Ethical approval was sought from Ethics Review Committee, Ragama. The overall response rate was 85.7% (187 out of 218 students). There were more females in the study sample (n = 168, 89.8%) and mean age was 22.5 (SD 0.6) years. All participants were Sinhalese and Buddhists. Among all students, 178 (95.2%) followed biology for Advanced Level examination. The overall score was computed by adding marks allocated for each response. A total score of 20 or above was considered as having perceived stress. Mean score was 21.7 (SD 4.6). Out of all, 131 (70.1%) were in 20 or above range which is regarded as the stressed state. Perceived stress was significantly higher among male students ($p = < 0.001$) and those who were younger in the batch ($p = <0.002$). Stress relieving programs should be designed and implemented to all first year Nursing Students.

Keywords*: Perceived Stress, Nursing Students, Hambantota*

IMPACT OF HEAT TREATING SESAME OIL UPON ITS COLOUR AND FREE FATTY ACID CONTENT

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Changes in colour and free fatty acid (FFA) content of crude and clear sesame oils upon heat treatment were investigated in this study. Crude sesame oil contained fine sediments. Gravity settling of sediments provided clear oil. Crude and clear oil samples were oven heated at two levels of temperatures (120^{o}C and 200^{o}C) and at two levels of heating durations (1 h and 4 h) in a 3-factor, 2-level full factorial design of experiment. Heat treated samples were cooled and centrifuged at 3500 rpm for 10 min. Colour was measured in a CIE L*a*b* scale using a UV-Vis Spectrophotometer. FFA was quantified using Sri Lankan Standard method 313/2.6:2009. FFA of clear oil did not undergo significant changes when heated for 1 h at 120^{o}C. Heating the clear oil for 4 h or at 200^{o}C and heating the crude oil at 120^{o}C induced similar but restraint increment in FFA. FFA of crude oil increased significantly when heated at 200^{o}C even for 1 h. L* colour index, measuring darkness (0) to lightness (100), decreased indicating the shift of oil colour towards darker shades with increasing heating temperature and duration. Observed changes in L* of crude oil, as in case of FFA, were significant, indicating the influence of sediments upon the colour and FFA of heated oil. A linear regression relationship between FFA and L* with normally distributed residuals was observed (R^2= 69%). The said resistance to changes in colour and FFA of sesame oil during moderate heating may be attributed to the presence of its inherent antioxidants (sesamin and γ-tocopherol) and to the formation of sesamol, a potent antioxidant, during moderate heat treatment of sesame oil. Prolonged heat treatment at elevated temperatures is known to destroy the antioxidants. Sesame oil is therefore recommended for application involving moderate heating of oil.

Keywords*: Colour, FFA, Heating, Sesame oil, Temperature*

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IDENTIFYING CHARACTERISTICS OF ELDERLY PATIENTS THROUGH A SCREENING TOOL FOR POST DISCHARGE PLAN AND FOLLOW-UP CARE (PDP&FC): A PILOT STUDY

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Post Discharge Plan and Follow-up Care (PDP&FC) are recognized practices in most developed countries. However, this practice is not available in Sri Lanka. Main objective of this study is to assess the characteristics of elderly patients through a screening tool for Post Discharge Plan and Follow-up Care (PDP&FC). A literature review was done to obtain research tools/instruments published on elderly patients, their characteristics and health seeking behavior. A screening tool was developed by reviewing the main characteristics which are to be useful in Sri Lankan context. Ethical approval was obtained from the Ethics Review Committee of Colombo South Teaching Hospital (CSTH). For the pilot study, a convenient sample of 12 participants was selected from CSTH. The sample represents all categories of patients those who admitted during the month of June 2017. The sample consisted of elderly patients (age range; 60-88 years, male/female; 1:1) who were having co-morbid conditions and on multiple medications. Most of them (10, 83.33%) follow government hospital clinics. Majority of patients, who live with either their spouse or children (7, 58.33%) or with children (4, 33.33%), and did not have a particular direct source of income (5, 41.66%). Perception of their 'family role' was also low. The highest education level was up to grade ten (7, 58.33%) and most of them were not employed (7, 58.33%). The major type of admission was 'emergency' (unplanned) with sudden onset of symptoms (10, 83.33%). However, frequency of hospital admissions during previous six months was low (5, 41.66%). With regard to their physical activities, most of them (8, 66.66%) need some kind of assistance to maintain their activities of daily living. Awareness and utilizing available social support systems were in moderate level. Almost all were remarkably involved in spiritual and religious activities (12,100%). The mass media was the remarkable means of obtaining spiritual support among participants (9, 75%). In conclusion, the screening tool developed was able to capture characteristics of elderly patients those who are ready for Post Discharge Plan and follow-up care (PDP&FC).

***Keywords**: Post Discharge Plan and Follow-up Care (PDP&FC), Elderly Patients, Sri Lanka*

NURSES WORKPLACE SATISFACTION AND ASSOCIATED FACTORS AMONG NURSING OFFICERS IN SELECTED DIVISIONAL HOSPITALS TYPE 'B' AND TYPE 'C' IN COLOMBO DISTRICT

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Nurses are one main category of healthcare professionals which directly interact with patients. Nurses are employed in all types of hospitals in Sri Lanka and especially their role is very important in Type B and C hospitals in which facilities are very poor. Studies done in other countries have shown that nurses' level of satisfaction has a major impact on the service quality and certain studies indicated that the perceptional distribution on Nurses Workplace Satisfaction (NWS) are varying with the type of hospital. Studies done in Sri Lanka were limited to National and General hospitals only. No study was reported in Type B and C Divisional Hospitals in Sri Lanka. Therefore, this study was conducted to analyze NWS and associated factors in Type B and C Divisional Hospitals in Colombo District. A descriptive cross-sectional survey was conducted using a self-administered questionnaire which was developed and piloted by the main researcher. After taking the ethical clearance, the questionnaire was administered among 146 nursing officers in selected divisional hospitals during March to April 2017. The response rate was (82%). Results show that majority of respondents (92, 76%) are of the view that their level of workplace satisfaction is good. Another (27, 22%) had moderate perception and only (2, 1.7%) respondents indicated poor perception on the workplace satisfaction. Moreover, a significant relationship with NWS were identified among number of dependents of the respondents' families, patient care equipment availability, safety of the patients and professional valuation ($P=0.000<0.05$). This study has shown that the overall perception on NWS is 'good' among the nurses in Type 'B' and 'C' Divisional Hospitals, although previous studies done at National and General levels of hospitals in Sri Lanka, rated it as 'not satisfactory'. This warrants a large scale of study that includes all categories of nurses when assessing perception in workplace satisfaction of nursing profession in Sri Lanka.

***Keywords**: Nursing, Workplace Satisfaction, Hospitals in Sri Lanka. Divisional Hospitals*

TECHNICAL SESSIONS

ON

HUMANITIES & SOCIAL SCIENCES

A SOCIOLOGICAL STUDY ON SATISFACTION OF FACILITIES PROVIDED BY THE GOVERNMENT FOR NEWLY RELOCATED PEOPLE IN JAFFNA DISTRICT

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In 2009, soon after the completion of the war, the government commenced resettlement programs to resettle the liberated people to the Northern and Eastern Provinces. Approximately 33,570 families were resettled in the Jaffna district. They were treated with dignity and respect, providing all basic needs along with humanitarian assistance including facilities and services. The facilities which they were provided, determine their quality of life where; quality of life is based on their perceptions, feelings or attitudes towards life. Based on this, the research focuses to understand the degree of satisfaction by these families in comparison with the services provided by the government. Twenty four items consisting of seven items on satisfaction of personal life domains and seventeen societal conditions were measured to achieve the objective. Satisfaction of home, job, salary, relations, friends, spouse and children were taken as personal domains. Transport, nature, telephone, library, health facilities, public schools, religious places, drinking water, air, electricity were included to the societal conditions. All items were rated on one to five point Likert type scales. Thirty families were purposively selected as study population of residents in Jaffna AGA Division. Research findings revealed that 50% of families were satisfied with their present home and 90% of families were satisfied with their job and salary. A significant 80% of selected families were very satisfied with their friends than relatives. 65% of families were very satisfied with drinking water, air, electricity, transport, health facilities, public schools, religious places, nature and telephone facilities which they utilize during their day to day life and that is more than 50% of the population. Further, 30% are satisfied with streets and roads, government programmes, internet, settlement area and land. Finally based on the research findings, the government provided facilities and services for the resettled people are at a satisfactory level and it has improved their quality of life.

***Key Words**: Quality of life, Satisfaction, Resettle, Facilities*

THE RELATIONSHIP BETWEEN STRATIGRAPHIC PATTERNS AND PALAEOCLIMATE CHANGE IN THE KALU GANGA (RIVER) BASIN IN SRI LANKA

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Quaternary sediments of Sri Lanka are distributed in river valleys as valley-filled deposits and floodplain deposits. The characteristics of this sediment, help reconstruct the past environmental conditions of the study region. The dominant mode of sediment transport deposition as well as the composition and stratigraphy reflect the prevailing environmental conditions. The past studies, although few in number, shed some light on the environmental change during the Quaternary period of Sri Lanka. The alluvial deposits bear evidence of past environmental conditions that prevailed in this region. Some past studies have shown that Sri Lanka experienced dry and wet phases in the climate in association with the glacial and inter-glacial periods respectively. These climatic events would have affected the sedimentation processes in the wet zone of Sri Lanka. The wet conditions were associated with the strong monsoonal circulation with higher rainfall, while dry periods with weakened monsoon conditions. These changes would have left their mark on the sedimentary record of the island, particularly the wet zone. The selected study area, the Kalu Ganga basin is famous for gem gravel and has a long history of gem mining. Gems are found in fluvial deposits as well as colluvium and material transported by mass movement from the upper catchment slope areas. The gravelly river bed loads are deposited in the river channel and in point bars as a single layer or as multiple layers where the river has undergone aggradation. The gem gravel is often overlain by finer sediment deposited by local streams. Gem mines provide a valuable opportunity to examine the stratigraphy and other environment characteristics of the fluvial sediments in this area and help identify environmental indicators such as erosion and weathering. The stratigraphic characteristics of the sediment of the upper, middle and lower regions of the Kalu Ganga basin were sampled and field observations were made. Research results brought out with important findings in relation to the stratigraphy of many sediments layers in the Kalu Ganga river basin. There is a spatial variation in the number and the depth of gem bearing sediment layers in the Kalu Ganga basin. Since the lake sediment layers are found in the lower catchment, it is assumed that there was paleoclimate changed in the Quaternary period.

Keywords*: Sediment layer, Deposition, Kalu Ganga, Stratigraphy, paleoclimate change*

GIS APPLICATIONS FOR RESIDENTIAL SUITABILITY: A CASE STUDY IN KANDY MC

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The process of urbanization is a universal phenomenon taking place the world over. Such growth of urban population and economic activities causes a rapidly increasing pressure on the land. Growth of human settlements, both around existing cities and within rural areas, is a major driving force of land use and land cover change. It is therefore imperative that suitable land for residential use has to be identified to maximize space utilization and limit environmental degradation. As the second largest city and one of the world heritage cities in Sri Lanka, Kandy city has developed as a compact city by attracting more urban activities. Therefore, it is very important to guide this growth with finding most suitable locations for residential development. In this respect, Geographic Information Systems (GIS) provide a tool in integrating and analyzing of land resources to determine the suitability for a land use or several land uses. The study objective was developing a GIS model for assessing land suitability for residential development in Kandy Municipal Council (MC). In the study four steps were utilized as selecting criteria, site screening, Analytic Hierarchy Process evaluation and site evaluation. The study focused on major criteria as land use, slope, elevation, land slide areas, distance to road and distance to existing town centers and environment. A questionnaire survey was done for weighting the criteria. GIS overlay process was utilized to combine the factors and to develop final suitability map. The resulted map shown that 46% (596 ha) are highly suitable for residential development and 22% (284 ha) are suitable and 32% least suitable and not suitable for residential development. According to comparison of resulted map with Urban Development Authority zoning map 84% proposed development areas located on highly suitable and suitable land while 16% of the proposed development areas are located on either least suitable or not suitable land. The integration of GIS and Analytic Hierarchy Process has been found to be effective in selecting the residential sites within the Kandy MC. Moreover this method can be applied for in other urban areas as an advance decision supportive tool in urban and regional planning.

Keywords: *Kandy, Urbanization, Geographic Information Systems, Analytic Hierarchy Process, Suitability*

සීගිරි ජල උද්‍යානයේ උතුරු කොටසේ ජලමල් යථාවත් කිරීමේ පර්යේෂණ කැණීම

බුද්ධිකසිරි පී.ආර්.ඒ*

සමාජීය විද්‍යා පීඨ පර්යේෂණ අංශය, සමාජීය විද්‍යා පීඨය, කැලණිය විශ්වවිද්‍යාලය
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සීගිරිය පුරාවිද්‍යා සංකීර්ණයේ ඇති අංගයන්ගෙන් සුවිශේෂි අවධානයකින් සහ උද්යෝගයකින් අධ්‍යයනය කරනු ලබන ක්ෂේත්‍රයක් වනුයේ මෙහි ඇති සංකීර්ණ ජල තාක්ෂණික පද්ධතියයි. එය ඉතා සූක්ෂම හා සරළ න්‍යායානුකූලවය, එනම් පීඩනය සහ ගුරුත්වය සැලකිල්ලට ගනිමින් හැඩගස්වා ඇති මෙම ජල පද්ධතිය පස්වන සියවසේ ශ්‍රී ලංකාවේ පැවති ජල කළමනාකරණ තාක්ෂණයේ හා වාස්තු විද්‍යාවේ ඥණයේ උපරිම ඵලය ලෙස සැලකේ. සීගිරිය නරඹන්නෙකුට ඒ පිළිබඳ සිහිපත් කළ පමණින් මතකයට නැගෙන්නේ සිතුවම්, ගල මුදුනේ පවතින මාළිගාව හා ජල මල් පද්ධතිය වේ. මෙවැනි වැදගත් අවධානයක් යොමුවන ජලමල් පද්ධතියේ ක්‍රියාකාරිත්වය මෑත වසර කිහිපයක සිට ක්‍රමයෙන් හීන වී යාම ආරම්භ වී තිබුණි. ඒ අනුව මේ පිළිබඳ අවධානය යොමු කොට එහි පැවති සංකීර්ණ ක්‍රියාකාරිත්වය හඳුනාගැනීමට උත්සහා කළ අතර අනතුරුව කලින් පැවති ක්‍රියාකාරිත්වය දුර්වල වීමට බලපා ඇති හේතූන් මොනවා ද යන්න පිළිබඳ පරීක්ෂා කරන ලදී. ඒ අනුව ජලමල් පද්ධතියේ සක්‍රීයව පවතින්නේ වැසි කාලයේ දී ය. එයට හේතු වී ඇත්තේ සෙසු කාල වලදී ප්‍රමාණවත් වැසි නොලැබීමත් සහ ජලනල මාර්ග පද්ධතිවල ඇති අවහිරතාවයයි. ඒ අනුව ජල උද්‍යානයේ උතුරු කොටසේ ජල මල්වල ක්‍රියාකාරිත්වය යථාතත්ත්වයට පත් කිරීමේ අරමුණෙන් 2016 වර්ෂයේ ජනවාරි මස පර්යේෂණ කැණීමක් ආරම්භ කළ අතර එය $භ_{1}ඵ_{15}$ හා $භ_{1}ඵ_{16}$ යනුවෙන් නම් කරනු ලැබේ. එහි දී කොටුදැල් ක්‍රමවේදය ඔස්සේ ජලමල් උද්‍යානයේ උතුරු කොටසේ කැණීම් කටයුතු සිදු කළ අතර මෙහි දී ජලමල් කරා ජලය සපයන කාණු හඳුනාගත් අතර එම එම ජලකාණු පද්ධතිය තුළ රොන්මඩ සහ වෙනත් අපද්‍රව්‍ය බහුල වශයෙන් එක්රොක් වී පැවතිනි. මේ හේතුවෙන් උතුරු කොටසේ ජලමල් සඳහා ප්‍රමාණවත් ජල ධාරිතාවක් නොලැබීම නිසා ජලමල් වල ක්‍රියාකාරිත්වය අඩපණ වීමට හේතු වී ඇති අතර එම නිසා සිරවී ඇති රොන්මඩ ආදිය ඉවත් කොට ජල කාණු පිරිසිදු කරනු ලැබීය. මෙහි දී උතුරු ජලමල් සඳහා ජලය සපයන ප්‍රධාන ජලමාර්ග පද්ධති තුනක් කැණීම් කිරීමේ දී හඳුනාගනු ලැබූ අතර එහිදී ප්‍රධාන ජල කාණු උතුරු සීතල මාලිගය හරහා ද අනිත් ජල කාණු දෙක පර්වත ප්‍රදේශයෙන් සහ දකුණු ජලමල් ප්‍රදේශයේ සිට පැමිණේ. මෙසේ ජල කාණු ඔස්සේ පැමිණෙන ජලය ප්‍රධාන ජල බිත්ති දෙක ඔස්සේ උතුරු ජලමල් සඳහා ගමන් කරනු ලැබේ. මෙහිදී මෙම ජලකාණු එකිනෙක කැණීම් කොට රොන්මඩ ඉවත් කොට එම ජලමල් යථාතත්ත්වයට පත්කරනු ලැබේ.

ප්‍රමුඛ පද : *ජල උද්‍යාන තාක්ෂණය, ජලමල්, ජල කාණු, සීගිරිය*

IMPACT OF FLIPPED INSTRUCTION ON LEARNING ESL GRAMMAR

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This paper reports an experimental study on flipping in a university-level English as a Second Language (ESL) classroom in Sri Lanka. Flipping that is being widely experimented with, mainly in teaching science, technology, engineering, and mathematics (STEM), is a pedagogical model in which traditional in-class instruction is replaced with pre-recorded lectures, which the students watch in advance. Therefore, class-time is mainly utilized not for presenting the syllabus contents but for interactive activities promoting higher order cognitive skills such as application, analysis, synthesis and evaluation. However, despite its widespread popularity in STEM classrooms, only a little is known as to how flipping can be effectively used in a second language classroom. Thus, the goal of this study was to investigate whether flipping could have an impact on students' learning of grammar of the target language. The experiment in this concern was conducted with 50 first year undergraduates who acted in two equal groups as experimental and control. The experimental group was coached under flipping and the control group was not. A comparison of their pre-test and post-test scores and qualitative data from a post-class survey and focus group discussions show that flipping creates a positive impact on students' performance in the target language and their motivation. While presenting the results, the authors will also discuss the challenges generally encountered in flipping and the possibilities of extending the method to teach non-STEM disciplines.

Key words*: flipping, ESL, motivation, collaborative learning, grammar component*

A MATTER OF LIFE AND DEATH; ROAD TRAFFIC ACCIDENTS IN SRI LANKA

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Road traffic accidents have reached an alarming level in Sri Lanka. Thousands of people died and become disabling due to this terrible road traffic accident annually. This study was conducted among 30 victims who met with accidents in 2016 to explore the contributory factors and reasons behind the road traffic accidents and to exemplify the diverse effects of road traffic accidents in the Akkaraipattu Divisional Secretariat division of Ampara district. Primary data were collected using interviews, observations and case studies. Secondary data were gained through records, journals, articles, annual reports and websites. Collected data were analyzed using qualitative and quantitative methods and presented in a descriptive manner. This study revealed that road users are the main cause of road traffic accidents. Especially driver impairment is the main contributory factor for these accidents. The study found that violation of traffic rules is the most prominent reason (22%) and driving while being sleepy and fatigue is the least contributory reason (8%) for the road traffic accidents. Other reasons are driving at excessive speeds, not wearing helmets, disrespect of the road rules and regulation, driving under the influence of alcohol and other drugs, and failure to perceive traffic situation. According to the study, negative consequences of road traffic accidents can be classified into three broad categories as physical, financial and psychological effects. People who got major injuries suffer a lot physically and experience difficulties in performing day-to-day activities and most of them are still not fully recovered from their physical impairments. Road accidents create enormous economic hardship due to the loss of family breadwinners. It creates severe financial burden including cost of hospitalisation, long-term care, material damage and production losses. Some of the psychological effects of road traffic accident victims are anxiety and depression. Further, they feel guilty, fear, nervousness, sleepless, angry and irritation. Every life of human beings is precious to the family members and society. Road safety programmes, good policies and planned interventions which include better understanding of the social impacts of road-related deaths and injuries are important to predict and prevent these terrible road traffic accidents in Sri Lanka.

Keywords: *Accidents, Deaths, Injuries, Road*

NEW DEVELOPMENT OF SOCIAL CHANGES IN SEXUAL DIVISION OF ESTATE LABORS Special REFERENCE TO PUSELLA ESTATE OF KURUWITTA – RATHNAPURA DISTRICT

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There have been many gender role regarding the society of the traditional men and women. With the Social, Economic and Political conversions took place, this has affected the gender role of the estate workers. Currently the division of labor has been somewhat complicated in this concept of the gender role. So as there's a great need of analyzing the same to examine the needs, we hope that this research will help us succeed in doing the same. At present, the concept of the gender of men and women has being growing rapidly. Sexuality of men and women which they have inherited biologically is being changed due to the long term changes which have been taken place in this society. The society itself has altered each men and women's attitudes, identity, gender roles and occupation. There are also differences in the work industry when it comes to differentiating work between men and women. This research is based on Emile Durkheim's division of labour theory. He argued that the division of labour was resulted of higher evolution and believed that it magnified the natural biological differences between men and women, such as women being more emotionally affective and men more intellectual. The major objective of this study is to put more effort in to widening the political views of the socialized , division of labor changes took place after 1977 due to the globalization, privatization and open economy changes in Sri Lanka. The study is based on data collected from the Pusella estate of kuruwita - Rathnapura district. 40 peoples were selected as respondents using the snowball method based on their sex, ethnicity and employment. The study reveals that Majority are involved in self-employment and private jobs. Mainly Education and family background of employees' mindset has been a major reason in choosing jobs. According to the findings compared from 2013 to 2015 there was a decreased of the labour force in Pussella estate. But in 2013 compare to men and women employed to the labour force was high and it was 54.8%. In 2014 it was 58.9% and 2015 it has risen up to 62.9%. Considering the employment percentage of the men's in 2013 it was 45.2%. In 2014, it was 41.1% and in 2015 it was decreased to the 37.4%. There were many reasons like low wage, changes of traditional men's duties were caused to new development of social changes of sexual division of labor among this estate labors. There are second generation labors that don't want to do labor jobs like their families too. In the estates, compared to the percentage of the men's working the percentage of the women has gone up comparatively. Free education and social transformation have changed the situation in Pusallawa estate in a positive way and many of them were get opportunities to engage other kind of jobs out of the estate. There has been a

change of roles in families as women too, have started doing the work load that once was for men to do, and because of that, the head role of the family have been swapped or become equal. Finally, men and women have gone through a massive process of change, due to sexual division of labor. Through this research, it was cleared that this has caused a remarkable turn on the lives of the estate families.

***Keywords**: Estate Labors, Sexual Division of Labor, Social Change, Globalization, Gender Role*

CAN A JUDICIAL MEDIAL OFFICER (JMO) BE SATISFIED WITH THE WORK HE PERFORMS PERTAINING TO HOMICIDES?

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Judicial medical officers are called upon to perform judicial post mortem examinations on cases of suspected homicide. At times the alleged assailant/s is/are also examined by the JMO. Visiting the scene, collection of trace materials, obtaining photographs, identification of the body, obtaining a relevant history and finally performing the judicial autopsy are a few straight forward medico-legal duties of a JMO. The JMO's prime responsibility usually ends at giving expert evidence in a court of law pertaining to the homicide. JMOs also tend to gather information regarding the proximate cause for the perpetrator's violent behaviour and other contributory factors for the incidence. This history taking is often very superficial and the JMOs usually prefer to rely upon the story brought up by the police. With the following illustrations, the authors wish to discuss the mere causes for homicides disclosed by the relatives during the investigations. Yet, the authors also emphasize the importance of having a deeper understanding of the multiple causes and risk factors for homicidal acts in general.

Case 1: A 65 year old retired teacher was found dead in her bathroom. The police opined that she might have fallen accidentally or as a result of a natural illness. The postmortem examination though commenced as an accidental or natural death, demonstrated injuries around the neck, proving the homicidal nature of the event.

Case 2: A heavy alcoholic who was also a cannabis addict was murdered by a manual labourer working in a nearby quarry.

Case 3: A middle-aged male suffering from morbid jealousy and paranoid personality disorder killed his de-facto partner.

The cause of death and other medico-legal issues were able to be sorted out by conducting a post mortem examination in above three cases. Yet, the authors feel that there is a lacuna of understanding as to the investigation of the social, psychological and emotional aspects of the assailants and family members who are involved with homicides. This emphasizes the need for "psychological autopsy" and a deeper understanding of criminal psychology for prevention of such incidences in future, in addition to the established criminal justice system in the country.

Keywords: *homicides, violence, psychological autopsy, personal development, JMO*

APPROACH OF HINDI POETRIES FOR A SUSTAINABLE LIFE STYLE TOWARDS THE LASTING HAPPINESS WITH SPECIAL REFERENCE TO THE *SADVÅTTA* IN AYURVEDA

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Ayurveda is an ancient Indian medical system that guides human in maintaining a healthy mind and body. It has been described good conducts or ethical regimens for a balanced state of life as *Sadvåtta*. If one follows these rules and regulations, it leads to a long and healthy life as well as wealth. Poetries are literary works in which special intensity is given to the expression of feelings and ideas by the use of distinctive style and rhythm. With the civilization of Indian culture since ancient era, Hindi poets adopted ethical regimens as topics for their poetries and gave a message to maintain a sustainable life. The objective of this literary study was to analyze the Hindi poetries that emphasize the ethical regimens and compare with *Sadvåtta* mentioned in Ayurveda. Hindi poetries were taken for the study and compared the information with *Sadvåtta* mentioned in Ayurveda *Våddhatrai*.According to the information obtained from study, Hindi poetries related to medieval period (1375 – 1700 Century) and modern period (1900 Century – up to date) have been emphasized ethical regimens which are supporting for a sustainable life style towards the lasting happiness. When they compared with the *Sadvåtta* in Ayurveda, they are mentioned under *Vyavahārika* (Habitual), *Mānasika* (Mental), *Sāmājika* (Social), *Dhārmika* (Moral) and *Vaiyaktika* (Personal) categories of *Sadvåtta* since Vedic era. Ayurveda stands to protect the health of a healthy person as well as cure diseases and India as the originated place of Ayurveda, it is bonded with Indians. Poetries can speak to a person's mind smoothly. Hence, it might be the Hindi poets in medieval and modern periods wielded the ethical regimens mentioned in Ayurveda as their topics and given to the society for the betterment of sustainable life style towards the lasting happiness.

***Keywords**: Hindi, Poetries, Ayurveda, Sadvåtta, Life*

TYPES OF BORROWINGS FOLLOWED IN UDAYA PRASANTA MEDDEGAMA'S ENGLISH TRANSLATION OF GURUḶUGOMI'S AMĀVATURA

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Borrowing, the direct transfer of a source language term into the target language without any modification, is a commonplace translation procedure which is preferred in overcoming a metalinguistic lacuna and in introducing the colour and the flavour of the source culture into a target text. The aim of this study has been to identify the types of borrowings followed by Udaya Prasanta Meddegama in his English translation of Guruḷugomi's Amāvatura. Data were collected through a comparison carried out between the source text and the target text, namely Kodagoda Gnāṇāloka Thero's edition of Guruḷugomi's 'Amāvatura' and Udaya Prasanta Meddegama's 'Amāvatura: The Flood of Nectar', respectively. Target terms which have been designed by the direct transfer of elements were identified and were categorised according to their formation patterns. Accordingly, the types of borrowings identified are regular borrowing (loanword), annotated borrowing, converted borrowing, and loanblend. Among them, annotated borrowing is a complex procedure which consists of two sub-procedures namely footnotes and text embedded annotations. Text embedded annotations are also two-fold, namely bracketed annotations and sentence embedded annotations. Further, it was observed that a constructive admixture of these different procedures has been followed by the translator, the aim being maintaining balance between the flavour of the source culture and the extent of comprehension of the target readers. As a result of following the said procedures of borrowing frequently, a considerable amount of new target language terms have been designed and added to the target text, when representing concepts not native to its culture. In this respect, 'Amāvatura: The Flood of Nectar' qualifies to be called a linguistically creative translation.

Key words: *borrowing, direct transfer, extent of comprehension, linguistically creative translation, source culture*

A STUDY ON THE CHARACTERISTICS OF SRI LANKAN ARTS GRADUATES EMPLOYED IN THE PRIVATE SECTOR

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One of the major challenges that the Sri Lankan government faces is creating a large number of employment opportunities in the public sector for university graduates. After receiving a free tertiary level education, most of the graduates feel that it is the obligation of the government to find public sector employment for them. Even though this expectation is quite high among Arts graduates, there are few who prefer employment in the private sector. The objective of this study is to identify the characteristics of Arts graduates who prefer the private sector over the public sector for employment. This study was based on a survey that was conducted in year 2016 on a random sample of Arts graduates from Sri Lankan universities who had graduated in 2012 to identify the changes in their employment over time. Among the 469 graduates who responded, 12% (56) of them indicated that their first employment was in the private sector. This paper focuses on these graduates who were employed in the private sector. The results show that the majority (70%, 39) of them had moved to the public sector, while only 23 % (13) of them had remained in the private sector during the study period (2012 to 2016). When comparing these two groups it can be seen that gender, civil status, parent's highest education, English literacy skills are the main characteristics that differentiate them. The study also reveals differences in certain aspects of their first employment, the ones who opted the public sector and the others. These aspects were the Economic benefits of employment, job satisfaction and the retirement benefits they had received in their first job. As a solution to reduce this high demand for public sector jobs by Arts graduates, the authorities could focus on enhancing the student's English literacy skills, conducting awareness workshops that provide knowledge about employment opportunities in the private sector and also showcasing the benefits of private sector over public sector employment at the beginning of the university life can bring about a change in attitudes among Arts graduates in general.

Keywords: *Arts Graduates, Private Sector employment, Public Sector employment, Higher education, Employability*

SPATIAL DETERMINANTS OF POVERTY IN RURAL SETTLEMENTS IN SRI LANKA (WITH SPECIAL REFERENCE TO GALIGAMUWA DIVISIONAL SECRETARIAT DIVISION)

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As a developing country Sri Lanka always suffers from numerous social and economic problems. Therefore, it is important to have spatial studies on rural poverty to know about underlying causes. This study was carried out in three GN divisions namely Lahupana, Ranapana, and Bambaragama which are located inside the Galigamuwa Divisional Secretariat Division. Most of the inhabitants of these villages were re-settlers by the central government due to landslide hazard. Therefore, identification of factors behind the poverty and its spatial distribution were the main objectives of this study. According to the proportion of beneficiaries in Lahupana, Ranapana, and Bambaragama (17:13:13) 100 questionnaires were given randomly to the households of the study area. Overlaying and proximity techniques used as spatial analysis tools inside the study. Flow maps were used to recognize the significant facilities needed for residence of the study area. In addition regression model was used to determine women's role in poverty. According to the analysis it was revealed that study area comprises of a terrain of mountains 49 % and 21 % of steep slopes and other 30% with gentle slopes and flat lands. Seventy nine percent of respondents claimed that soil erosion lead to degradation of soil and it adversely affected cultivation. This study also revealed that 54% of population were women. According to regression analysis women who were engaged in agricultural activities and estate works lead to have a negative impact on income level rather than males but women with O/L education qualification lead for increasement of income compared to males by 2,565 rupees. Very poor road conditions with less accessibility and none of major roads, 4% of jeep and cart roads and 1% of minor roads were available compared to Kegalle district. With these difficulties, proximity analysis identified that people have to travel 18 km for rural banking facilities and 6 km to get basic health facilities. Flow maps identified police station, national schools, village fair and super markets are most needed facilities but located far away from the study area. Targeted pro-poor policies are required for poverty alleviation as well as investments in roads and improvements in soil fertility needed for potential poverty reduction.

***Keywords**: poverty, proximity analysis, regression model, flow maps, accessibility*

MODERATING ROLE OF BRAND ATTITUDE ON PURCHASE INTENTION OF THE WOUNDED BRAND IN A PRODUCT HARM CRISIS: VIEW OF YOUNG CONSUMERS' IN ASIAN EMERGING MARKETS

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Brand Attitude pays an important role in purchase intention in product harm crises. Present study examines this by using a total sample of 101 Chinese (n=51) and Sri Lankan (n=50) based undergraduate marketing and business management specializing students. A fictitious product harm crisis scenario explained a company culpable product harm crisis situation. A fictitious yogurt brand was used as the stimulus brand on the basis of pre-test. ANOVA results based on the young consumers' view revealed that brand attitude significantly moderates the purchase intention of the wounded brand in a product harm crisis ($F = 3.17$, $P<0.05$), while exploring an unexploited corner of the product harm crisis management literature. This is an important management strategy in product harm crises. Therefore this research is of great significance for the product harm crisis managers, researchers, marketers and policy makers in particular.

Keywords*: Brand attitude, product harm crisis, purchase intention, China, Sri Lanka*

A COMPARATIVE STUDY ON BIRTH CONTROL IN DEMOGRAPHIC AND BUDDHIST PERSPECTIVES

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This study focuses on identifying the concept of birth control from a demographic and Buddhist perspectives, based on a qualitative analysis of secondary data from the *Thripitaka* and demographic literature. In the modern world, fertility plays a major role in increasing the world population. Reproduction is a phenomenon that fulfils the procreation and sexual needs of humans. In demography, sexual union of a male and a female and conception are two main factors needed for a birth. According to Buddhism, sexual intercourse, mothers' fertile period and the arrival of consciousness are the three factors essential for a birth. The concept of birth control has a long history. Birth control is mainly used for stopping unwanted pregnancies and a method of reducing family size. According to Buddhism, induced abortions are a sin. Therefore, birth control is considered as an action that avoids killing a foetus. Buddhism suggests four types of natural birth control methods. Natural birth control methods prevail even today; rhythm and withdrawal are the main types that can be identified. Buddhagosha thero, who wrote commentaries to *Thripitaka*, notes five birth control methods - *Watta, Chamma, Panna, Thipusasadani* and *Wakapatta. Chamma* and *Watta* in Buddhist perspective are similar to the modern methods of male and female condoms. *Thipusisaadani,* meaning an instrument made of Lead, is similar to the modern method Intrauterine device (IUD). Since technology has developed far beyond that was observed in Buddha's time, methods similar to modern birth control such as birth control pills, sterilization and emergency contraceptives are not found in the Buddhist perspective. Use of birth controls is high today. Though this should reduce induced abortion, it prevails due to high proportions of unwanted births. Especially in countries where abortions are illegal, foetuses are killed under unsafe conditions, also risking the mother's life. It is better to avoid conception rather than engaging in unsafe abortions. If the Buddhist perceptions of using birth control to avoid abortions and thus the killing of a life are inculcated among the populations, this would result in a reduction of risky abortions, and thus positively impact the reproductive health of populations.

Keywords*: birth, birth control, Buddhism, demography, comparative study*

SOCIAL COHESION THROUGH HISTORY CURRICULA IN POST-WAR SRI LANKA

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The concept National Reconciliation has become the main theme in articles, conferences and workshops in post war Sri Lanka. During the course of the thirty year ethno-civil war and afterwards the government of Sri Lanka is looking for a nation within the frame of multi culturalism is celebrated and respected. To ensure the nation's development in Sri Lanka the government has implemented many projects and still endeavors on it. As a long term perspective education system has to play a vital role on building social cohesion. This has been identified by the government and clarified in the official documents which were implemented during the course of war and after wards of the warin Sri Lanka (Some of the reports are; The first Report of the National Education Commission 1992, National Framework for Relief, Rehabilitation and Reconciliation in Sri Lanka, 2002, LLRC Report, 2011, Transforming Education 2020: Corporate Plan 2016- 2020 draft, 2015: National Institute of Education etc.).Nevertheless under the education system the history textbooks in secondary education in Sri Lanka are unsuccessful in addressing the competing historical consciousness of the two main ethnic groups.Historical narratives which shape and mould the historical consciousness of the Sinhala and Tamil communities poses a fundamental challenge to the process of national reconciliation. Much research done in abroad (The textbooks in Rwanda, Israel) has proved that how can history textbooks can highlight social, cultural and ethnic diversity and promote mutual respect and tolerance. Under the mechanism of education the research has examined the contribution of history textbooks on reconciliation by analyzing the historical narrations in textbooks. The aim of the research is to build up a theoretical discussion on the gap between social cohesion and history textbooks in Sri Lanka. The research methods are mainly based on qualitative data which was collected through library research. Content analysis was used in Sinhala and Tamil medium history textbooks from grade six up to grade eleven. The analysisof the textbooks in the theoretical concepts of historical significance, memorization, and racial hierarchy shows the historical narrations in textbooks are full of omissions. And also text books provide a Sinhalese centric narration which has omitted the Tamils and Muslims. The textbooks are highly ideologized or politicized and particularly portrayed the Sinhala kings as heroes defeating the Tamils. The analysis of Tamil medium history textbooks shows that it is same as the Sinhala medium version which follows in a single point of view which strength memorizing historical facts rather than expanding critical thinking of the two ethnic groups. To construct a sober dialogue among the Sinhalese and Tamils it is essential to transform the narrations based on a single point of view to an alternative approach like shared history or joint history. Likewise it has been highly recognized through research done in worldwidethat multiple historical narratives can reinforce peaceful tendencies in post conflict societies.

***Keywords**: Social Cohesion, History Text books, Historiography, Historical Significance, Shared history*

ASSESSMENT OF TEACHER ATTITUDE TOWARDS INCLUSION OF SEX EDUCATION IN TO THE SCHOOL CURRICULUM: A STUDY BASED IN KELANIYA EDUCATIONAL ZONE

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Sex education is one of the most important aspect of life and everyone should have a good knowledge on this to face and deal with the several social challenges in today's world. But our teenagers are lacking the knowledge on this. Therefore, teachers have a great responsibility to make students knowledgeable in sexuality. This descriptive cross-sectional study was conducted among 339 secondary school teachers and a self-developed questionnaire was used to collect data in selected schools in the Kelaniya educational Zone to assess the teachers' attitude towards inclusion of sex education in the school curriculum in selected schools in the Kelaniya educational zone. The opinion of the majority (98.8%) was that the "School children should have adequate knowledge on sexuality". Most of the teachers (90.7%) mentioned that sex education should be included in the school curriculum but only 61.8% of the participants were interested in teaching this subject. More than 70% of the teachers have identified the topics on male and female genital organs, personal safety, puberty, reproduction and birth, abstinence (values of sexual abstinence until marriage), sexually transmitted diseases (STDs) and HIV/AIDS, sexual coercion and assault, teenage pregnancy, rape / sexual abuse, parental responsibilities and family/individual values and moral beliefs on sexuality as important and to be taught in school. The majority (92.3%) of the teachers' opinion was that teacher training programs should be conducted to educate the teachers on sex-education. Sixty-seven percent of the participants did not think that sex education encourages the students to engage in sexual activity. The majority of the teachers have a positive attitude towards the inclusion of sex education in the school curriculum and the majority of the teachers have mentioned that sex education would make students knowledgeable, healthy, morally independent and responsible adults as well as help the students to make correct decisions in their lives.

***Keyword**: Attitude, sex education, teachers, students*

A STUDY OF THE PERFORMANCES OF POST DRAMATIC THEATRE AND SANSKRIT DRAMA

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The term 'post dramatic theatre' has become an increasingly important one which has been subjected to much discussion in contemporary theatre. German author, Hans-Thies Lehmann's theory on Post Dramatic Theatre has been of vital consideration in drama and theatre since 1970. This is a notable experience of collapse on conventional theatre. It is necessary to analyze systematically of conventional theatre practices according to post dramatic theatre. Sanskrit drama and Bharatamuni's Natyashastra are the key works of conventional theatre. Therefore, this research is aimed to focus on both post dramatic theatre and the selected texts of Sanskrit drama. There are two fundamental processes in Post dramatic theatre such as the representation of the external world and the structuring of the time. According to the director's perspective on the representation, he/she has to be concerned about what is to be included in the script. All the Sanskrit theatre is inspired by the stories from Mahabharata, except Shudraka's Mruchchakatika. To use post dramatic theatre on such stories it is necessary to analyze that theory and practices in real to depict Sanskrit theatre in to the modern concept. Therefore, this research aimed to discuss post dramatic theory and practices in relation to Sanskrit drama. The scope of the present study covers Kalidasa's Abhignana Shakuntalam, Shudraka's Mruchchakatika and Harshdeva's Ratnawali. Through the process I hope to create an alternative dramaturgical intervention of post dramatic theatre and Sanskrit theatre and its contemporary relevance. Within this scope, I will also examine a number of other aspects and phenomena that will further define the broader outlines of this study.

Keywords: *Post dramatic theatre, Performances, representation, Sanskrit drama*

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කනිෂ්ඨ අධිශිෂ්‍යත්වලාභී, සිංහල අධ්‍යයන අංශය, කැලණිය විශ්වවිද්‍යාලය.
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සිරිල් බී. පෙරේරා යනු ක්ෂේත්‍ර ගණනාවක සුවිශේෂ ශක්‍යතාවන් පෙන්නුම් කළ කලාකරුවෙකි. නවකතා, කෙටිකතා, කාව්‍ය, පුවත්පත් ලිපි ආදිය ලිවීමෙන් ඔහු පළ කළ කුසලතාව විද්‍යමාන වෙයි. සිරිල් බී. පෙරේරාගේ සාහිත්‍ය කලා දායකත්වය සිනමා මාධ්‍යය කෙරෙහි වැඩි වශයෙන් උපයෝගී වී තිබෙන බව ප්‍රකට කරුණකි. සිනමා අංශයෙහි ද ඔහුගේ දායකත්වය බහුවිධ මානයන් ඔස්සේ විහිද ගොස් තිබේ. සිනමා ගීත රචනය, තිර පිටපත් රචනය, සිනමාව පිළිබඳ ඉගැන්වීම කටයුතු කිරීම ඒ අතුරෙන් කිහිපයකි. එමතු නොව ඔහු ප්‍රබල සිනමා විචාරකයෙකු ද වෙයි. මෙම පර්යේෂණයේ අරමුණ වන්නේ සිනමා විචාරය අරඹයා සිරිල් බී. පෙරේරා දක්වා ඇති දායකත්වය පිළිබඳ විමසා බැලීම යි. ඔහු සිනමා විචාරයෙහිලා කුමන අංශ කෙරෙහි අවධානය යොමු කොට තිබේද යන්න මෙහි පර්යේෂණ ගැටලුව යි. මෙම පර්යේෂණ ගැටලුව නිරාකරණය කර ගැනීම සඳහා මූලාශ්‍රය වශයෙන් පෙරේරා විසින් ලියන ලද විචාර හා බැඳුණු සිනමා කෘති යොදා ගැනිණ. ඔහුගේ විචාර සහිත පුවත්පත් ලිපි සහ විචාර කෘති ද මෙහිලා මූලාශ්‍රය විය. මීට අමතරව අන්තර්ජාලය ආදිය ද පර්යේෂණ ක්‍රමවේදය වශයෙන් උපයෝගී වූ අතර වෛෂයික ප්‍රාමාණිකයන් සමග කළ සාකච්ඡා ද මෙහි ලා ඉවහල් විය. ඒ අනුව ඔහු නවසිය හැටේ දශකයෙහි ඉදිරිපත් කොට ඇති විචාර කලාව යුගය සමතික්‍රමණය කළ ඒවා බැව් සිතිය හැකි ය. විශේෂයෙන් 'පරසතු මල්' වැනි සිනමා කෘතියකට ඔහු ඉදිරිපත් කරන විචාරය අතිශය මනෝ විශ්ලේෂණවාදී ය. මනෝ විශ්ලේෂණවාදී සිනමා විචාර කලාවක ආරම්භක අවස්ථාව වශයෙන් මෙය ගිණිය හැකි ය. මීට අමතරව ඔහු සිනමා විචාරයෙහිලා සාහිත්‍යාත්මක පක්ෂය කෙරෙහි ද වැඩි අවධානයක් යොමු කර ඇති බව පෙනේ. තාක්ෂණික හා ශිල්පීය ක්‍රමවේද භාවිතය මෙන් ම සිනමා සෞන්දර්ය කෙරෙහි ද ඔහු දක්වන අවධානය තීව්‍ර ය. මෙලෙස බලන විට සිරිල් බී. පෙරේරා යනු ලාංකේය සිනමා මානයට නවමානයක් එක් කළ එමෙන් ම සිනමාවේ බහුවිධ අංශ කෙරෙහි අවධානය යොමු කළ විචාරකයෙකු බව සඳහන් කළ හැකි ය.

***ප්‍රමුඛ පද** : විචාරය, දායකත්වය, තිරරචනය, සෞන්දර්ය, නවමානය*

A NOVEL FORMATIVE ASSESSMENT TO ENHANCE GRADUATE ATTRIBUTES: A STUDY WITH POLYMER ENGINEERING TECHNOLOGY STUDENTS

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In the process of providing accessible, flexible and efficient technological education, assessment methods have a greater influence on how and what students learn than any other factor. It has long been assumed that there are two main purposes of assessment. The first is to provide certification of achievement (summative assessment). The second purpose of assessment is to facilitate learning (formative assessment). Formative assessment refers to assessment that is specifically intended to generate feedback on performance to improve and accelerate learning. Hence, Institute of Technology of University of Moratuwa assess the students only at the year-end examinations (summative assessment), this research comprehensively sought to explore the potential of a poster exhibition project as one of the formative assessments in a scheme of continuous assessments.
This study was carried out with Level 2 Polymer Engineering Technology students and four consecutive annual poster exhibitions had been conducted for four different batches. Poster exhibition project was a one month project and the 24 students in each batch. After having the constructive feedback for the rough skeletons of the posters and modifying them for five to six times, the students created amazing posters in groups. The students were evaluated throughout the project according to rubrics under attendance, information searching, creative thinking and design of the poster, support for the whole project, meeting deadlines, presentation skills. The final examination paper on the polymeric materials course included problematic situations where students needed to apply relevant subject matter and practical aspects presented in the poster exhibition and the students were able to score full marks for those questions. In addition to the feedback and the year-end examination results the students were asked to respond for a close-ended questionnaire and descriptive statistics of the responses were analyzed. The overall results show that poster exhibition project is an excellent formative assessment and it pays greater attention to develop graduate attributes to compete confidently in the real-world professional context.

Keywords: *formative assessment, poster exhibition, graduate attributes*

BEHAVIOURAL PROBLEMS AMONG PRESCHOOL CHILDREN OF WORKING MOTHERS IN SRI LANKA: WITH REFERENCE TO NEGOMBO EDUCATIONAL ZONE

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Preschool period or early childhood is a great time for a child to learn things. But the same period they have more tendency to become easily frustrated. Most of the children suffer from behavioral problems even one time or more throughout their development. Parents have major responsibilities towards their children to make them mentally and physically perfect. Mother is the main character for a child more than others. Therefore figure of mother could affect the beaviour of a child in negative or positive way. Presently a large number of mothers are working in Sri Lanka due to many reasons and most of them fail to devote enough time for their children to make them feel loved and special. It leads to cause some problems in child. Preschool children are dominant figures in determining the future behaviors of children. Preschool behavioral problems may continue into later childhood. Therefore the objectives of this research were to assess the behavioral problems of preschool children among working mothers, to assess the behavioral problems of preschool children among non-working mothers and compare the behavioral problems of preschool children between working and non-working mothers. Selected sample size was 40 pre-school children of working and 40 pre-school children of non-working mothers. Manuel for the Preschool Behaviour Questionnaire (PBQ) was used to gather data. Data were analyzed by using simple statistical methods such as percentages. To show the analyzed data bar charts was used. The findings of this study showed that mild level of behavioral problems of preschool children were reported in 23.2% of working mothers and 79.3% of non-working mothers, whereas 16% of preschool children of non-working mothers and 58% of working mothers reported moderate level. Higher levels of behavioral problems were reported in 18.8% of working mothers children's and 4.7% of non-working mothers children. Therefore, the study concludes that preschool children of working mothers have more behavioral problems than those of non-working mothers.

Keywords: *Behavioral problems, preschool children, working mothers, non-working mothers, level of behavioral problems*

THE ROLE OF L1 INFLUENCE IN THE ACQUISITION OF L2 PREPOSTITIONS: AN ERROR ANALYSIS

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In the field of English as a second language (ESL) learning and teaching, a large number of studies have focused on error analysis: a type of linguistic analysis that focuses on the errors produced by learners. In fact, errors are an inseparable part of learning and researchers are highly interested in learner errors since they are believed to contain crucial information on the strategies employed by second language (L2) learners. Prepositional errors are a major type of errors observed frequently in the writings produced by undergraduates. This study attempts to provide a comprehensive account of the types of errors which Sinhala speaking learners whose L2 is English commit in the use of prepositions in their writing, and to identify whether there is a significant impact from the learners' first language in committing these errors. Findings were drawn mainly from the qualitative data collected from the writing samples of randomly selected fifty first year Sinhala speaking undergraduates studying in the Faculty of Humanities and Social Sciences of the University of Sri Jayewardenepura. Learner errors were classified according to the Surface Structure Taxonomy of errors (SST) under wrong substitution, preposition omission, and unnecessary insertion recording the frequency of occurrence of each error type. The findings reveal that students are likely to make errors when differences exist between their L1 and L2 while the similarities have contributed to the accurate production of English. It is evident that students seem not to discern yet about how and what prepositions they should use in certain sentences. Translating directly from Sinhalese into English seems a common practice among these students. Hence, this highly outcome-oriented investigation reflects L1 interference as the major source of prepositional errors in writing in English. It is hoped that this study will help L2 learners and teachers of English realize the gravity of L1 intrusion, create hypotheses concerning L2 and test them constantly and eventually develop strategies to overcome them.

***Keywords**: English as a second language, first language, second language, interference, Surface Structure Taxonomy*

A LINGUISTIC ANALYSIS OF THE ERRORS ENCOUNTERED WHEN TRANSLATING TECHNICAL DOCUMENTS FROM ENGLISH TO SINHALA USING GOOGLE TRANSLATOR

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Google translator is an online tool provided by Google for translation to transgress language boundaries. Millions of documents translated by human translators are fed into Google translator and it looks for patterns in millions of documents to help decide on the best translation. Recently, Google translator added Sinhalese as one of the 103 languages that is supported. Since there were errors found in the English to Sinhala translations done by the undergraduates with the assistance of Google translator, this study attempts to conduct a linguistic analysis of the errors encountered when translating technical documents from English to Sinhalese using Google translator. Thus, ten sentences from the activities given to the students were translated into Sinhalese using Google translator and they were compared to their standard Sinhala translations respectively. The sentences quoted from technical documents included the Constitution, government vacancy advertisements, and External Course advertisements. The collected data indicated that when a complex sentence with few clauses are given to translate, due to the structural difference between English (Subject + Verb + Object) and Sinhalese (Subject + Object + Verb), thus, 50% of complex sentences have not been translated structurally correct. In addition, the language style of technical documents are absent in 70% of the Google translated sentences. 45% of the technical terms related to relevant subjects have been correctly translated, while the exact meaning of the original sentence is depicted only in 30% of the translations. Thus, it seems Google translator can produce a correct translation using a compound sentence. However, its reliability is questionable when translating technical documents, since it fails to deliver the translation of technical terms, language style and unambiguity. Thus, it is recommended to feed more standard Sinhala translations with different sentence structures into Google translator to improve the quality of English to Sinhala translations.

Keywords: *English, Errors, Google Translator, Sinhalese, Structure, Technical Terms*

පඤ්චතන්ත්‍රාගත ආර්ථික ක්‍රමෝපාය කිහිපයක් පිළිබඳ විග්‍රහයක්

වැල්ලවායේ නන්දරතන හිමි

භාෂා, සංස්කෘතික අධ්‍යයන හා ප්‍රාසංගික කලා අධ්‍යයනාංශය
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ධනය යනු මිනිසාගේ ජීවන ප්‍රවෘත්තියට අතිශය වැදගත් අංගයක් වන අතර එය ඉපයීම සඳහා සමාජයක විවිධ ක්‍රමෝපාය පවතී. එම ධනෝපාය ක්‍රම කාලානුරූපී ව විවිධ විපර්යාසයන්ට බඳුන් වීම ලෝක ප්‍රවෘත්තියේ සාමාන්‍ය සංසිද්ධියකි. සංස්කෘත සාහිත්‍යයේ ඉතා සුප්‍රකට සමාජ විශ්ලේෂකයකු මෙන් ම නීතිශාස්ත්‍රඥයකු වශයෙන් පෙන්වාදිය හැකි විෂ්ණුශර්මන් පඬිතුමා කාලීන වශයෙන් සමාජයේ පැවති විවිධ පැතිකඩ විමර්ශනයට ලක් කොට ඇති විද්වතෙකි. ඔහු විසින් විරචිත පඤ්චතන්ත්‍ර නම් කෘතිය පෙරදිග මෙන් ම අපරදිග වියතුන්ගේ විශේෂ අවධානයට ලක් වූ විශිෂ්ට උපදේශ කෘතියක් වන අතර, ඉතා සරල ආකාරයෙන් රාජ්‍ය පාලනානුබද්ධ නීතිශාස්ත්‍රය මෙන් ම අර්ථශාස්ත්‍රය පිළිබඳ කරුණු සාකච්ඡා කොට ඇති කෘතියක් ද වේ. එහිදී මිත්‍රභේදය, මිත්‍රප්‍රාප්තිය, ලබ්ධප්‍රණාශය, කාකෝලූකීය, අපරීක්ෂිතකාරක යන තන්ත්‍ර පහකින් යුක්ත සිය කෘතියෙහි මිත්‍රභේදය නම් කොටස යටතේ ධන ක්‍රමෝපාය කිහිපයක් කෙරෙහි විෂ්ණුශර්මන්ගේ විශේෂ අවධානය යොමු වී ඇත. එනම් සිඟා කෑම, රාජ්‍ය සේවය, ගුරු වෘත්තිය, මුදල් පොළියට දීම, කෘෂිකර්මාන්තය, වෙළෙඳාම වශයෙනි. ඒ අනුව තද් ආර්ථික ක්‍රමෝපායන් අතුරින් ඉතා සාර්ථක ධනෝපාය ක්‍රමවේදය කවරක් ද යන්න විමසීම මෙහි පර්යේෂණ ගැටලුව යි. යථොක්ත ධනෝපාය ක්‍රමවේද පිළිබඳ හා එවායේ ආවේණික ලක්ෂණ විමර්ශනය කිරීම හා සමස්ත ධනෝපාය ක්‍රමවේදයන් අතුරින් විෂ්ණුශර්මන් පෙන්වා දී ඇති සුවිශේෂ ධනෝපාය ක්‍රමවේදය කවරක් ද යන්න පෙන්වාදීම මෙහි පර්යේෂණ අරමුණ වේ. ඒ ඒ වෘත්තීන්ට ස්වභාවයෙන් ආවේණික දුක් ගැහැට හා සුවතාව සම්බන්ධ ව විෂ්ණුශර්මන් විසින් සිය කෘතියෙහි වෙන් වෙන් වශයෙන් කරුණු පැහැදිලි කොට ඇති අතර, ඒවායේ ස්වභාව ලක්ෂණ පැහැදිලි ව හඳුනා ගැනීමේ අවකාශය ද ඒ අනුව ලැබී ඇත. සමස්තයක් ලෙස පරාධීන නොවී සුවිශේෂ ප්‍රතිලාභයන් ලැබිය හැකි ඉතා සාර්ථක ධනෝපාය ක්‍රමය වෙළෙඳාම යන්න විෂ්ණුශර්මන්ගේ නිගමනය යි. තව ද දේශාන්තරයන්හි සඤ්චාරය කරමින් ආනයන හා අපනයන ක්‍රමවේදය ඔස්සේ වෙළෙඳාම් කිරීම මගින් ඉතා විශාල ධනෝපායක් මෙන් ම නිරවුල් හා ස්වාධීන වූ නිදහසක් ද උරුම වෙන අයුරු වැඩිදුරටත් ප්‍රකට කොට ඇත. ඒ අනුව පඤ්චතන්ත්‍රාගත මිත්‍රභේදය නම් කොටසෙහි දැකිය හැකි මෙම ආර්ථික විග්‍රහය අතීතයට මෙන් ම වර්තමානයට ද යෝග්‍ය ආර්ථික විග්‍රහයක් බව කරුණු විමසීමෙන් තහවුරු වේ.

ප්‍රමුඛ පද: විෂ්ණුශර්මන්, පඤ්චතන්ත්‍රය, මිත්‍රභේදය, නීතිශාස්ත්‍රය, අර්ථශාස්ත්‍රය, ධනෝපාය ක්‍රම, වෙළෙඳාම

WOMEN'S OCCUPATION AND SOCIAL CLASSIFICATION: HOW DOES IT AFFECT TO CONCEAL HARASSMENTS BY THEIR HUSBANDS IN AN URBAN CONTEXT?

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From a modern context, as a result of gender equality being an accepted norm, majority of women across the world are leading independent lives engaging in various occupations, professions, etc.. Owing to the growth of educational opportunities and, current progressive trends in women's rights movements, women are no longer limited or confined to their household chores. On the contrary they have become an integral part and partners of national development and foreign income generation. Nevertheless, with all these developments and changes gender discrimination is still at large in the South Asian region and women, be it homemakers or professionals have to face numerous hardships and challenges, both at home and work-places. The persuading factors of this study are to identify whether women belonging to a higher strata of the society could achieve total (gender related) independence, to identify if they are truly satisfied with their choices, rights and privileges and the level of inter-personal relationships they have with their spouses (husbands). To assess these factors, a sample of 295 women were selected from a population of about 3800 women attached to government, semi-government and private sector who occupy positions of executive grade and above in Colombo district. To gather data, interviews, formal and informal discussions, and case studies were conducted and additional data was gathered by administering questionnaires. According to the research findings, 88% of women were identified as living with many unsatisfactory conditions and harassment. However, owing to their social and professional status these women are compelled to conceal these issues from society and tolerate these conditions, simply attributing them to their negative "Karma." A serious situation of this problem arises when women contact non-communicable diseases such as asthma, heart ailments, pressure, depression, etc. as a result of the constant mental and physical trauma caused by their spouses (husbands). In addition to this, they face work-place issues (pressure) stemming from the psychological/physical trauma they encounter at home. Other work environment issues they face range from sexual and mental abuse, lack of decision making power and, inequality in career advancement and promotions. A critical factor that stems from these findings is, though working women enjoy a certain level of detectable independence, they deliberately conceal the domestic abuse they encounter in order to avoid labeling and, prejudices. They believe social/work-place stigmatizing is much devastating than domestic discrimination and abuse, as that could adversely affect their careers and social status.

Keywords: *women, husbands, occupation, gender, social classification, harassment, social status*

ව්‍යවහාර සිංහලයේ අර්ථ පරිවර්තනයට බඳුන් වී ඇති වචන ඔස්සේ පැන නැඟී ඇති අර්ථ විපර්යාස පිළිබඳ විමර්ශනයක්

ජයනි සමීරා ගමගේ

සිංහල අධ්‍යයනාංශය, කැලණිය විශ්වවිද්‍යාලය
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භාෂාවේ මූලික කාර්යය අර්ථයක් ප්‍රකාශ කිරීම යි. භාෂාවක පවතින ශබ්ද මඟින් කිසියම් අදහසක් ඉටු කර ගත හැකි නම් එහි තේරුමක් ඇත. භාෂාවක ශබ්ද, පද, වචන, වාගාලාප හා වාක්‍ය ඔස්සේ අර්ථ නිපදවිය හැකි ය. නූතන වාග්විද්‍යාවේ දී අර්ථය හා සම්බන්ධ ව සාකච්ඡා කෙරෙන මාතෘකාවක් වන්නේ අර්ථ විපර්යාසය යි. ඒ අනුව මෙම පර්යේෂණයේ දී අවධානය යොමු කරන ලද්දේ ව්‍යවහාර සිංහලයේ වචනාර්ථ විපර්යාසය පිළිබඳව යි. සිංහල භාෂාවේ වචනාර්ථ විපර්යාසයට බඳුන් වී ඇති ක්‍රම කිහිපයක් සොයාගෙන ඇති අතර ඉන් අර්ථ පරිවර්තනයට බඳුන් වී ඇති වචන කෙරෙහි පමණක් මෙහි දී අවධානය යොමු විය. යම් වචනයක අර්ථය වෙනත් අර්ථයක් බවට පරිවර්තනය වීමෙන් අර්ථ විපර්යාස හටගන්නේ කෙසේ ද? යන්න විමසා බැලීම මෙම පර්යේෂණයේ අරමුණ යි. මෙය හුදෙක් ප්‍රායෝගික ව්‍යවහාරය ආශ්‍රයෙන් සිදු කරන ලද්දකි. වචනවල මුල් අර්ථය පරීක්ෂා කිරීමේ දී පුස්තකාල භාවිතයෙන් ප්‍රාථමික හා ද්විතීයික මූලාශ්‍රය ද ශබ්දකෝෂාර්ථ ද ඇසුරු කරන ලදි. පර්යේෂණයට ඇසුරු කරගත් වචනවල පූර්ව අර්ථ හා නව ප්‍රකට අර්ථ අතර යම් සබඳතාවක් පවතී ද? පවතී නම් ඒ කුමන ආකරයකින් ද? යන්න විමසා බලන ලදි. සමීප සබඳතාව, සමානතාව වැනි හේතූන් මත උපචාර වශයෙන් හෝ වෙනත් ක්‍රමවලින් වචනයක අදහස සෙසු අදහසක් සමඟ ගැටීමේ ප්‍රතිඵලයක් මත වචනයක අර්ථ පරිවර්තනයක් සිදු වී ඇති බවත්, ඒ ඔස්සේ අර්ථ විපර්යාසයක් සිදු වී ඇති බවත් නිගමනය කළ හැකි ය.

ප්‍රමුඛ පද: *අර්ථය, අර්ථ පරිවර්තනය, අර්ථ විපර්යාසය, නූතන වාග්විද්‍යාව, ව්‍යවහාර සිංහල භාෂාව*

TEACHING LEGAL ENGLISH TO UNDERGRADUATES: CHALLENGES FACED BY LEGAL ENGLISH LECTURERS IN A UNIVERSITY LEGAL ENGLISH PROGRAMME

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Legal English, among all the other areas of English for Specific Purposes (ESP) has become one of the most complicated type of English due to the difficult terminology, differences in law systems and the difficulty in interpreting and describing legal concepts, terms and legal procedures. Majority of Sri Lankan university Legal English lecturers find teaching Legal English challenging as they are used to teach General English or English for Academic Purposes. Also, they do not have sufficient content knowledge of legal professions and law fields to satisfy the learner and other stakeholder needs. The aim of this study was to find out the challenges faced by five Legal English lecturers in a university Legal English programme. Semi structured interviews were conducted to identify the lecturers' views on the nature of learning and teaching, training and support given by the employer, confidence in teaching, professional identity and visions for the future. The results of this study include the efforts that the lecturers make to create learning opportunities to the law undergraduates to use legal concepts and vocabulary that would enable the learners to be competent in both the learning and target situations in law. Most of the lecturers consider their learners as subject specialists from whom they learn the content knowledge of law. The lecturers consider themselves as negotiators: the lecturers are more familiar with teaching English for Academic Purposes whereas the law undergraduates are familiar with Legal English. The lecturers develop themselves by self-studies on reading Legal English text books and much support should be given by the authority of the university. This study suggests that the lecturers should be given adequate knowledge of Sri Lankan law and Legal English teaching methodology that would uplift their identities as lawyer-linguists.

Keywords*: challenges, English for Legal Purposes, teacher training, Legal English, Legal English lecturers*

THE IMPACT OF ATTITUDES ON SECOND LANGUAGE LEARNING: A STUDY BASED ON THE 1ST YEAR UNDERGRADUATES AT THE FACULTY OF SCIENCE, UNIVERSITY OF PERADENIYA

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Attitudes are considered to be an individual difference which influence in the process of Second Language Learning. The main aim of the research is to identify the impact of the learner attitudes of the 1st year undergraduates at the Faculty of Science, University of Peradeniya on Second Language learning and achievement. The sample for the research is 78 students from the Faculty of Science, University of Peradeniya. The mixed method comprising of both the quantitative and qualitative data was collected from the self- directed questionnaires, unstructured interviews and the marks for English from the Dean's office at the Faculty of Science . The Pearson Correlation Coefficient and Microsoft Excel application are used in order to analyze the data. There is a positive correlation of r= 0.6 between the attitudes of the language learners and their grades at the end of the English programme in the 1st year. Thus it is possible to identify a positive impact of learner attitudes on Second Language learning. In analyzing the data further it is observed that the students with positive attitudes have performed better than the students with neutral and negative attitudes. The "A" grade for English has been achieved only by the learners with positive attitudes towards learning English. 29.48% of the language learners with positive attitudes have obtained the "A" grade. Furthermore no student with positive attitudes has obtained a fail grade; C- , D or E . On the other hand no learner with negative attitudes has achieved "A" grades for English while "D" and "E" grades which are the lowest grades have been achieved only by the learners with negative attitudes. The learners with neutral attitudes have only achieved "C" grades and 33.33% of the learners with neutral attitudes have obtained fail grade; "C-" for English. In analyzing the results, it is possible to identify that the learners with positive attitudes learn the language more successfully than the students with negative and neutral attitudes. Thus, there is an impact of attitudes on Second Language Learning.

***Key words**: attitudes, second language, learning, impact, individual difference*

CHANGING TRENDS IN AGRICULTURAL LAND USE IN THE MONARAGALA DISTRICT OF SRI LANKA: IMPLICATIONS FOR POVERTY ALLEVIATION

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This study emphasizes the agricultural land use changes and their implications for poverty alleviation. Agricultural land use change is a key requirement for improving rural income and making a significant reduction in poverty levels. Over 70% of the world's poor are living in rural areas, with agricultural land use as a major source of subsistence. Thus, improving the productivity of their land use systems is essential for increasing income and food security among them. Understanding the linkages between agricultural land use changes and poverty is essential for designing policies that simultaneously reduce rural poverty and encourage the adaptation of sustainable land management practices in the country. The main objective of this study was to identify the changing trends in agricultural land use and their impact on poverty alleviation in Monaragala District. The study was conducted in Monaragala district and several methods were employed for collection and analysis of data and information. A general investigation of trends in the land use changes and the poverty situation from 1956 to 2012 in Sri Lanka and in depth analysis was undertaken for the selected district. Bio physical and socio economic variables were used to examine the linkages between dependent and independent variables. The agricultural land use changes were assessed using the Geographical Information System, land use maps and satellite images from 1956 to 2012. Households (252) and plot level data were used to identify the land utilization types (LUT) existing in the area during last fifty years period with special attention on implication for poverty alleviation. The study proved that there is a strong relationship between agricultural land use changes and poverty levels during the study period (poverty in chena farmers' 89%, farmer who converted chena into Banana 32% and Vegetable mixed crops 39.4%). Further, the special case studies ascertained that the living standard of the agricultural land users who changed their LUTs became upgraded (Small holder rubber (Marginal tea areas and sugarcane areas in the Intermediate Zone) with the exception that in certain cases where poverty was increased (LUTs of estate managed Banana & Mango) due to land accumulation. Agricultural land use types such as Rubber smallholder with intercrop, Export agricultural crops (pepper, cinnamon), Banana and Vegetable mixed crops could be introduced to the selected areas where similar agro climatic conditions prevail to alleviate rural poverty.

Keywords: *Poverty Alleviation, Agricultural Land Use Changes, Implications*

PERFORMANCE OF UNIVERSITY OF SRI JAYEWARDENEPURA IN U-MULTIRANK

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Rankings compare universities using a range of indicators. Most available global rankings focus on research using data extracted from popular bibliometric databases. Some of these rankings are available on regional, specialist and professional basis. U-Multirank is a multi-dimensional ranking. It has a range of indicators which can be arranged according to individual preferences. Multi-dimensional rankings facilitate peer-group compatibility and are powered by interactive web-based technologies. U-Multirank has two levels of reviewing its participating member institutions; institutional- based and field-based. University of Sri Jayewardenepura (USJP), which has the highest number of undergraduate admissions among the Sri Lankan universities in 2016, participated in U-Multirank in 2016 and 2017 surveys. The objective of participating in these surveys is to get an understanding of the USJP performance in dimensions considered in U-Multirank . USJP participated only in institutional-based survey. U-Multirank focuses on five dimensions of higher education and research activities; teaching and learning, research, knowledge transfer, international orientation and regional engagement. This ranking system collects data not only from information supplied by the institutions themselves, but from international bibliometric and patent databases and surveys completed by students at participating universities. The main questionnaire for the institutional survey consists of sections on student related data, programmes and graduates, academic staff, currency and unit, revenues, expenditure, research and knowledge transfer. According to the results of U-Multirank 2017 survey, USJP is in an excellent position in the areas of teaching and learning, moderate in research and international orientation and need improvements in knowledge transfer and regional engagement.

Keywords*: University ranking, Higher education, Sri Lankan universities, U-Multirank*

AN INVESTIGATIVE STUDY ON THE ADOPTION OF SYMBOLIC DHARMA IN TANTRIC BUDDHISM

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Tantric Buddhism recognized as one of the major philosophical schools in Buddhism which was later period developed as *Vajrayāna* and *Mantrayāna*. The etymologically term *tantra* derived from the prefix √*Taṅ* which means the immeasurable strength of knowledge. However, in later period with the development of its doctrinal factors above meaning of the term *tantra* turned into the meaning as "mystic doctrine". Tantric Buddhism greatly influenced by Mahayana Buddhist Philosophy. One of specific characteristics of Tantric Buddhism is that it explained philosophical factors by using symbols. Some basic symbolic doctrines introduced by tantric Buddhist teachers are charms (*mantra*), signets (*mudra*), circuits (*maṇdala*), spell (*dārani*) etc. In this context, Mantra was made by them summarizing traditional doctrinal factors and long sutras. For example *AṣṭasahasrikāPrajṇaparamitaSūtra* summarized as *Prajṇaparamitamantra* by using world *praṅ*. Beside above *Sūtra,* many other *Sūtra* have summarized by using their theory of *mantra*. The words *om,āh,hūm,svā* and *hā*are such logarithmic terms of Sutras were used when they chant *mantra*. They employed *mudra* to symbolize some tangible mysterious object. Especially *mantra* used to show the power of the sound and *mudra* employed to show the power of tangible mysterious things. These *mudras* have shown up by using fingers and toes. Some well known such symbols which have mysterious meaning are *Karmamudra*, *Dharma mutra*, *Samaya mudra* and *Mahamudra*, Here *maṇdala* means circuitous, quadrilateral and different shape of forms. In the *mudras* there are mystic drawings and arts that interpret the doctrinal facts of Tantric Buddhism. According to the Tantric Buddhism, to develop and cultivate the concentration it is much essential to use that *mandala*. Yogic practices, also known as *Sādhy Dharma* is fundamental teaching of tantric Buddhism. There are four basic Yogic practices as *hata*, *laya*, *mantra* and *raja*. Besides above symbols and stamps, there are some other specific signs in tantric Buddhism which represent the different kinds of philosophical teachings of tantric Buddhism. Thus, tantric Buddhism is very distinctive philosophical school that introduces novel philosophical trends to world. Even today some doctrines of Tantric Buddhism are used by Buddhist people in the worldwide. In this research Data was collected referring library and E- library. The data from the primary and secondary sources related to the field collected through the libraries and discussed with scholars in the field. The data analysis method of the research is descriptive method.

Keywords: Symbolic Dharma, Tantric Buddhism, *Mantra, Mudra, Dharani.*

A CRIMINOLOGICAL STUDY ON THE FACTORS OF PROPERTY RELATED CRIMINAL OFFENCES IN SRI LANKA (WITH SPECIAL REFERENCE TO GALLE DISTRICT)

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Population growth has created many social problems. Though the increase number of consumers struggle to share limited resources, existing natural resources do not increase. Land is one of them. According to global estimations the world's population is around 7,500,000,000 and Earth's total area (including land and water) is 510,000,000 km^2 (197,000,000 sq. mi.) Therefore, the worldwide human population density is around 13.7 per km^2. Because of limited resources, a competition has been created for the ownership of the land property. As a result of this competition "Property related offences" have increased. Moreover, there is a significant increase of crimes against people related to property. The main objective of the study was to find out factors affecting property related criminal offences in Sri Lanka with special reference to Galle District. 50 people who had a relationship with the victims of property related crimes were selected using purposive sampling method via police records during the period from 2010 to 2015. Data was collected through in-depth interviews conducted from 31st January to 31st of May 2017 and analyzed using MS office package. The study revealed that homicides, intimidations, assaults and burglaries have occurred due to land related problems. These mainly occurred regarding, houses, breezeways, servitude, paddy field and tea fields. Almost all the victims and criminals had close family relationships and had controversial situations regarding the division of their own properties. 25% of the sample pointed out forgeries regarding property divisions. 64% of the cases were reported way from the uptown area. 51% of the sample were having trial more than 10 years. Weaknesses of the traditional land divisions, cultural attitudes, unawareness of the law, tantrum, lawsuits dragging on for a long time were recognized as factors affecting property related criminal offences. Legal reinforcement, establishing new mediation institute and making people aware of these problems were recommended as controlling methods of this property related issues.

Keywords: *Crime against person, Crimes against property, Criminal offences, Limited resources, Social problems*

AN INITIATIVE TOWARD LEGAL ONTOLOGY: ANALYSIS ON MARRIAGE REGISTRATION ORDINANCE

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In Greek, *Ont* stands for "existence" or for "being". Hence, Ontology could be defined as philosophical field of study on existence of the world. i.e. systematically studying on existence of things around us. Aristotle dealt with this subject in his Metaphysics and defined Ontology as the science of "being qua being," i.e., the study of attributes that belong to phenomenal world. Although ontology rooted on to philosophical basis, it has numerous adaptations and applications in variety of fields. Information Technology and its solution developments are such areas, where ontology foundations can deliver promising solutions. But, our investigations into local legal sector revealed very many deficiencies mainly due to incapability of traditional manual legislative procedures in coping with ever increasing demands on legal services. However several other sectors such as trading, financial have shown tremendous service improvements with the IT solution adoptions. In order to manage inherited complexity in legal sector and thereby to streamline and to achieve process improvements without any doubt development of complete and sound legal ontology is primary with utmost impotence. In this paper, completed analysis has been reported on relief and remedies on divorce under the Marriage Registration Ordinance (No. 19) of 1907 for relief and remedies on divorce subject area under purview of district courts in local court system that has been used as the basis for the development of the proposed Legal Ontology in this research work. Proposed Legal ontology founded on tri-folded intuition; actor, activity and document. Firstly, proposed legal ontology consists of identified of all concerned stakeholder inclusive of legal service personnel, service recipients, and all other peripheral participants and their higher level conceptual categorizations. Secondly, all possible activities that these stakeholders could perform within legal service collaboration pre, during and post hearing stages. Finally, the proposed legal ontology attempts in framing and formalized all judicial documents in this specific selected areas of application. Development of such legal ontology for legal service sector could deliver wider range of benefits not only for IT technology solution developer, but also for the par-ties mastering this particular discipline as well as aforementioned entire stakeholder spectrum could also be benefitted with resulting process improvements. Among these shared knowledge, traceability between different layers of concern at designing and different stages at operations are major!

Keywords*: legal ontology, relief and remedies, Marriage Registration Ordinance (No. 19) of 1907, legislative procedures, divorce*

YOUTH GANGING: WHO ARE THEY AND THE AFFILIATION MODE OF YOUTH GANGS TO THE CITY OF COLOMBO IN SRI LANKA

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Colombo is considered as a city that provides great opportunities for Gangs. Some of the gang members are born in Colombo while others have become residents owing to their marriage, employment or being unauthorized dwellers. Thereby they could became either founders in forming gangs or co-partners of existing groups. Most of them were unauthorized dwellers, yet, they believe that they are owners of their settlements ignoring the status of illegal occupancy. With such a grievous mentality those youth who were born in streets and grew up as street children without legal ownership of any land tend to find a permanent place for settling, eventually building a mentality to behave like heroic bandits. The geographical ownership inherited from their ancestors also considered whereas, some youth get opportunity to join gangs through senior gangsters, friends, or relatives. Other than the residential qualifications, there were other supportive elements for youth to join gangs in urban context. The Research focused on 493 identified youth gang members belonging to 75 gangs within 14 GN divisions in Colombo city, belonging to the age group of 18 – 32 years. All the said gangs and the gang members were identified within the study area through a snowball technique using available contacts and via the data gathered using formal research methods. In addressing the above, this paper has been developed to understand the concept of, Youth Ganging: Who are they and the factors that play a pivotal part in sustaining them on the streets, giving specific emphasis to youth gangs operating in Colombo and suburbs. In supplementing, the research focused on areas to ascertain the expansion way through their conflicts and negative impact youth gangs have on the lives of general public in the specified area.

***Key Words**: affiliation mode, Ganging, Urban context, Youth*

INFLUENCE OF PANINIAN BACKGROUND TO HIS SUTRĀS

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Sanskrit Language is one of the remarkable language among the oriental languages. It has grown systematically since Paninian contribution to the grammar field. It was begun in 4th century B.C. by composing of the Astādhyāi. The Astādhyāi is considered as the first computational grammar book in the Asian countries. A lot of grammar rules are explained in the Astādhyāi in an aspectual and mixed manner. The study of Astādhyāi reveals some rules which were influenced from Paninian background. This period, 4th century B.C. was a religiously and philosophically developed period in India. The concepts of Buddhist, Brahmins and Jainism etc. were forced to Paninian rules. There are some concepts which are directly connected to some rules. Nakshasthre cha lupi (2.3.45), Dvithīya bhrāhmane (2.3.60), Chathurthe bahulan chandasi (2.3.62), Yajeshcha Karane (2.3.63) are some illustrations that prove it. According to the following sūtrās, the rules are made to indicate the concepts themselves. As an Indo Aryan language Sanskrit has a firm relationship to the Vedic religions. Therefore the religion of Brahmin, mostly caused to Paninian grammar rules. It is special and historical as it occurred at the very beginning of Asian languages. Therefore I hope to specialize the influence of Paninian background to making of the sūtrās in Astādhyāi. As a primary source Astādhyāi and secondary sources which are related to the topic will be prosecuted.

***KeyWords**: Astādhyāi, Background, Influence, Pānini, Sūtras*

IMPACT OF GENDER AND IDENTITY ON LEARNING ENGLISH AS A SECOND LANGUAGE

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Second language learning has become a socially valued vital learning process since it has the influencing potential to form, manipulate and change the social individual identities towards the positive recognition. In Sri Lankan social system while Sinhala and Tamil languages have been recognized as first languages of most people, English functions as the second or target language. Through a gradual social transformation English has become the most prestigious language in the society and the competence in English is required as the most obligatory qualification for a person to be recognized in the society. The research has focused on identifying and analysing how and to which extent the social factors such as gender differences, cultural diversities, disparities between the social classes and specifically the identities of the individuals influence on learning English as the second language. Within the data collection process both the primary and secondary data collection methods have been utilized and within the primary data collection method a questionnaire has been designed and given to a sample group of 50 respondents from University of Sri Jayewardenepura. Through this analytical sociolinguistic research the relationship between identity and learning English as a second language, the impact that identity practices on person's capability and accessibility to the English language learning process have been taken into consideration. Accordingly it has been identified that English language competency level of urban respondents is higher than rural respondents and the rural identity of the individuals has an influential and discouraging impact on their English language learning process. Depending on the gender differences, the language performance and the language competency levels of the respondents tend to differ in relation to the four language skills and it has been brought forth that the competency level of the female respondents is higher than the male respondents. A higher percentage of individuals believe and accept the vitality of English in higher education and it has been recognized as a supportive channel which enhances Individuals' capabilities and identities in achieving their future goals despite the existing social discriminations.

***Keywords**: English, Gender, Identity, Social elevation, Social discrimination, Second Language*

AN EFFECTIVE JUDICIARY AND THE NEED FOR A CONSTITUTIONAL REFORM IN SRI LANKA

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The judiciary if that is to be called effective, must be provided with independence, proper structural framework, clear distribution of jurisdictions which are accessible easily and effectively by the people, the power to inquire into any action which is not in compliance with the Constitution and most importantly the potential to hear cases of violation of rights and other constitutional provisions impartially and deliver justice without delay. The 1978 Constitution has problems with regard to who exercises judicial power, the unconstitutional practice on appointment, removal dismissal etc. of judges, lack of post-enactment judicial review, jurisdictional issues such as the fundamental rights jurisdiction of the Supreme Court and the constitutional and practical difficulties associating with it, delay in delivery of justice etc. There were many attempts made in the past to reform judiciary but failed, 2000 draft Constitution and the report of the All Party Representative Committee are few recent examples of such. The ongoing constitutional reform process has paid considerable attention to reform existing judicial framework. The objective of the research is to explore the areas of judicial functions which need reform and the recommendations made toward this end in the contemporary political discourse. The study is library based thus provisions on judiciary in the 1978 Constitution, literatures on judicial independence, the reports of the Public Representation Committee, the Sub Committee on Judiciary and Centre-Periphery relations, the UN expert panel reports on independence of judiciary and the past attempts for judicial reform have been subjected to critical analysis. This research also involves a comparative study as to the framework for judicial functioning in other jurisdictions such as in India and South Africa. Recommendations have been made in Sri Lanka with regard to vesting of judicial power directly on the judiciary, changes in the court structure, establishment of Constitutional Court and increase the number of judges, the supervisory power of the Constitutional Council over appointment of judges, fair procedures for transfer, dismissal of and disciplinary actions against judges, vesting of fundamental rights jurisdictions with Court of Appeal sitting in the provinces with flexible procedures, the power of post-enactment judicial review etc. Unlike in the past, steps to be taken to incorporate those far reaching recommendations into the Constitution in order to make the judiciary effective in promoting democracy and justice.

***Keywords**: Judiciary, effectiveness, reform, recommendations, new Constitution*

THE SIGNIFICANCE OF THE GREEN CONCEPT IN THE FACE OF ENVIRONMENTAL CHALLENGES (A SPECIAL STUDY IS BEING CARRIED OUT AT THE UNIVERSITY OF KELANIYA ON THE GREEN UNIVERSITIES CONCEPT)

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In today's social development, a number of environmental problems can be identified. Groundwater, soil, air pollution, urbanization, human activities, and natural disasters are among the major ones. According to the United Nations Environmental Program, green economic concept is the development of an economic system that promotes the development of human development and social justice, and drastically reduces environmental risks and drastically uses organic manpower. The first Green University of Sri Lanka is the University of Kelaniya.
The main purpose of this study, which is specifically geared to the Green University concept of the University of Kelaniya, is to study how important green is to ameliorate the environmental crisis. The site of the Kelaniya University was selected as the field of study and an analysis of the data was obtained through participatory observation and interview methodology. Prof. Kalinga Mudali of the University of Kelaniya and Dr. Epa were interviewed for the interview. The end of the research was to conclude that a great deal of work can be done through the concept of the Green University which operates within the University of Kelaniya to mitigate environmental problems. At the same time, the use of natural resources in an efficient and effective manner, the use of natural recyclables, the production of natural fertilizers, the use of energy in a conservative manner and the implementation of practical sustainable development programs. Accordingly, a proposal can be made to move towards accelerated sustainable development within the university system, not only in the university system but also in the implementation of the green concept within the entire society.

***Keywords**: Environmental Crises, Sustainable Development, Universities, Green Concepts. Natural Resources*

THE IMPACT OF GENDER DIFFERENCE ON SECOND LANGUAGE LEARNING WITH SPECIAL FOCUS ON THE FOUR LANGUAGE SKILLS

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The relationship between Gender difference and language learning is analysed across countries, mother tongues and language families. This study intends to investigate the relationship between gender and second language learning of the undergraduate. It aims to reveal the link between gender and success levels of the participants. This is achieved through the analysis of their performance in English according to their gender, paying special attention to the four language skills. The motivation for the study arises from the lack of female first year repeat students in English over the years in the Faculty of Science, University of Peradeniya. The sample of this study consists of 46 (23 male and 23 female) first year Biology and physical science undergraduates from the Faculty of Science, University of Peradeniya. The data is mainly based on the English test results of the participants and the mid and end semester results of the students are obtained for analysis. The quantitative data collected are analysed using Statistical Package for Microsoft Excel Windows 2010.The findings reveal that females are significantly more successful than males in terms of overall grades achieved. Moreover, the fact that female participants excel at certain language skills while males excel at others is also confirmed through independent analysis of the scores of the language skills. Males perform better at listening compared to females though at an insignificant statistical margin and perform similar in writing. Females contrariwise excelled at reading and speech skills with a significant margin, contributing to keeping the female participants at a higher position on the scale in the overall score. Other factors like attendance and testing mechanisms are revealed as noteworthy variables affecting the second language learning process in the course of conducting the study. Thus, it is discovered that there is a significant connection between gender, language learning, and achievement in English in relation to independent language skills, which can aid the teachers to form a teaching strategy which utilizes integrated skills that caters to the needs and abilities of both the genders.

***Keywords**: language, second language learning, gender, language learning skills*

THE IMPACT OF THE EXPOSURE TO ENGLISH AS A SECOND LANGUAGE ON DEVELOPING THE SECOND LANGUAGE PROFICIENCY: A CASE STUDY ON THE UNDERGRADUATES OF THE FACULTY OF SCIENCE, UNIVERSITY OF PERADENIYA

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Majority of the new entrants who enter the University of Peradeniya are the students who have done their Advanced Level examination in either Sinhala or Tamil medium and they come from different socio- economic backgrounds. As soon as they come to the university, they are obliged to change their medium of instruction to English. Thus, it is important to develop their second language proficiency i.e. English in order to complete their degree program successfully. According to scholars, exposure to second language plays a significant role in second language acquisition. The aim of this study is to examine how the exposure to English has an impact on developing the second language proficiency of these students. Both the exposure they had before they came to the university and after they came to the university are taken into consideration on the basis of the districts that they come from, their present place of residence and the opportunity to use resources. The significance of the study lies in the fact that the research sample consists of first year science undergraduates who are compelled to change the medium of instruction to English in the tertiary level. The mixed methodology was used and both qualitative and quantitative data are collected. The English marks (EN100) that they have obtained during the first year are observed to check their proficiency level. Semi structured interviews are conducted with the sample to find their exposure to the second language. According to the results, the students who had or have an exposure to English have a greater level of proficiency in English than those who did not have or do not have an exposure. Furthermore, it is found that the level of language proficiency affects their final Grade point Average too. In conclusion, it can be observed that, exposure has an impact on developing language proficiency of these first year undergraduates of the Faculty of Science, University of Peradeniya.

Keywords*: exposure, second language, language proficiency, undergraduates, Grade point Average*

A CRIMINOLOGICAL STUDY ON THE DIFFICULTIES OF THE SUSPECT KEPT IN REMAND PRISON FOR LONG PERIODS

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This study is based on the cases with much social attention for long time detention of suspects. It is also developed on the cases of detaining male suspects more than one year. In certain occasions, suspected individuals are sentenced less than one-year imprisonments. The ultimate problem is that the suspect is still not proved as guilty. It is a considerable problem that a person who is not found guilty is kept in a remand jail. Accordingly, the central problem of this research study is to understand the nature of socio – economic background of male suspects those who are kept in custody for more than one year. The sample limit had taken as the only male suspects those who are kept more than one year in new Magazine prison. As the sample 110 male suspects were randomly selected for the purpose of this research study. First is the primary source, qualitative information obtained through methods of interview and questionnaire and observations. Data analysis was done in quantitative and qualitative approach. The following facts were derived from the research. Keeping suspects in the custody for longer periods were a threat to their physical and mental wellbeing. It was also learned that the fewer facilities and overcrowding of prisons, cause mental and physical difficulties among these male suspects. Isolation from the relatives as a result of long time detention was one major problem for them. Total separation from the family environment for a long period of time had resulted in weaker psychological conditions. It was obvious that the weaknesses of criminal justice system cause to kept suspects in remand prison for long periods. One of the main reasons for this delay was delaying of the reports from Government Analysts Department. According to the research, accelerating the criminal justice system improving the methods and efficiency of investigations, considering the background of the suspects when calling for financial bonds and reforming the law on personal bonds could be proposed.

Keywords*: Male Suspects, Remand prison, Analysts' reports, Bonds, Witnesses*

TECHNICAL SESSIONS
ON
MANAGEMENT, COMMERCE & INDUSTRY DEVELOPMENT

‘INTENT REVEALS DESIRE’ AN ASSESSMENT OF POTENTIAL ENTREPRENEURIAL INTENTIONS OF BRUNEI YOUTH

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Today’s young generation will become tomorrow’s spirit of a nation. One of the biggest and fundamental issues common for every nation is youth unemployment. With limited opportunities for employment by the government and few corporate organizations in the state, entrepreneurship becomes a viable alternative for job creation and social development as well as work as a proper tool for economic diversification in Brunei Darussalam. This study has designed to provide understanding about the potential entrepreneurial intentions from the perspective of students in Brunei Darussalam. The study has conducted as a cross-sectional research which uses individual as the unit of analysis and also an explanatory research whereby the purpose was to identify and understand the entrepreneurial intentions of students in Brunei Darussalam and understand the factors affecting their decision. The study is based on other entrepreneurial intentions models from previous research. The ultimate dependent variable was the entrepreneurial intentions of students. The survey was conducted based on a self-administered questionnaire on 450 students in selected public and private higher learning institutions in Brunei. The study concluded with interesting facts findings. Subjective norms are the main influential force towards entrepreneurial intentions and the least influential factor is perceived behaviour control. Entrepreneurial knowledge and the entrepreneurial attitudes act as moderate influencing factors towards entrepreneurial intentions. There will be high potential for youth to focus on entrepreneurship as their career preference in the long run. It will be really essential to have continuous career guidance and monitoring system. Study suggests that there are possibilities for the students to divert their intentions from their present behaviours in the future.

Keywords: *Entrepreneurship, Intentions, Youth, Brunei*

AGENCY CONTRIBUTION ON ACHIEVING TEMPORARY AGENCY WORKERS' ORGANIZATIONAL COMMITMENT: A STUDY IN ABC (PVT) LTD.

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Nowadays Profit-oriented organizations are using cost effective strategies. Outsourcing has become as one of main cost- effective strategies. In that scenario agencies and temporary workers are linked with organizations. Temporary agency workers are coming under non-standard employments, who have temporary attachments to the client organization. With the competitive, dynamic business environment and flexible work arrangements, temporary agency employments are emerged in Sri Lanka. Temporary agency workers are dual committed employees. However, with this dual commitment, Client organizations face issues in achieving temporary agency workers' organizational commitment due to low attention of agencies to temporary agency workers. Even though the Clint provides due attention to temporary agency workers, they fail to receive due commitment due to the lack of attention from agency to temps. This study was conducted to identify the agency related factors affecting to temporary agency workers' organizational commitment. This study was carried out as a cross sectional field study with a sample of 93 workers from temporary agency works in the ABC (Pvt) ltd. Floor level temporary agency workers were selected as sample. Data were collected via a standard questionnaire that met accepted standards of validity and reliability. Descriptive statistics, Simple ranking, Factor analysis, ANOVA and Independent Sample T-Test technique were performed to analyze data. Temp-to-consult ratio is the most influencing factor of temporary agency workers' commitment in agency context. Job satisfaction, Agency support, Side bets, Interactional justice, lack of alternative employments, Procedural justice, Distributive justice, Reciprocity norm acceptance, Socialization, Breach of psychological contract, Lack of skill transferability are the other factors which affecting organizational commitment from higher to lower. Findings revealed that eleven out of thirteen factors are Job related factors, other two are organization related and person related factors. Most client companies provide their attention, while agencies fail to provide their due attention. It shows, it is useless to expect temporary agency workers' organizational commitment without providing due attention from agency. Therefore, how much temporary agency workers are dual committed, that much they are eligible to receive dual attention from client as well as from their agency.

Keywords: *Temporary agency worker, organizational commitment, agency, temps, outsourcing*

FORECASTING EMPLOYMENT OF TOURISM INDUSTRY IN SRI LANKA

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The tourism industry in Sri Lanka is growing over the recent past; increasing arrivals from various destinations. As a result, the employment in the industry also shows a rapid growth, but there were very few attempts in forecasting employment in the tourism industry in Sri Lanka. Hence, the objective of the study was to find out the suitable forecasting techniques for total employment of tourism industry in Sri Lanka. Annual employment data for the period of 1970 to 2015 were obtained from the Sri Lanka Tourism Development Authority (SLTDA). Karl Pearson's correlation used to test the correlation between total employment and tourist arrivals. Time series plots used for pattern identification. Simple Regression Model (SRM) and Auto Distributed Lag Model (ADLM) tested for forecasting. The Anderson-Darling test used to test the normality of data and residuals. Ljung-Box Q test, Auto-Correlation Functions (ACF) and Durbin-Watson (DW) test used to test the independence of residuals. Augmented Dickey-Fuller (ADF) test used to test the stationary of the series. Forecasting ability of the models was assessed by both relative and absolute measurements of errors. The SRM was not successful, but the ADLM satisfied the validation criterion. Both relative and absolute measurements of ADLM were very low. Hence, the ADLM is recommended for forecasting total employment of tourism industry in Sri Lanka. The results of this study will be facilitating for decision making and various strategy development related to overcome the surplus and shortfall of employment. It will be useful for workforce planning in both public and the private sector in the tourism industry. It is useful for developing various training programs such as workshops, academic and professional courses related to hospitality management. Further, the finding of the study can be used to assess the economic benefits to the host community in various tourism areas in Sri Lanka.

Keywords: *Simple Regression Model, Auto Distributed Lag Model, Measurements of Errors.*

APPLICATION OF SUPPLY CHAIN MANAGEMENT PRACTICES TO PUBLIC SECTOR CORPORATIONS TOWARDS ORGANIZATIONAL CONTINUITY - EVIDENCE FROM SRI LANKA

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Sustainability as a construct is still debated and is yet to attain a consensus among researchers and practitioners. Sustainability in supply chain is another dimension where few researches have been done in Sri Lanka's, public sector. In order to narrow the study the researcher will be taking one dimension of sustainability that is continuity of the organisation. Sustainability is the integration of environmental, social, and economic criteria that allow an organization to achieve long-term economic viability in narrow term it is the continuity of the organisation. The purpose of this paper is to examine the factors affecting the supply chain management principles and its application to public sector corporations. When researcher considered sustainability as the depended variable and carried out the literature survey following six independent variables emerged. They are namely goal alignment to supply chain objectives, standardization, waste elimination, revenue generation, knowledge in supply chain management practices, mind set of employees. Firstly the researcher used qualitative techniques using in depth interviews. Findings of the qualitative study were used in quantitative technique using 37 samples (permanent officers) in 16 public sector corporations. The sample size obtained for the study was appropriate according to the rules of thumb proposed by Roscoe. Such as that sample sizes larger than 30 and less than 500 are appropriate and the sample size should be several times (preferably 10 times more) as large as the number of variables in multivariate study (including multiple regression analyses). Dimensions are Integration of SCM strategy with the core strategy, cost reduction, profit maximization. The researcher came up with questionnaire consisting of 3 dimensions and further divided to 21 elements. Four point Liker scale used to capture the respondents feedback on the dimensions delineate from the Sustainability literature. Utilized four point Liker scale instead of 5 points since people tend to be with neutral answer at the middle position. Search for the Literature was done using sustainability and green procurement. Since objective is to check the validity and reliability of the instrument search was limited to 26 references. Out of the 34 corporations registered under Department of Public Enterprises 16 corporations were selected. The study narrowed down to cover 10 corporations. Respondents or cases collected of 37 executive and above grades from these corporations. The responses were analyzed using SPSS. The study validates the importance of applying supply chain management principles such as lean

concepts. Very few studies have documented industry specific sustainability practices in Sri Lanka and much lesser have studied in relation to lean supply chain. This was verified by the actors who participated in the in-depth interviews and focus group discussions. Furthermore, standardized procedure is developed through the literature survey. Also it was revealed during the interview process that the knowledge on the supply chain process is very important for the continuity as well as the goal alignment and standardization. Furthermore this argument was confirmed when the instrument was used through the quantitative study. When these results were analyzed using SPSS. It confirmed the validity and reliability of data. The research reconfirms the importance of having revenue generation projects and waste elimination projects for the continuity of any public sector corporations especially corporation who depends on the Treasury funds. Proposed model needs to be applied to other sectors in public sector such as service and manufacturing. Model linked to organizational business operations at the strategic, tactical, and the operational levels helps in the alignment of the organizational activity towards the strategic intent of the organizational sustainability. It also helps in equipping the organization to achieve the operational excellence and the strategic business growth. Since the procurement in government sector is bound by the NPA guidelines there should be policy recommendations with the introduction of the National Procurement commission. Current study is unique in its attempt to understand the capability of proposed lean supply chain concepts and application same in public sector towards continuity.

***Keywords**: Sustainability, Continuity, Lean supply chain, Goal alignment, Revenue Generation*

FACTORS INFLUENCE ON PURCHASE INTENTION OF LAPTOP AMONG THE UNIVERSITY STUDENTS: A STUDY ON WORD-OF-MOUTH

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Consumers are affected by several informational sources in today's globalized environment such as Word-of-Mouth (WOM) communication. WOM can be defined as the act of consumers providing positive or negative information to other consumers. The marketing literature abounds with the claim that WOM communication has a substantial influence on consumer purchase intention. For this reason, it should be important to determine the factors related to WOM communication not only for researchers but also especially for the practitioners. The aim of this study is to determine the influence of Word-of-Mouth on Eastern University student's laptop purchase intention and the factors related to Word-of-Mouth. In this sense it has examined the three factors which are Interpersonal factors, Personal factors and Situational factors to determine whether these factors influenced on WOM receiver's purchase intention. Furthermore, the influence of tie strength between sender and receiver, similarity between sender and receiver, sender's and receiver's expertise about the laptops, opinion leadership, receiver's perceived risk, receiver's information search extent and message's trustworthiness were considered. In the study, survey method has been employed. A structured questionnaire has been addressed to undergraduate students at Eastern University, Sri Lanka. Stratified random sampling was used to obtain 210 responses from students who intent to buy laptops in near future. Reliability test, Descriptive analysis, ANOVA, Independent sample t-test, Pearson correlation analysis, Partial correlation analysis and multiple regression analysis have been used to analyze data by SPSS 19.0. The findings indicated that all the three independent variables have a positive influence on dependent variable and among those variables; Situational factors influence is higher than other variables. Under that factor, Message's trustworthiness dimension is highly influenced on WOM related Laptop purchasing decisions of the students.

***Keywords**: Word-of-Mouth Communication, Purchase Intention, Laptop purchasing behavior, Personal factors, Interpersonal factors, Situational factors*

SOFTWARE ENGINEERING KNOWLEDGE CONSTRUCTION IN SOFTWARE COMPANIES - AN EMPIRICAL STUDY IN SRI LANKA

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Research on knowledge management in software engineering companies encounters very many unsolved and emerging issues needed to be tackled. This situation leads to a research area with utmost importance. Software development is a knowledge intensive and collaborative endeavor. It encompasses a diversity of knowledge related to concerned business domain, adopted development processes, techniques and available technologies. The success of the development heavily depends on knowledge and experience of the software engineers. Formalization of this knowledge in order to effective sharing among software engineers is uphill tasks. Hence, our research study aims to reduce this gap by evaluating current status of knowledge management practices in Sri Lankan software companies by an empirical study. Concurrent mixed methods research design, which allows researchers to collect quantitative and qualitative data concurrently has been used in this context. Knowledge synthesis theory which is an approach from systems science is used in this study to analyze and to interpret the perceptions of software engineers working in selected software organizations with respect to their knowledge management practices adopted by them. Findings of this study emphasized that the implementation of knowledge management practices consists of challenges related to technological, organizational as well as personal aspects such as Personal Software Process. Especially knowledge management can be seen as an opportunity to establish a common language among software engineers so that they can interact, negotiate and share the knowledge necessary in the software development process. The results also insist that incorporating knowledge management practices in software engineering, resulted savings in time and cost for development as well as better decision-making abilities leading to better quality software product. Along with these findings, our corresponding analysis and suggestions for more effective knowledge management and better creativity support, and some perspectives and future research directions in this field are presented.

Keywords: *software engineering knowledge, knowledge management practice, tacit knowledge, knowledge sharing, organizational learning*

INFRASTRUCTURE: UNDERPERFORMING DIMENSION OF LOGISTICS PERFORMANCE INDEX (LPI) IN SRI LANKA

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Sri Lanka has designed key development agendas in recent years to uplift its trade facilitation. One of the main aims is to convert Sri Lanka into a logistics hub to facilitate international trade. The perception of the logistics sector in executing such agendas is indeed supportive in terms of proper policy planning. As a multi-dimensional evaluation indicator, LPI has seemingly taken the interest of potential investors. However, the LPI scores of Sri Lanka have not been satisfactory when compared with major competing countries in the region. Therefore, assessing the logistics performance of the country has become a contemporary requirement. The role of freight forwarders is vital in such assessments. Particular to this context, this research mainly aims to analyze the reasons for the most underperforming dimension of LPI. Quality of trade and transport related infrastructure was identified as the most underperforming dimension. The findings were based on a survey questionnaire with a sample of 60 logistics professionals from 20 freight forwarding companies and personal interviews. A prioritization of infrastructure development was identified through Analytical Hierarchy Process. The structured model with the indicators of each dimension in the infrastructure dimension of LPI was verified through Factor Analysis. The key findings highlighted that eventhough rail infrastructure was identified as the most underdeveloped, the respondents ranked the priority order for development as port infrastructure, warehouse and transloading, ICT infrastructure, road infrastructure, airport infrastructure and rail infrastructure respectively. In addition, poor cargo handling facilities at ports and warehouses, road congestion, not having separate lanes for trucks, not implementing a national level single window system, unsuitability of the current railway network for freight operations, lack of collaboration between private sector and government, not revising the tax structure for cargo handling equipment imports and not having an independent regulatory body for logistics were recognized as major reasons for poor infrastructure.

Keywords: *Logistics Performance Index, Infrastructure, Trade and Transport, Analytical Hierarchy Process, Freight Forwarding*

FARMER PERCEPTION AND PREFERENCE TOWARDS THE ORGANIC FOOD PRODUCTIONS: A CASE STUDY AT HADABIMA AUTHORITY SRI LANKA

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In paying attention to the present Sri Lankan agricultural food market, there is an increasing trend towards the organic. But it seems that the available local organic food production systems and markets are not able to cater the increasing demand of the consumers for the organic foods. However, the farmers' perception on shaping the development of organic food industry is still questionable. Therefore, the main objective of the study was to find out the farmer perceptions and preferences regarding Sri Lankan organic food productions. Study location was Hadabima sales outlet at Gannoruwa and all the potential organic producers, who do supplies for the outlet were taken into the sample and the sample size was thirty one (31). Pre-tested structured questionnaire was used as the research instrument and the data were analysed by descriptively and using correlation coefficient values. According to the study 94% of farmers were willing to shift for the organic food production methods and 96% of farmers were aware about the benefits and limitation of the organic farming. Study revealed that the preference of doing organic farming is significantly affected by the farmer's age ($p=0.020$), education ($p=0.000$), and time engaging in the farming ($p=0.048$). High demand, high prices and cost reduction for chemical fertilizers were stated as the main benefits while low input availability, higher labour intensively and more time consuming nature was stated as the major limitations by them. Moreover, the awareness about the benefits and the limitation of the organic farming is significantly affected by their age ($c_{Benifits}=0.831$, $c_{Limitations}=0.67$) and time engaging in the farming ($c_{Benifits}=0.868$, $c_{Limitations}=1$). Therefore the study concluded that Sri Lanka is now having a strong positive potential for organic food productions in order to cater the consumer demand in the sector while it was encouraged by the high prices and demand and discouraged by the low input availability and higher labour intensive nature of the sector.

Keywords*: Organic food production, organic farming, organic agriculture, Sri Lanka*

EXPLORING THE CHALLENGES IN TRANSITIONING FROM TRADITIONAL PROJECT MANAGEMENT TO AGILE PROJECT MANAGEMENT

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It is only less than a decade that Agile Project Management (APM) was introduced and got popular steadily and it has been hailed as the silver bullet which will successfully address the high project failure rate. Many organizations have been using Traditional Project Management (TPM) methodologies for years and are now either considering or in the progress of introducing APM approach as a substitute for the more rigid, inflexible and control oriented TPM methodologies. The defined values in APM and their outcomes have motivated many project managers to adopt these methodologies. Since migration from TPM methodologies to APM methodologies is growing highly, managers of the companies should be aware of problems, hindrances and challenges they may face with during the agile transformation process. Accordingly this study focused on determining the challenges involved in adopting APM methodologies by organizations that followed TPM practices in Sri Lanka. Data collection was performed through an in-depth interview with experts in the field where this research was an exploratory study which primarily focused on Sri Lankan Information Technology (IT) industry. Data were analyzed using coding techniques and findings have illustrated the challenges identified through the research in relation to the literature under six key thematic areas namely; organizational culture, leadership, structure, management practices, work unit climate and individual and organizational performance. Moreover, the motives to adopt APM methodologies and weaknesses in TPM approach were illustrated. Findings revealed that organizational culture is the utmost challenge in adopting APM methodologies which further indicates that the adoption of APM is not just about introducing a new set of rules or techniques. Instead, it involves a major organizational change, which affects many stakeholders. Therefore, management should concentrate to overwhelm these challenges effectively where it implied that managers must champion, disseminate and reinforce the agile vision across the entire organization. Thus, an agile transformation is a process which takes several months to make the complete effect. At the successful implementation of APM would generate multiple benefits such as increased the potential for higher customer satisfaction, improved flexibility and augmented team motivation. However, the results of this study have to be verified using a large sample.

Keywords: *Agility, Agile project management, IT industry, Project management*

STUDY OF BUSINESS PROCESS OUTSOURCING (BPO): EVIDENCE FROM GARMENT MANUFACTURING COMPANIES IN COLOMBO DISTRICT

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Some companies consider doing their core and non-core activities in-house and other see it more profitable to get it done from other expert companies. So, outsourcing has become very crucial in most firms 'corporate decisions'. Today's organizations require rapid growth, and most organizations require a service provider with new capabilities, and numerous modes in delivery of content. This has encouraged most firms to outsource some of their non-core activities to remain competitive. But most of the companies still spent their important resources for non-core activities. Therefore this study intended to analyze the reasons for Business Process Outsourcing (BPO), its benefits and challenges. The study was made on a selected sample and senior level managers of 5 client companies that have already outsourced and 5 outsourcing vendors were selected by using convenience sampling method. Study was adopted questionnaires method to gather necessary data. Mean, Standard Deviation, and Person's correlation coefficient were used to analyze data. The activities outsourced were indicated to be accounting, support, distribution, production, human resource activities, logistic, advertising, design and technology services. Companies are increasingly looking for outsourcing to save time, process and cost advantages. Because of outsourcing firms can compete effectively in the market place due to firms would benefit from decrease in operating costs, focus on core business and therefore achieve improved customer satisfaction, timely delivery of services to clients, faster response to customer demands, reduced commitment to full-time human resource expenses, improved quality of products, reduction of capital investment, improve the employees technical knowledge, brought about specialized industry knowledge, good expertise knowledge for the project. Challenges as high incremental charges for the work they do extra, cost of delayed delivery or not delivering, vendor failure to deliver, leak of confidential information, privacy and integrity issues, loss due to disasters and recovery costs, disclosure of commercial secrets, interest conflicts with outsourcing partners and quality problems may occurred.

Key words: *Business Process Outsourcing (BPO), Garment Manufacturing Companies, Reasons, Benefits, Challenges*

FACTORS INFLUENCING ON ENTREPRENEURIAL OPPORTUNITY RECOGNITION IN SRI LANKA

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Entrepreneurship is one of the fastest developing concepts in the world's modern economic setting. Presently, in every industry and in both corporate and small businesses, entrepreneurs are regarded as the major driving force for expansion and development of an economy. In this context, Small and Medium Scale Enterprise (SME) sector provides significant level of contribution to the national economy by providing larger number of employment opportunities. Globally entrepreneurship depends on entrepreneurs' skills and ability to seek opportunities. In case of Sri Lanka, it is wrong to say business opportunities are lacking. There are some unsought opportunities for which people are still blind. Having taken this climate into consideration researchers intended to make a search of factors that have been considered by existing entrepreneurs in initiating their ventures. This study is survey based and it was enriched with qualitative and quantitative perspectives. According to results of preliminary survey and literature review, it was a puzzle to researchers that why many people who have willingness to initiate businesses have still failed to identify determinants that can be used to capture entrepreneurial opportunities in the country. In this context, in collecting data mainly primary and secondary sources were associated. In collecting data, a structured questionnaire was administered among 150 respondents selected from Western province including Gampaha and Colombo districts. The sample profile consisted of 75 respondents per district. For convenience of the analysis, it was supposed to consider only SME sector. The convenience sampling method was chosen to select the respective sample. As this is relevant to the inductive reasoning, overall study was worked out along with that approach. For the purpose of presenting and analysing data both descriptive and inferential statistics were associated. Under inferential statistics, multiple correlation analysis was applied. Based on the conclusion, social networks, cognitive factors, prior knowledge and educational background have significant positive relationships between entrepreneurial opportunity recognition in Sri Lanka. There is no any proper mechanism to motivate individuals in Sri Lanka to become as entrepreneurs. Funding sources of ventures in Sri Lanka also are highly lacking. Finally, the innovativeness and the creativity among Sri Lankans is apparently low in the current context in Sri Lanka in order to become as effective entrepreneurs.

Keywords: *Entrepreneurship, social networks, self-efficacy, risk perception, creativity*

FACTORS AFFECTING THE EMPLOYABILITY OF ARTS GRADUATES IN PUBLIC UNIVERSITIES (IN CASE OF UNIVERSITY OF SRI JAYEWARDENEPURA)

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Arts graduates, who are a stylized component of the educated personnel, obviously face severe difficulties in finding suitable employments. Unemployment has become a considerable critical problem in the present context under several crises. The contribution of the university to the preparation of employable Arts graduates was criticized by different stake holders. Hence this article reviews the key factors behind the employability of Arts graduates in Public universities, the findings will be useful to overcome the current status. Sample of 180 Arts graduates who passed out during 2012-2016 period was gathered from university of Sri Jayewardenepura, which was reported where the highest number of students studying in Arts faculty and most of the undergraduate courses are offered. Structured questionnaire and interview sessions were conducted to gather primary data by using stratified random sampling technique. Related published literature, data and information collected in the past were used as secondary data. Binary Logistic regression analysis technique was used to model the dependency of employability with associated factors. Descriptive statistics, Cronbach's Alpha Value, KMO and Bartlett's test, Composite indices, chi square test, contingency tables and odd ratios were also used for analytical purposes. Results discovered that the employability of the Arts graduates have been critically affected by several academic as well as personal, professional and parental factors in addition to their own job search behaviour. The possible reasons for Arts graduates unemployment were identified as skill mismatch, graduates' attitude and job queuing behaviour, employer perception, information asymmetry, language constraints, higher studies and voluntary unemployment. The mind sets of academic as well as industry should be changed to work collectively to establish a permanent links to realize the important of the economic and human value of Arts graduates. The university system needs to be reoriented, concerned with quality, relevance etc. and introduce job oriented programmes to match with the local and global needs. The government also can take certain initiatives to merge the status of the public universities with the requirements of the industry particularly to the expected knowledge, skills, and attitudes.

***Keywords**: Employability, Graduates, Mismatch, Industry, Job Oriented*

AN ANALYSIS OF THE KNOWLEDGE OF HIV/AIDS BASED ON DEMOGRAPHIC FACTORS AMONG THE SELECTED HOTEL EMPLOYEES

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According to the National STD/AIDS Control Programme (NSACP) Report of Sri Lanka (2006), there are approximately 4000 patients with HIV. Some of the main factors which increased HIV infection in Sri Lanka are tourism, large youth population, migration, growing commercial sex, drug use etc. Hotels take the main role in the tourism industry. The purpose of the study is to examine the knowledge of HIV/AIDS based on demographic factors among the selected hotels employees in Sri Lanka. Primary data of the study were collected through a questionnaire distributed among 90 employees who worked in 5 * hotels in Sri Lanka. The knowledge of HIV/AIDS was considered as the dependent variable which consisted of general knowledge, knowledge of transmission, knowledge of prevention and knowledge of misconception. Demographics of respondents were considered as the independent variable which consisted of marital status, age, qualification and position. Alpha value of 0.823 shown that the questionnaire used for the study is reliable. According to the finding of the study, the correlation coefficient values of -.348 revealed that there is a negative relationship between the qualifications and knowledge of transmission such as having sexual relationship with a HIV infected person, from infected mother to child during pregnancy, birth, or breast-feeding and sharing injection as needles, syringes. Further, the mean value of 3.9 proved that the employees who worked in the selected hotels had a good knowledge of HIV/AIDS transmission. The correlation coefficient value of .062 shows that there is a positive relationship between age and knowledge of prevention. Apparently, the mean value of 3.41 shows that the employees have good knowledge of HIV/AIDS prevention as well. However, the mean value of 3.8 and 4.1 shows that the knowledge of misconception is high among the employees with regard to HIV always leads to AIDS and no life expectancy for HIV positive person. Consequently, the researcher suggests that there should be regular HIV/AIDS awareness programmes at workplaces in order to improve knowledge of HIV/AIDS among the staffs which can help to achieve the aim of "ending AIDS" by 2025 in Sri Lanka.

Keywords: *Knowledge of HIV/AIDS, Demographics, Hotel Employees*

A METHODICAL PLAN OF ACTION FOR THE GRADUAL DEVELOPMENT OF WEALTH FROM BUDDHIST PERSPECTIVE

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As a matter of fact, that the Buddhist economic philosophy has been taken a specific place in the society. Some well-educated and also intellectuals, including Albert Eistein, are convinced that teachings of the Buddha contains the most satisfactory solution to the ills or problems of the modern society. By today most of the people are struggling with economic problems. Therefore, one has to strive hard to earn as much as possible by righteous. As well as one must protect what has been earned and fulfill one's duties by following beings and be and economically sound person, avoiding wasteful extravagant expenditure and be contended. According to the teachings of the Buddha the Buddha has preached happiness of two kinds of happiness. The happiness of this life and the happiness of here after life. At a matter of fact that the Buddha proclaims that one should be capable of achieving these four kinds of well-beings such as physical well-being, mental well-being, social well-being and also spiritual well-being. Here first three are the results that we can see within this life itself. To be free from physical, mental and social ills one must earn money. Without enough money to survive one's life, he or she is suffering under these three aspects. They will not be able to experience spiritual progress as well. The Buddha as shown a methodical plan of action for the development of wealth and bringing happiness into their lives. Earning, managing and consumption is meant as economy. In Buddhism, what are the ways of earning wealth and how wealth should be protected as well as the way of consumption are the main objectives that are going to discuss in this paper. If someone can understand the Buddha's economic teachings definitely they can lead a happy life instead of suffering due to the lack of wealth. This attempt is to discuss the effective ways of earning money.

Keywords*: Economy, Management, Consumption, happiness, Buddhist perspective*

THE IMPACT OF GOVERNMENT EXPENDITURE ON ECONOMIC GROWTH: A SRI LANKAN PERSPECTIVE

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Over the last twenty-five years, Sri Lanka has experienced a decreasing trend in government expenditure as a percentage of Gross Domestic Product. At the same time, the composition of expenditure too has changed in an erratic manner. It is the Keynesian view that government expenditure has the potential to drive economic growth. Thus, this study mainly focuses on the impact of government expenditure on economic growth with special emphasis on the different components of government expenditure in Sri Lanka. After thirty years of war and having a significant portion of government expenditure on defense, time has come to explore the real drivers of economic growth, especially which components of expenditure contributes more to growth. Annual data from 1983 to 2015 is used in the analysis which covers a period of 33 years and the Multiple regression model under the Ordinary Least Square Method is used to generate the model results. The study reveals that expenditure on education and transport and communication have a positive significant impact on economic growth and education expenditure has the highest positive impact. The results also reflect that increasing government expenditure on education in Sri Lanka, strongly contributes to economic growth. In addition to that, expenditure on health is not significant but it has a positive impact on economic growth while the defense expenditure has an insignificant negative impact on the growth. In conclusion, the study suggests that allocation of spending towards education is more critical for achieving and sustaining economic growth in Sri Lanka.

Keywords: *Government expenditure, economic growth, fiscal policy, Sri Lanka*

LEAN MANUFACTURING, ITS MISCONCEPTIONS AND HOW TO OVERCOME THEM TOWARDS A SUCCESSFUL LEAN JOURNEY

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Lean manufacturing or lean production, often simply "lean", is a systematic method for waste minimization ("Muda") within a manufacturing system without sacrificing productivity. Lean also takes into account waste created through overburden ("Muri") and waste created through unevenness in work loads ("Mura"). Waste in a process simply defines as any activity that does not add value. One could ask the question value for whom? In Lean, all value is defined from the vantage point of the customer. Value is any activity that transforms the product in a way the customer is willing to pay for. By eliminating the 7 wastes in Lean which is overproduction, material handling, waiting, defects (rejects) or rework, inventory, over processing, unnecessary motion of people, the non value adding activities can be reduced thus reducing the lead time which can be invested back in the business. The customer satisfaction comes down to mainly three main areas; quality, cost and delivery. Several tools are being used to achieve this; tools such as Poka Yoke and Kaizen are very much focused on ensuring that service and product quality are perfect. Just in Time is about providing flow using kanban systems to ensure that the customer gets what they want when they want it. Standardized working through 5S and keep machines reliable through Total Productivity Management (TPM) to help achieve this. Cost is thereby reduced by removing all non-value adding steps.

Lean principles are elegant in simplicity, yet complex when considering all the aspects of the system of production. However, in today's context, applying lean in a manufacturing / service organization simply means teaching lean tools developed by Toyota to its employees and letting them loose to implement them in their own area of work. What we are forgetting is that Toyota has not developed these tools as universal problem solving tools but to solve their own problems. Copying what you see in another plant is doomed to failure, unless the conditions in your plant exactly matches the plant that you are copying. If we dismantle a car engine in order to learn how it works, certainly will not make us a motorcar engine designer, unless we learn the laws of physics, the design criteria, the design principles and other basic theories required to make you a design engineer. World is trying to copy Toyota for two decades or so, and has not yet produced a single company, outside Japan who could keep adapting and improving its quality and cost competitiveness as systematically, as effectively, and as continuously as Toyota. This paper provides an insight to the misconceptions of the above thinking which had led to lean implementation failures and recommend ways to rectify the situation to embark on a successful lean journey for any organization.

Keywords: *lean manufacturing, misconceptions, Total Productivity Management, 5S*

A SMART PURCHASE-ORDER MATERIALS HANDLING SYSTEM FOR APPAREL ORGANIZATIONS

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The Apparel Industry is one of the major manufacturing industries in Sri Lanka and plays a significant role in the nation's economy. The performance and growth in this industry has significantly arose due to many technical advancements in IT and non-IT fields. Hence, many apparel organizations have incorporated efficient processes to uphold their business. However, excess material wastage during allocation of raw materials in the process of manufacturing is a notably identified issue faced by many apparel organizations, due to changes in order quantities and quality measures. In order to carry out investigations related to this matter, one of pioneers in this industry playing a leading role in manufacturing and exporting of many branded apparel and textile was chosen. MAS Bodyline (Pvt.) Ltd is a production factory under MAS Holdings, and also facing the above mentioned major problem during material planning for purchase-orders according to the Director of Marketing, 2017 at MAS Bodyline. Along with the inability to solve this problem, several corresponding sub issues have also aroused resulting failures of orders. However, even with the company's SAP system going through upgrades and changes in processes for Just-in-time (JIT) methodology, the issue has not been able to solve yet. Therefore, along with the most appropriate approaches and methodologies, this research outlines the factors and findings affecting incorrect consumption measures and investigates its impact on planning to reach correct consumption measures. In order to reach this correct measure, this project proposes a Business Solution Process Model and an IT system 'Smart Purchase-Order Materials Planning System' with the most appropriate tools and technologies, which will eradicate all issues relating to incorrect consumption measures. Therefore, this system will not only solve the main problem of the organization but also will allow many other benefits reaching to increase profits and gain further recognition in the industry by producing quality and in-time products.

***Keywords**: Material Wastage, Bill of Materials (BOM), Forecasting, Data Mining, Decision Tree Analysis*

TECHNICAL SESSIONS
ON
NATURAL & LIFE SCIENCES

EFFECTS OF FOOD ADDITIVE MONOSODIUM GLUTAMATE ON LIFESPAN OF *Caenorhabditis elegans*

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Monosodium glutamate (MSG) is a widely used flavor enhancer and due to its increased use in the food industries, the individual consumption is steadily increasing worldwide. Recent studies showed that excess accumulation of MSG is harmful for human health. The main objective of this study was to evaluate the effect of MSG on lifespan using *Caenorhabditis elegans* as the model organism. Wild type (N2) and insulin receptor mutant *daf-2* (CB1370) strains of *C. elegans* obtained from *Caenorhabditis* Genetic Centre at the University of Minnesota. Seeded Nematode Growth Medium (NGM) plates were prepared with different concentrations of MSG (0.01mM, 0.05mM, 0.1mM, 1mM, 5mM, 10mM, 20mM and 24mM) and negative control. 0.05mM is equal to the average amount of MSG consumed by human per day. Twenty four L4 larvae were transferred from respective synchronous cultures of wild type and *daf-2* strains. The population was scored on daily basis until the whole population was dead. Worms failed to respond to repeated prodding on the head and tail were scored as dead. Experiment was done in triplicates. Final data were analyzed using OASIS (Online Application for Survival Analysis) and life span curves were generated. Here, N2 showed a mean life span reduction whereas, *daf-2* mean life span was increased comparatively but both results were not significantly different from their respective negative controls. Since previous studies suggest that MSG could have a negative impact on organisms, MSG concentration gradient was tested in wild type worms. The lower MSG concentration (0.05mM) significantly declined the mean life span of N2 by 13.77% ($P<0.05$). With increasing MSG concentration, the mean life span was further decreased by 16.83% significantly ($P<0.05$). Overall the present study suggests that food additive monosodium glutamate exerts a significant reduction of *C. elegans* lifespan probably via *daf-2* gene, implying an effect of insulin signaling pathway on lifespan.

Keywords*: Caenorhabditis elegans, Food additive, Life span, Monosodium Glutamate*

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ISOLATION AND CHARACTERIZATION OF YEAST STRAINS FOR BIOETHANOL PRODUCTION

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The industrial scale sugar fermentation process for bioethanol production applies yeast strains. The final ethanol yield depends on the viability of yeast under stressful conditions such as temperature, osmotic pressure by sugars and ethanol concentration which emerge inside a fermenter. Therefore this particular study was done to characterize isolated yeast strains by means of their thermo, osmo and ethanol tolerance. Rotten and fresh fruits (Apples,grapes,oranges) from market, garden soil and compost samples were inoculated into Yeast Extract Peptone Dextrose (YEPD) broth to isolate yeast strains. Discrete yeast colonies were obtained by streaking loopful from each flask on YEPD agar plates supplemented with tetracycline 30 mg/ml. Yeast pure cultures were maintained at 4 ˚C in YEPD agar slants. Light microscopic observation of typical morphology was helpful in confirming yeast strains. Throughout the study, loopful from 24 hour-old culture in YEPD agar slant was used as initial inoculum. Ten yeast strains were individually inoculated into YPD broth (5 ml) tubes with different ethanol concentrations (2%, 10%, 20%, 30%, 40%, 50%, and 60%) and sugar concentrations (2%, 5%, 10%, 20%, 30%, 40%, and 50%) separately and the tubes were incubated at 37 ˚C for 24 hours without shaking. To determine the temperature tolerance, they were inoculated into YPD broth (5 ml) tubes and incubated at different temperatures (10˚C, 25˚C, 37˚C, 44 ˚C and 50 ˚C) for 24 hours without shaking. The growth of strains was measured as an indication of absorbance at 595 nm by UV-Visible spectrophotometer after 24 hour incubation. The stress tolerance of each strain was studied on Yeast Extract Peptone (YEP) agar modified with different sugar and ethanol levels to determine the combined effect of sugar (substrate) and ethanol (product) on viability of yeast strains. The maximum growth temperature tolerated by all the tested stains was 37˚C. Sugar tolerance varied from 2% to 5% for majority and ethanol tolerance varied from 30% to 40%. However, when these conditions were combined for growth, the tolerable ranges decreased and best growth of 5 strains were observed on 200 g/L glucose + 80 ml/L ethanol at 30 ˚C for 72 hrs. Y1 and Y5 yeast strains tolerated most of the combined stress conditions applied.

Keywords: *Bioethanol, Sugar fermentation, Stress tolerance, Yeast.*

IDENTIFICATION OF THE POTENTIAL MOLECULAR TARGETS OF HUMAN HERPESVIRUS 4 USING BIOINFORMATICS TOOLS

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Human Herpesvirus 4 (Epstein-Barr virus) is a human pathogenic virus that causes chronic infection leading to severe health problems including cancer. Although, few control strategies are used, a proper medication has not been implemented. The novel gene editing techniques, which are ZFN (Zinc Finger Nuclease), TALEN(Transcription Activator Like Effector Nuclease) and CRISPR/Cas9(Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR associated protein 9) have a potential to be used to control these pathogens and some researches have been carried out to investigate the potential of applying CRISPR/Cas9 on human herpesvirus 4, although the *in vivo* application is controversial. In this study, we carried out a bioinformatic analysis to find the target sites of TALENs. There the viral gene *LMP2A* was selected which shows an important role in the viral persistence inside host cells. If this gene could be altered the viral impact on the host could probably be diminished. We analyzed the *LMP2A* gene for potential TALEN targets with the tool 'TAL effector nucleotide targeter 2.0' and the targets with highest possible specificity of binding to the specified TALENs were selected. And we carried out an analysis to find the off-target bindings in human genome and other locations of the viral genome for the selected TALENs. Then among these TALEN sequences, TALENs without off-target bindings were selected. These identified TALEN binding sites would be useful in the medical treatment of the viral infection as an alternative method of treatment.

Keywords*: Human herpesvirus 4, LMP2A, TALEN, Off-targets, Bioinformatics*

PRODUCTION OF POLYCLONAL ANTISERUM FOR LOCAL ISOLATE OF *Chilli Veinal Mottle Virus* (ChiVMV) IN *Capsicum annum* (CHILLI)

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Chilli Veinal Mottle Virus (ChiVMV) is the most prevalent virus in Chilli cultivations in Sri Lanka. Indexing of virus is mainly carried out using commercial kits. But those are of high cost. Locally developed polyclonal antiserum can be used to detect the local strain of ChiVMV efficiently and at a low cost using Enzyme Linked Immunosorbant Assay (ELISA) technique. In Sri Lanka, production of polyclonal antiserum for ChiVMV has not been recorded previously. Therefore, this study was carried out to produce polyclonal antiserum for ChiVMV. Purification of ChiVMV was carried out according to the previously developed protocol. New Zealand white female rabbit was used for the immunization process. Prior to immunization, pre- immune serum of the rabbit was withdrawn and tested by available indirect ELISA protocol to ensure that antibodies against ChiVMV is not present in the serum. Purified virus preparation was injected to the rabbit, one intraveinal (IV) followed by four intramuscular (IM) injections with Freund's Incomplete Adjuvant (FIA) at weekly intervals. Three bleeds were withdrawn at weekly intervals after third injection. An indirect ELISA procedure was carried out to determine the best bleed, best antiserum dilution, best extraction buffer and best conjugate dilution. As antiserum titer was low in the first bleed, second and third bleeds were used to optimize the protocol. Since both second and third bleed gave high absorbance values for healthy plant samples, antisera of both bleeds were cross-absorbed with healthy Chilli plant sap. Cross-absorbed serum of the second bleed was selected as the best antiserum for detection of ChiVMV. Of the three buffers tested, PBST+2%PVP+0.13%Na_2SO_3+0.2%EA was found to be the best extraction buffer to extract the virus. Best antiserum and conjugate dilutions were 1:100 and 1:200 respectively. Absorbance values at 405 nm wavelength taken one hour after substrate addition gave clear difference between healthy and infected plants. This locally produced polyclonal antiserum for ChiVMVcan be used to differentiate the ChiVMV infected plants from the non-infected plants.

Keywords: *Chilli, ChiVMV, Immunization, Indirect ELISA, Polyclonal antiserum*

CONTAMINATION OF MC-LR IN THILAPIA (*Oreochromis niloticus*) COLLECTED FROM SELECTED RESERVOIRS IN ANURADHAPURA DISTRICT

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Microcystin-LR (MC-LR) is a cyanotoxin derived from some cyanobacteria and it can be accumulated in aquatic organisms. MC-LR accumulation in tilapia (*Oreochromis niloticus*) collected from three reservoirs, Nallachchiya Wewa, Galkulama Wewa and Anakattiya Wewa, in Anuradhapura District was studied to evaluate the risk posed by the MC-LR in fish on human health. Thilapia is the most famous fresh water fish consumed by people as animal protein source in Sri Lanka. Sample collection, transportation and analysis were according to the standard protocols and MC-LR was quantified by High Performance Liquid Chromatography (HPLC). Fish skin, flesh and head were analyzed for MC-LR and Tolerable Daily Intake (TDI) values were calculated following WHO guidelines. The standard lengths of fish were ranged between 16.7 ± 0.34 cm – 22.5 ± 0.62 cm. The mean concentration of MC-LR in skin, flesh and head were recorded as 5.12 ± 0.02 ppm, 2.33 ± 0.01 ppm and 14.41 ± 0.57 ppm respectively in samples collected from Nallachchiya Wewa. In Galkulama Wewa level of MC-LR in skin, flesh and head were 4.09 ± 0.01 ppm, 4.35 ± 0.21 ppm, 14.13 ± 0.43 ppm where as in Anakattiya Wewa, level of MC-LR in skin, flesh and head and 7.53 ± 0.06 ppm, 2.57 ± 0.01 ppm, 14.11 ± 0.81 ppm respectively. TDI of MC-LR in fish skin and head in Nallachchiya Wewa was 0.27 ± 0.04 µg/day/person and 0.19 ± 0.02 µg/day/person where in Galkulama Wewa 0.18 ± 0.03µg/day/person and 0.11 ± 0.01 µg/day/person respectively. These values were exceeded WHO recommended TDI value. However, the TDI values in flesh for both reservoirs were 0.03 ± 0.01 µg/day/person and the value was below the WHO value. In Anakattiya Wewa, TDI in fish skin and head were recorded 0.53 ± 0.04 µg/day/person and 0.2 ± 0.02 µg/day/person. These values were exceeded the TDI value given by WHO. TDI in fish flesh samples in the tested water bodies was 0.04±0.01 µg/day/person and the value was equal to the WHO value. The results of the study revealed that consumption of head and skin part of fish has a potent risk on accumulation of MC-LR. Thus, it can be recommended to remove head part and skin prior to consumption, and awareness is needed to minimize the potent risk of accumulations of MC-LR in human body.

Keywords: *MC-LR, Thilapiya, TDI, Anuradhapura District*

CHARACTERIZATION AND SCREENING FOR PROBIOTIC POTENTIAL OF LACTIC ACID BACTERIA ISOLATED FROM CURD.

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Probiotics are live microorganisms when present in adequate amounts bestow health benefits on the host. Lactic acid bacteria (LAB) have been accepted generally recognized as safe (GRAS) for human consumption due to their proven probiotic properties. Present study was conducted to evaluate the probiotic potential of thirteen strains of LAB previously isolated and purified from curd. Morphological, biochemical, physiological characterization and probiotic potentials were studied for isolated strains. Finally antibiotic resistance was studied using selected antibiotics.Gram staining, catalase activity, endospore staining, motility, indole production, methyl red reaction, Voges-Proskauer reaction, utilization of citrate, oxidase activity, urease activity, production of H_2S, arginine hydrolysis, growth at different temperatures, gas production from glucose and fermentation of different carbohydrates, were studied. Probiotic potentials of the isolates were determined by evaluating the pH tolerance, bile tolerance, NaCl tolerance, phenol tolerance, survival in the presence of simulated gastric and pancreatic juices and ability to survive at high and low temperatures. The isolates were identified as species belonging to the genus *Lactobacillus* and the probable species were identified as *Lactobacillus plantarum*, *Lactobacillus brevis* and *Lactobacillus delbrukeii* sub sp. *lactis*. The tolerance test results revealed that the most of isolates were able to withstand and grow under reduced pH (1.5 and 3.0), alkaline pH (9.0), extremes of bile (up to 0.5%), phenol (up to 0.6%) and NaCl (up to 6.5%). Isolates were also able to grow at high and low temperatures and in the presence of simulated gastric and pancreatic juices. Antibiotic resistance varied among the isolates. CD010 was resistant to six of the tested antibiotics; sulphamethoxazole, ampicillin, amikacin, cephalothin, vancomycin and norfloxacin. Results shown that six isolates were identified having higher probiotic capacity. These findings illustrate that the LAB isolated from curd have desirable probiotic properties. This provides an opportunity for further investigation of isolates for their safety aspects and technological properties.

Keywords: *Curd, Lactic acid bacteria, probiotics, Lactobacillus, antibiotic resistance*

FRUGIVORY OF SRI LANKA YELLOW-EARED BULBUL (*Pycnonotus penicillatus*) IN HORTON PLAINS NATIONAL PARK

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The term "frugivore" means whose diets include a substantial portion of fruits at least during some seasons. Therefore, this study was conducted on a frugivorous bird, Sri Lanka Yellow-eared Bulbul (*Pycnonotus penicillatus*) which is an endemic threatened species. The study area was Horton Plains National Park (HPNP). During the study period data collection was carried out from September 2015 to June 2017 on three consecutive days per month. Within the study area, there were Cloud Forest habitat, Cloud Forest Die-back habitat and Grassland habitat. The study was aimed to identify the feeding plants and seasonal fruit availability of *P. penicillatus*. Three, 100 m fixed line transacts were marked in each habitats by using a global positioning system device (GPS). Within that transects behavioural study was carried out to construct an ethogram. Direct methods such as focal animal sampling and faecal analysis were used to identify food items of *P. penicillatus*. Feeding plants were identified by using field guides. Faecal samples were collected at the field and further analysed in the laboratory to identify fruit parts. To find out the food abundance, five individuals per each plant species, of identified fruit-producing plants were tagged. All the fruits (ripen and unripen) were counted in three branches of each tagged tree during four climate seasons {First Inter-monsoon Season (March – April), Southwest-Monsoon Season (May – September), Second Inter-monsoon Season (October – November) and Northeast-Monsoon Season (December – February)}. Within this study period *P. penicillatus* preferred, 16 species of feeding plants belonging to 11 families. They were feeding on five endemic plant species including *Symplocos bractealis, Berberis ceylanica, Callophyllum walker, Syzygium sclerophyllum* and *Eugenia mabaeoides*, nine native plant species and one introduced plant species. Both the direct observations and faecal analysis methods confirmed that ripen fruits of *Rubus ellipticus* was the major food of *P. penicillatus*. They had a wide range of fruits distributed in every layer of the forest ranges from shrubs to trees. Furthermore, there were fourteen plant species with ripen fruits availability throughout every climate season. Therefore, the current results of the study revealed that, the *P. penicillatus* had sufficient amount of fruits within every climate season at the HPNP to fulfil their diet. Moreover, it is recommended to protect important protected areas such as HPNP which are harbouring a large variety of feeding plants. These studies will be important to conservation activities to warrant the protection of endemic threatened birds such as *P. penicillatus* for future generation.

Keywords; *Frugivory, Pycnonotus penicillatus, Horton Plains National Park, Tropical Montane Cloud Forest.*

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DETECTION OF KNOCKDOWN RESISTANCE (*kdr*) MUTATIONS IN SRI LANKAN *Aedes aegypti* POPULATIONS

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Dengue is a serious arboviral disease in Sri Lanka with an increasing number of dengue fever cases reporting every year. The control of primary vector *Aedes aegypti* solely depends upon the source reduction for breeding and the application of insecticides to the vector populations. However, increase of reported number of cases suggests the inefficiency of current control strategies and possibility of emerging resistance to currently used insecticides. Early detection of *kdr* mutations which confer resistance to pyrethroid insecticides is important in management of resistance in vector populations. Polymerase chain reaction was carried out to detect the presence of three *kdr* mutant alleles F1534C, V1016I and V1016G in 207 *Ae. aegypti* mosquito samples collected from eight districts (Colombo, Jaffna, Galle, Kandy, Puttalum, Trincomalee, Hambanthota and Batticaloa) in Sri Lanka. The data revealed the presence of F1534C mutant allele in Sri Lankan *Ae. aegypti* populations for the first time. The mutant allele was found to be wide spread in the island. It was interesting to note that mutant C allele frequency was highest among mosquito populations in Jaffna district (0.148) closely followed by populations in Colombo district (0.143). The lowest was recorded in mosquitoes collected from Kandy district (0.043). However, the present study was not able to record the presence of V1016I or V1016G mutant alleles in the studied mosquito populations. The spread of the mutant allele throughout the country poses a threat of higher resistance development for pyrethroid insecticides. In Sri Lanka pyrethroids are extensively used for vector control measures as a routine practice and as an emergency measure in the event of an epidemic situation. Unplanned and the long term insecticide applications could have led to resistance development thus more strategic and diverse tools should be applied for the control of the vector.

Keywords: *Dengue, Aedes aegypti, Insecticide resistance, knockdown resistance (kdr), F1534C*

Acknowledgments: Financial assistance by the university grant ASP/01/RE/SCI/2016/37, and Center for Biotechnology, University of Sri Jayewardenepura

QUANTIFICATION OF ORGANOPHOSPHORUS PESTICIDES RESIDUES COW'S MILK COLLECTED FROM NUWARA ELIYA DISTRICT

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Nuwara Eliya district is the leading milk producer in Sri Lanka. Milk can be contaminated with pesticide residues through the feed and water sources. Thirty two milk samples were collected from milk collecting centers in 5 DS divisions of Nuwara Eliya district, during January 2016 to January 2017 and analyzed for the residues of organophosphorus pesticide (OPPs). The transfer of OPPs to dairy cow's milk when fed with feed and water were assessed in this study. Sixty feed samples (vegetable residues and grasses) and 15 water samples were collected from various dairy farms. Milk samples were analyzed by the multi-residues analytical method DFG S-9 for pesticide contamination. Feed samples were extracted with acids using QuEChERS method. Pesticides residues were analyzed using GC-MS. The results showed that mean of all milk samples had greater content of profenofos (0.0938 ± 0.02 ppm), chlorpyrifos (0.0132 ± 0.0028 ppm) and prothiofos (0.0516 ± 0.0016 ppm) than their maximum residue limits published by World Health Organization (WHO). Chlorpyrifos and diazinon were detected in all feed samples with the mean values of 0.046 and 0.011 ppm, respectively. In addition, 68% of feed samples contaminated prothiofos (0.064 ppm) and profenofos (0.1114 ppm) at concentrations greater than their maximum residue limits of WHO. However, organophosphorus pesticide residues were found below the WHO permissible limit in analyzed water samples.

Keywords: *Organophosphorus pesticide residues; cow's milk; cattle feed; water; risk assessment*

Acknowledgement: Financial assistance by National Research Council (NRC), Sri Lanka Research grant (13-088).

LARVAL STAGES OF THE BIOFOULING COMMUNITY FOUND IN COLOMBO PORT, SRI LANKA

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Colombo Port is one of the major international ports in the Indian Ocean bridging the East-West shipping route. Therefore, the port is highly susceptible to the introduction of larval stages of potential biofouling organisms via ship hull fouling and ballast waste. Though the larval stages of biofouling taxa are the key players in biofouling community formation process, the community compositions of the larval stages within the Colombo Port are poorly understood. Therefore, identification of the larval stages of biofouling assemblages within the Colombo Port is imperative for the protection of our native coastal communities as well as to develop monitoring and protective measures against biofouling and associated activities. Larval stages of the Biofouling assemblages in 3 sampling locations i.e. Colombo International Container Terminal (CICT); Passenger Jetty (PJ); Unity Container Terminal (UCT)) within the Colombo Port was investigated from March 2016 to December 2016 fortnightly. Artificial settlement collectors made of metal plates, were deployed at 1 m and 3 m depths in each location to detect the larval stages of biofouling community. Collected larvae from different depths at sampling site were identified using standard guides. larval stages of seven species, *Spirorbis* sp.*(*Annelida*), Amphibalanus amphitrite*, *Austrominius modestus* (Arthropoda), *Bugula neritina*, *Membranipora membranacea* (Bryozoa), *Botryllus schlosseri, Ciona intestinalis* (Chordata, Class Ascidiacea) were recorded. All seven larvae were found in all three sampling locations at both depths except for *Amphibalanus amphitrite and Austrominius modestus,* which were found only at 3m depth. The abundance of larval stages was increased with increasing depth. Among the larval species, *M. membranacea* is native to the temperate waters of Europe and Pacific Coast of North America, while *B. neritina* native is native to Eastern Europe. The native ranges of *Ciona intestinalis* and *Bugula neritina* are unknown but suspected to be from Northern Europe. Therefore, necessary actions should be taken to minimize risk of future marine invasion events.

Keywords: *Biofouling, Larval settlement, Colombo Port*

PATHOGEN INHIBITION EFFICIENCY OF FUNGICIDES ON *Corynesporacassiicola* ISOLATES FROM TRADITIONAL AND NON – TRADITIONAL RUBBER GROWING AREAS

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Natural rubber, *Hevea brasillensis,* is one of the major economically important estate crops. It is the third largest export income in Sri Lanka. Rubber cultivations were first established in the wet zone of the country and the cultivated areas are known as traditional rubber growing areas. Recently, rubber cultivations have been expanded to the dry zone of the country and the cultivated areas are known as non – traditional rubber growing areas. *Corynespora cassiicola* is the most destructive foliar pathogen of the rubber plant and causes *Corynespora* Leaf Fall Disease (CLFD) of rubber. This disease has been the cause for a major economic loss in the rubber industry. Characteristic symptom of CLFD is 'railway – track like' lesions. This study was carried out to identify the difference in the efficiency of two different fungicides; mancozeb and carbendazim, on *Corynespora cassiicola* isolates from traditional and non – traditional rubber growing areas. Poison food technique was used to assess the pathogen inhibition efficiency of fungicides. Potato Dextrose Agar (PDA) plates with different fungicide concentrations (for mancozeb; 50, 100, 200, 400, 800, 1000 and 1600 ppm and for carbendazim; 2, 3 and 4 ppm) were used to observe the pathogen inhibition efficiency. Carbendazim showed drastically low inhibition concentration, 4 ppm, compared to mancozeb, 8 ppm. Pathogen inhibition efficiency of both fungicides did not show a statistically significant difference ($P<0.05$) between pathogen isolates from the two geographical regions.

Keywords: *Hevea brasillensis, Corynespora cassiicola, CLFD (Corynespora Leaf Fall Disease), traditional and non – traditional rubber growing areas*

Acknowledgment: The financial assistance provided by the development project on – Identification of pest and disease problems of rubber in non - traditional areas to develop improved management strategies

ACCUMULATION STATUS OF MICROCYSTIN – LR (MC-LR) IN *Ipomoea aquatica* PLANT TISSUES

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The majority of water bodies in Sri Lanka are contaminated with Microcystin-LR (MC-LR). MC-LR has acute and chronic hepatotoxic and nephrotoxic effects on animals and humans. The aim of this study was to investigate accumulation status of MC-LR in a selected leafy green, *Ipomoea aquatica* (Kangkong) in the laboratory and the field. Among various aquatic plants, *I. aquatica,* is the most preferable leafy green of Sri Lankan diet. Kangkong plants were exposed to fresh blooms of the genera *Microcystis* under hydroponic conditions in the laboratory. In the field study, plant tissue samples of *I. aquatica* were collected from Padaviya where MC-LR in water has been detected. Quantification of MC-LR was done using photodiode array - High Performance Liquid Chromatography method (PDA-HPLC). The mean concentration of MC-LR bioaccumulation in the samples of the laboratory study and the field study was 350.82±2.86 µg/kg and 132.86±0.26 µg/kg respectively. The evaluated mean human health risk via the consumption of *I. aquatica* grown in the laboratory and for the samples collected from the field was 0.06±0.01 µg/kg and 0.03±0.01 µg/kg of body weight per day. The values were stated beyond the Tolerable Daily Intake (TDI) of 0.04 µg/kg of body weight per day of MC-LR recommended by World Health Organization (WHO). Thus, the results of the present study indicated that MC-LR accumulate in Kangkong plants. Therefore, in order to prevent the risk of human exposure to MC-LR via the food chain awareness should be raised among the public to avoid the consumption of contaminated leafy greens. Moreover, regular monitoring of freshwater sources of Sri Lanka for the prevalence of MC-LR and other cyanotoxins is an essential step forward.

Keywords*: MC-LR; Ipomoea aquatica; bioaccumulation; Tolerable Daily Intake; human health risk*

METHOD OPTIMIZATION TO DETECT 2- METHYL ISOBORNEOL (2- MIB) IN WATER BY GAS CHROMATOGRAPHY-MASS SPECTROMETRY (GC /MS) USING SOLID-PHASE MICRO EXTRACTION (SPME)

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2- Methyl isoborneol (2- MIB) is a key compound which causes off flavors in water. Despite no recorded health hazards, water consumers reject the water with 2- MIB due to its unpleasant musty odour and taste. The aim of this study was to optimize a method to detect and quantify 2- MIB for the first time in Sri Lanka. Human olfactory system detects the 2- MIB at the minimum of ~5 ng l^{-1}. A method for the determination of 2- MIB in water by head space solid-phase micro extraction (HS-SPME) is presented. Various SPME fiber types have been tested for 2- MIB extraction efficiency from water. Medium polar SPME fiber (divinylbenzene/carboxen / polydimethylsiloxane (DVB/CAR/PDMS) microfiber with film thickness 50 µm) proved to be the most efficient for 2- MIB extraction as 2- MIB is a semi volatile odous compound. Extraction conditions including the extraction time, sample volume and temperature were optimized. The best sample size found to be 10 ml and the optimum extraction time is 15 min and the best extraction temperature is 40 °C. Use of 3.0 g of Sodium Chloride (NaCl) found to be the best salting out agent. Fiber desorption was carried out at 270 °C for 5 minutes at the GC injection port. Injection port was operated in pulsed splitless mode and Helium was used as the carrier gas at a flow rate of 1.1 ml/min. Mass spectrometer was operated under as electron ionization mode at 70 eV. The selected ion for the quantification of 2- MIB was of m/z 95 (Base peak) which gave the most prominent peak. Solid-phase micro extraction integrates sampling, extraction, concentration and sample introduction into a single solvent-free step and analytes in the sample are directly extracted and concentrated to the extraction fiber. The optimized method is a cost effective and saves sample preparation time.

Keywords*: 2- MIB, off flavors, Semi volatile, Solid-phase micro extraction (SPME), Optimize*

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ACCUMULATION STATUS OF MICROCYSTIN- LR IN CULTURED AND NATURAL SAMPLES OF *Oreochromis niloticus* (NILE TILAPIA)

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Toxic cyanobacteria produce bio active compounds known as cyanotoxins. For example, toxin strain of *Microcystis aeruginosa* produce Microcystin in water bodies (MC-LR, -RR, -LW etc.) and these can accumulate along the food chain to higher trophic levels. Among Microcystin variants, MC-LR is the most hazardous. Serious health hazards were recorded due to accumulation of cyanotoxin, Microcystin (MC-LR) in fauna and flora; all over the world. Thus, in the present study, contamination status of MC-LR in freshwater edible fish species, *Oreochromis niloticus* was evaluated as many people in country side of Sri Lanka consume *O. niloticus* as a major protein source. The array of MC-LR accumulation was quantified using ELISA (Enzyme-Linked Immunosorbent Assay. In this study, laboratory MC-LR exposed *O. niliticus* and the same fish species samples collected during the month of March (2016) from Beira Lake was studied. MC-LR concentration of Beira Lake water when fish samples were collected was 2.57±0.00 µg/ml where laboratory exposed tank showed 1.25±0.02 µg/ml. The highest MC-LR in fish skin of *O. niliticus* collected from Beira Lake was 1.657±0.01 ng/kg where MC-LR in skin of cultured fish was 0.833 ±0.02 ng/kg. The duration of exposure and the size of fish can be major reasons for detected results. MC-LR concentrations of liver, flesh and head of environmental samples were 6.60±0.01 ng/kg, 0.114±0.01 ng/kg and 0.314±0.00 ng/kg respectively. High concentration of MC-LR (1.593±0.01 ng/kg) in the laboratory cultured *O. niloticus* flesh was detected while a less amount of MC-LR was detected in head (0.018± 0.01 ng/kg). The recorded values were beyond the given WHO TDI value; 0.04µg/kg bw/day. It was found that MC-LR concentration in flesh even after the boiling at 100^0C was remained same in un-boiled fish flesh, revealing that temperature had no effect on removing MC-LR. The highest mean Bio Accumulation Factor was recorded as 0.241± 0.01 for skin whereas, the lowest recorded as 0.050±0.00 in flesh of environmental samples. Therefore, the risk assessed and the accumulation status shows that it is better off without the consumption of 'skin' of MC-LR contaminated fish species in order to avoid the bio accumulation of MC-LR.

***Keywords**: Microcystis aeruginosa, Oreochromis niloticus, Bio accumulation, ELISA, Bio accumulation factor*

DETECTION OF TETRACYCLINE RESISTANCE GENES IN ISOLATED BACTERIA FROM AQUACULTURE SITES IN SRI LANKA

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Tetracycline is a family of antibiotics that inhibit protein synthesis by preventing the attachment of aminoacyl-tRNA to the ribosomal acceptor (A) site. The extensive use of tetracycline as prophylactic and therapeutic agent in aquaculture can result in the occurrence of antibiotic resistant bacteria and Antibiotic Resistant Genes (ARGs) in the aquaculture environment. The aim of the study was to determine the genetic determinants which are responsible for tetracycline (TET) and Oxytetracycline (OTC) resistance in bacteria isolated from aquaculture farms in Sri Lanka. In this study, 42 TET bacteria strains (MIC $\geq$ 60 µgml) were isolated from 16 aquaculture sites. They were examined for the presence of the selected tet genes (*tet A, tet B, tet M, tet S*) using Polymerase Chain Reaction (PCR) method. *Bacillus* and *Staphylococcus* were the most dominant bacterial genera recorded for both OTC and TET resistance while bacteria species *Acinetobacter* sp., *Achromabacter* sp., *Staphylococcus* sp., and *Micrococcus* sp. were identified as main TET and OTC resistant bacteria species. Out of 42 bacteria isolated, one or more tet genes were detected in 30 strains (71%). It was found that, out of 30 tet gene positive bacteria, 21 bacterial strains were positive for *tet* (M), 14 were positive for *tet* (A) gene, 11 for *tet* (S) and 8 for *tet* (B) gene respectively. However 12 bacteria strains were not positive (29%) for selected tet genes. The results of the study revealed that, *tet* M (70%) was the most abundant gene among tet gene, followed by *tet* A (47%), *tet* S (37%) and *tet* B (27%). The results of the present study showed that bacteria isolated from aquaculture sites in Sri Lanka harbor a variety of tetracycline resistance genes which implies the need of an urgent monitoring system in aquaculture as this may lead to problems in the efficiency of antibiotic use in treating fish diseases and subsequent aquaculture production losses.

Keywords: *Tetracycline (TET); Oxytetracycline (OTC); Antibiotic resistance; Antibiotic Resistance Genes (ARGs)*

REMOVAL OF TEXTILE DYE (CI DIRECT BLUE 201) BY FUNGI AS A GREEN ENVIRONMENTAL SOLUTION

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More than 10,000 various types of dyes are manufactured annually for various industries including textile, cosmetic, plastic, and printing industries. Among these industries, textile industry accounts for 2/3 of world total synthetic dye production. Textile dyes are normally designed to be stable to light, chemicals and microbial degradation. Therefore, untreated or partially treated textile dye effluents which are finally end up in natural waters caused environmental and health impacts. Biological treatments have achieved growing concern as it has greater efficiency and cost effective than the conventional treatment methods. Present study was focused on isolation of CI Direct Blue 201 textile dye decolorizing fungal species from textile dye effluents in Sri Lanka. Wastewater and soil samples were enriched in static conditions by spiking dye at final concentration of 50 mg L^{-1} for 14 days. Fungal species were isolated from standard spread plate method using Potato Dextrose Agar (PDA) medium. Dye decolorization ability of isolated fungal species was performed in two phases; solid media experiment and liquid media experiment. Among 27 isolated fungal species, five species showed remarkable decolorization. Fungal species; Sp.7, Sp.9, Sp.14, Sp.18, and Sp.23 showed 49.23 ± 3.67%, 96.93 ± 3.91%, 75.08 ± 2.82%, 95.93 ± 1.75%, 66.63 ± 3.66% of decolorization respectively after 14 days of incubation. The FTIR spectrum analysis revealed that the peak area relevant to the C-H groups stretching (2850-3000 cm^{-1}) decrease with incubation. The Infra-Red absorption wavelength at 2362.65 cm^{-1} relevant to the changes of dye structure with the incubation. Thus FTIR and biosorption test confirmed that the decolorization was not based on surface adsorption but the degradation process. Hence, isolated fungal species are potential candidates for future biotechnological applications, especially to treat wastewater which having textile dyes.

Keywords: *Decolorization, CI Direct Blue 201, Fungi, Textile dye*

ANTIBACTERIAL ACTIVITY OF AQUEOUS EXTRACTS OF *Zanthoxylum rhetsa*. ROXB. AGAINST METHICILLIN RESISTANT *Staphylococcus aureus* AND EVALUATION OF RADICAL SCAVENGING ACTIVITY

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The treatments for infections due to multidrug resistance bacteria (MDR) have become a greater challenge in healthcare sector. Hence, these infections are lead to significant increase in mortality, morbidity and health care cost. Therefore, identifying novel and alternative therapeutic agents to combat them is an urgent need. The medicinal plants are good competitors for the task. *Zanthoxylum rhetsa* (Roxb), commonly known as "Thanahalu" in Sinhala has traditionally been used among Sri Lankan "Vedda" population to treat infected wounds. Therefore, current investigation was designed to evaluate the antibacterial and antioxidant activities of *Z. rhetsa*. The plant samples (fresh leaves, stem bark, root bark and prickles) were collected from Dambana, Sri Lanka. Each sample was shade dried and freeze dried to remove the trace amount of water. The dried powdered plant material (2.5 g) of each part was dissolved in 100 ml of deionized water and microwave assisted extraction was carried out for 5 min. Each aqueous extract was screened for antibacterial activity against 6 methicillin resistant *Staphylococcus aureus* (MRSA) strains, *S. aureus* ATCC 25923 and *S. aureus* NCTC 6571 by cut-well diffusion method. The bacterial suspensions adjusted to McFarland turbidity of 0.5 (approximately 1 x 10^8 cfu/ml) *were* inoculated on to Muller-Hinton Agar (MHA) plates and incubated at 35 ºC for 24 hours. The minimum inhibitory concentration (MIC) was determined by micro-broth dilution method. All the susceptibility testing was performed according to Clinical and Laboratory Standards Institute (CLSI) methods. The preliminary antibacterial screening to identify MRSA was done by disc diffusion assay using cefoxitin (30 µg) discs and the resistance strains were selected based upon there ZOI (≤ 21 mm). In addition, *in vitro* antioxidant potential was determined using DPPH (2, 2-diphenyl-1-picryl-hydrazyl) radical scavenging assay using L-ascorbic acid as a positive control. The aqueous leaves extract of *Z. rhetsa* showed comparatively larger Zones of Inhibition (ZOIs) against all MRSA strains (13-15 mm). Furthermore, there is no comparable difference in ZOIs for the aqueous extracts of *Z. rhetsa* stem bark, root bark and prickles. The aqueous leaf extract of *Z. rhetsa* showed significantly low ($p < 0.05$) MIC value (0.3125 – 1.25 mg/ml) compared to the aqueous extracts of stem bark, root bark and prickles tested. The aqueous extracts obtained from the stem bark and root bark showed high DPPH radical scavenging activity by showing EC_{50} values low as 64.31 ± 6.31 and 81.53 ± 3.42 µg/ml, respectively, and these values are significantly lower than ($p < 0.05$) it for other aqueous extracts of other parts of the plant tested. The current findings add to a growing body of literature on antibacterial activity of *Z. rhetsa*

against MRSA strains and it is open up new dimensions to find low cost, non-toxic antibacterial agents to combat MRSA infections.

Keywords: *Multidrug-resistant (MDR), antibacterial activity, Minimum inhibitory concentration (MIC), Zanthoxylum rhetsa, methicillin resistant Staphylococcus aureus (MRSA)*

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STRUCTURE-ACTIVITY RELATIONSHIP OF LONG CHAIN ALIPHATIC 2-METHYL KETONES CONSTITUENTS OF *Ruta graveolens* ESSENTIAL OIL AS FUMIGANTS AGAINST *Sitophilus zeamais* AND *Corcyra cephalonica*

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Essential oils have long been used as pharmaceuticals, in food products, in fragrances and particular emphasis has been placed on their fumigant insecticidal activities. Hence, identification of the main constituents responsible for fumigant activity combined with comparative-effectiveness research of each constituent are of interest, which could enable determination of the necessary structures for their fumigant action towards stored insect pests. As part of an effort aimed at the development of reduced-risk pesticides based on plant essential oils, fumigant effects of *Ruta graveolens* essential oil and its long chain aliphatic 2-methyl ketones (2-octanone, 2-nonanone, 2-decanone, 2-undecanone, 2-dodecanone and 2-tridecanone) were comparatively evaluated against *Sitophilus zeamais* and *Corcyra cephalonica*. Essential oil caused 100% mortalities at 66.67 ml l^{-1} air and 14.81 ml l^{-1} air against *S. zeamais* (LC_{50}= 0.602 ml l^{-1} air) and *C. cephalonica* (LC_{50}= 0.561 ml l^{-1} air) respectively after 24 h of exposure. All alkanones had LC_{50} values smaller than 0.486 and 0.209 ml l^{-1} air exhibiting significant fumigant lethality against *S. zeamais* and *C. cephalonica* respectively. Susceptibility of two insect species to the alkanones and parity of the alkanones was inversely associated. In that sense, odd-chained congeners exhibited significant fumigant effects against *S. zeamais* while even-chained congeners showing negligible toxic effects. Of these congeners, 2-nonanone and 2-undecanone demonstrated high fumigant activities with respective LC_{50} values of 0.186 and 0.196 ml l^{-1} air followed by 2-tridecanone (LC_{50}= 0.486 ml l^{-1} air). Contrastingly, *C. cephalonica* was more susceptible to even chained-congeners than to the odd-chained congeners whereas 2-octanone was not active at all. In that context, idiosyncratic interspecific fumigant insecticidal potential of alkanones of *R. graveolens* essential oil may be suitable as fumigants or vapor-phase pesticides in integrated pest management programs.

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***Keywords**: Corcyra cephalonica, fumigant, Ruta graveolens, Sitophilus zeamais, long chain aliphatic 2-methyl ketones*

SETTLEMENT PREFERENCES OF FOULING ORGANISMS IN RELATION TO SETTLEMENT PLATE ORIENTATIONS

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Biofouling is a process which aquatic micro and macro organisms accrete into a surface when expose to marine environment for a longer period. The development of biofouling communities follows a pattern of colonization and succession. The developing community affected by certain biotic and abiotic factors. The texture, surface topography and orientation of the hard surface, are major abiotic factors that mostly determine the composition of the settling community. Although, there are several studies looking at effects of surface topography and texture on biofouling community development, very little is known on the effect of plate orientation. Therefore, present study was to investigate the effect of surface orientation of the settlement plates on fouling. The study was conducted in six sampling locations within Colombo port. Sampling was conducted using artificial settlement plates. Settlement collectors were submerged in four different depths where first set was 1 m below the water surface and others setting at 1 m intervals. Monthly samples were collected from October 2014 to March 2017. Specimens were identified morphologically using fine morphological features and samples were quantitatively assessed by determining their covering percentage and species abundance. One-Way ANOVA test results showed that there was a significant difference ($0.05 > p$) between settlement plate orientation (i.e. vertical and horizontal), species richness and species coverage. Further, total richness data revealed that vertical surfaces occupy more species compared to horizontal surface. Results indicate that spatial orientation of surfaces play a major role influencing the settlement to structures. There may be other confounding physical and biological factors for settlement selection which need to be revealed.

Keywords: *Colombo Port, settlement collectors, plate orientation, biofouling organisms*

THE EFFECT OF REPLACING RUBBER CULTIVATION WITH OIL PALM ON THE DISTRIBUTION OF SOUTHERN AND WESTERN PURPLE FACED - LEAF LANGUR IN SRI LANKA.

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Southern purple- faced leaf langur (*Trachypithecus vetulu svetulus*) and western purple- faced leaf langur (*Trachypithecu svetulus nestor)* are endemic to Sri Lanka and primarily distributed in wet zone. The western purple-faced langur is already named as critically endangered due to habitat lost. Rubber lands, introduced during British Era in the wet zone are favorite habitats for leaf langurs that has somewhat a closer resemblance to natural forests. Therefore, the introduction of rubber had no adverse effect to the distribution of southern and western purple- faced leaf langurs. The main objective of this research is to identify the effect of gradual decrease of habitat of western and Southern purple- faced leaf langur by replacing rubber cultivation with oil palm cultivation in wet zone. The following study sites Galle, Matara, Kalutara, Colombo, Kegalla, Gampaha, and Ratnapura district were selected as leaf langers are also distributed in the same area. Annual reports of The Ministry of Plantation Industries (MoPI) were used to get information on the distribution of rubber and oil palm cultivations. Personal observations, questionnaires and publications about distribution of primates were used to identify the distribution of western and and Southern purple-faced leaf langur in the wet zone. Oil palm (*Elaeis guineensis*) cultivation initiated in an area of about 20 hectares in Nakiyadeniya estate in Galle in 1969 and had been expanded to 1,200 hectares by 1974. In 2014 the oil palm cultivation has expanded approximately to 7,953 hectares. Unlike rubber, oil palm leaves cannot be eaten by leaf langurs because of its thorny nature and they cannot stay on trees as well. Therefore, the replacement of rubber lands with oil palm has an adverse effect on the habitat of leaf langurs. MoPI in 2014 has targeted to expand the oil palm cultivation in Sri Lanka up to 25,000 hectares within the next 10 years by replacing rubber lands. As a result, 25,000 hectors of habitat of leaf langur will be lost in next 10 years. Therefore, the relevant authorities should take immediate action to safeguard the langur populations and their habitats.

Keywords: *Oil palm, Plantation, habitat, primate*

FOOD HABITS OF *Poecilia reticulata* (GUPPY) IN NATURAL WATER BODIES OF SRI JAYEWARDENEPURA CANAL SYSTEM

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Poecilia reticulata (guppy) was introduced in the 1930s from Central America to dry zone and the Western province of the country as a bio control agent for mosquito larvae .As at present, it is reported to have distributed across North Western, Western and Southern provinces and this species inhabits a variety of aquatic habitats including streams, marshes, paddy fields as well as ditches in urban areas. However, its role and the efficacy in controlling disease transmitting vector mosquitoes as well as its effect on other fish species in their habitats is poorly understood. Hence, the present study was carried out to investigate the food habits of *P.reticulata*. *P.reticulata* were collected once a month from selected habitats located in Attidiya, Bellanwila, Rattanapitiya, Nawala, near Parliament ground and near Jayewardenepura hospital area for a period of 12 months from January to December2016. Randomly collected 15 fish were analyzed for each sample site at each month. Collected sample were immediately preserved in 5% formalin solution and brought to the laboratory for their gut analysis. In the laboratory, total lengths (TL) of each fish were measured to the nearest 0.1 cm respectively and the stomach and gut were cut and opened. The food items were identified and counted using Sedgwick Rafter Cell, under the light microscope. Total number of food items per 1 ml dissolved gut was counted and percentages (%) of food items were calculated. The size range of collected specimens of *P.reticulata* investigated in the present study was 1.6 - 3.4 cm. Their feed mainly consisted of phytoplankton (35 %) (e.g.*Elakatothix genevensis ,Elakatothix biplex,Closterium pritchardianum ,Closterium moniliferum,Melosira granulata,Phacus longicauda, Peridinium raciborskii, Lyngbya limnetica*), zooplankton (23 %) (e.g. *Daphnia pulex, Dicranophorus australlensis*), adult mosquitoes of *Culex* sp. (4%), unidentified insect parts(12%) and fresh water debris (26%).The results indicated that they do not play any role as mosquito larvivorous fish in the Sri Jayewardenepura canal system. However, as they have consumed a small percentage of adult mosquitoes they may be contributing to wards mosquito controlling. More sampling is in progress to confirm these findings.

Keywords: *P. reticutata*, larvivorous fish, Natural water bodies, Gut contents, Food habits

STUDY OF THE VARIATIONS IN COMMON LABORATORY PARAMETERS IN DENGUE PATIENTS WITH SECONDARY BACTERIAL INFECTIONS

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Secondary bacterial infections adversely affect the clinical course of primary dengue viral infection. Delay in microbiological culture results may also delay the initiation of antibiotics. Study objectives included identifying criteria which predicts secondary bacterial infections before culture confirmation, identify the organisms causing secondary bacterial infections and their antibiotic sensitivity patterns. A retrospective case-control study was carried out at the Dengue Management Unit of Infectious Disease Hospital Angoda. Study analyzed data of 103 patients with suspected secondary infections and received antibiotics; out of which 33 were confirmed with cultures and a control group of 103 who did not receive antibiotics. Independent sample *t*-test was carried out to find the significance between the groups. Results showed highest frequency of secondary bacterial infections on 6^{th} and 7^{th} days of illness and *Streptococcus* and *Staphylococcus* being most commonly isolated. Confirmed group has significantly higher neutrophil count ($3.32\pm0.35x10^3/\mu L$) ($P<<<0.05$) and lower platelet counts ($49.33\pm7.66x10^3/\mu L$) ($P=0.01$) on 6^{th} and 5^{th} day of illness respectively. Whereas, the suspected group has significantly higher neutrophil count ($2.09\pm0.20x10^3/\mu L$) ($P=0.003$) on day 7 and lower platelet count ($49.11\pm4.01x10^3/\mu L$) ($P=0.0291$) on day 6. In both confirmed and suspected groups highest body temperature of the day was significantly higher ($P<0.05$) than the control from the fever day 3 onward and their HCT values ($38.62\pm1.12\%$, $39.44\pm0.62\%$) were significantly lower ($P=0.008$, $P=0.002$) on third and fourth days of fever. CRP of confirmed group were higher than the control group from 3rd day of fever onward with uncertain significance due to limited number of data. The study suggests that absolute neutrophil count, platelet count and HCT can be used for early detection of secondary bacterial infection in dengue patients before the culture results are available. Further studies would be recommended to formulate a clinical tool based on the above mentioned parameters for early detection of secondary bacterial infection in dengue patients.

***Keywords**: Antibiotics, microbiological culture, Dengue, Secondary infection*

Acknowledgment: Dr. Ananda Wijewikrama (VP), Dr. P.D. Idampitiya(VP), Medical and laboratory staff of IDH , Statistics department of university of Sri Jayewardenepura

DEVELOPMENT OF SEMI QUANTITATIVE MOLECULAR METHOD TO DETECT THE PROPORTION OF RICE IN RICE BASED PROCESSED FOOD PRODUCTS

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Rice flour plays a significant role as a wheat substitute in processed food industry due to its nutritional and health benefits. However, the level of substitution is limited as rice flour lacks gluten protein, which offers good baking properties. Hence, manufactures tend to falsify the rice percentage by mislabeling the rice based processed food products, in order to attract consumers. As food authenticity is one of the main concerns among consumers, correct labeling of food products is important. This study was planned to develop a molecular based method to semi-quantitatively detect the rice proportion in rice incorporated processed food products, as establishment of an analytical tool to detect rice adulteration has become an essential step. In the present study, amplification of a rice specific gene in genomic DNA of rice based food products was employed as the molecular method through Polymerase Chain Reaction (PCR) technique. Standard bread samples (n = 5) with known rice proportion were used to construct the standard curve of incorporated rice proportion versus DNA band intensity. Several rice based processed food products (n = 8) available in the local market were used to quantify the proportion of rice. The comparison was done by measuring the relative correlation of the DNA band intensity of the rice based food products with the standard bread samples. This study concluded that the DNeasyMericon Food Kit method provide optimum extraction conditions to extract DNA from processed food products, while local rice varieties could be amplified using Sequence-Tagged-Site (STS) E30 primers. However, amplification of DNA extracted from processed food was difficult due to the presence of PCR inhibitors. Semi-quantitative detection of rice contents was limited due to lack of sensitivity and reproducibility of the adopted method, therefore successful detection was achieved only from 100% rice based processed food products. Nevertheless, this molecular method can be used to detect 100% rice based processed food products qualitatively and semi-quantitatively, without using high cost Real-Time PCR machine.

Keywords*: DNA extraction, PCR, Rice content, Semi-quantitative detection, DNeasyMericon Food Kit*

SEASONAL VARIATION OF PATHOGENIC BACTERIA IN GROUNDWATER OF THE KELANI RIVER BASIN, SRI LANKA

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WHO estimated, around 1.5 billion people globally suffer from waterborne diseases and 3.4 million people die due to consumption of contaminated water. *Salmonella* spp., *Shigella* spp., and *Campylobacter* spp. are bacteria which frequently cause waterborne diseases worldwide, especially in Asian and African countries. Kelani river basin is the main source of drinking water for over 2 million inhabitants in the capital city Colombo. The present study was carried out to identify pathogenic bacterial contamination in the groundwater sources of the Kelani river basin. *Shigella* spp., *Salmonella* spp., *Campylobacter* spp., total coliform and feacal coliform were identified along with some physico-chemical parameters of water using standards methods. Seventy two groundwater sampling locations in the river basin were selected for the study during dry and wet seasons. The results showed that the entire Kelani river basin was contaminated with total and feacal coliform bacteria (colony count-200<) and the recorded numbers were greater than the threshold values given by SLS (Sri Lanka Standards) and WHO guideline for drinking water. It was detected that 17 sampling locations were positive for *Salmonella* spp. and two were positive for *Campylobacter* spp. during the study period. It was found that bacterial contamination was high during the dry season. However, *Shigella* spp. was not recorded during the study and serovar identification revealed that recorded *Salmonella spp.* were pathogenic for human. ANOVA test revealed that there is no significant difference between two seasons (0.05<p). Thus, the people and stakeholders within the river basin should aware about groundwater quality and responsibilities to safe guard aquifers of the river basin.

Keywords*: Kelani river basin, Groundwater, Physico-chemical parameters, Shigella spp. Salmonella spp. and Campylobacter spp.*

DETERMINATION OF NUTRITIONAL VALUE OF CYANOBACTERIA AS AN ALTERNATIVE SOURCE FOR FOOD SUPPLEMENT

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Cyanobacteria are biologically photosynthetic organisms inhabiting all over the world including arctic and antarctic region. They are rich with carbohydrates, proteins, vitamins, minerals and fatty acids. Higher photosynthetic ability, rapid growth, low space and nutrient requirement together with low production cost make cyanobacteria are promising candidates for food supplement. Therefore, a preliminary study was carried out to determine the total carbohydrate, total protein content and different sugar types present in different cyanobacteria species. 14 purified axenic strains isolated from different fresh water bodies namely *Limnothrix* sp. (U03), *Cephalothrix komarekiana* (U08), *Limnothrix* sp. (U09), *Synechocystis* sp. (U12), *Croocccidiopsis* sp.(U13), *Calothrix* sp.(U15), *Croococcidiopsis* sp. (U16), *Limnothrix planktonica* (U30), *Limnothrix* sp. (U33), *Geitlerinema* sp. (U36), *Oscillatoria* sp.(U40) *Synechocystis* sp.(U42), *Oscillatoria* sp (U55) and unidentified sp. (U32) were tested. The Dubois method was used to analyze the total carbohydrate content while the Lowry method was used to determine the total protein content. Different sugar types were analyzed using the Laboratory Analytical Procedure (LAP) where High Performance Liquid Chromatography (HPLC) analysis was carried out to determine the presence of different sugar types in the biomass. The highest protein content was recorded in *Limnothrix* sp. (77.33%) while the lowest protein content was in *Oscillatoria* sp. (15.27%). Other samples showed the protein content in the range between 19% to 50%. The highest total carbohydrate content was found in *Limnothrix planktonica* (56.15%) and the lowest in *Synechocystis* sp. (3.85%). HPLC analysis showed that Glucose, Galactose, Xylose, Rhamnose, Fructose and Arabinose were presented as sugars in the tested samples. Glucose was the most common sugar type and found in 8 cyanobacteria samples. Galactose was the second highest sugar type being present in 6 samples. Arabinose was found only in *Chroococcidiopsis* sp. Mannose was not present in any of the tested samples. The study suggested that cyanobacteria can be used as an effective food supplement. Among the cyanobacteria species studied, *Chroococcidiopsis* sp. and *Geitlerinema* sp. can be recommended as the best monosaccharides suppliers. *Limnothrix* sp. containing the highest protein and carbohydrate content and can be recommended as the best alternative food supplement.

***Keywords**: Cyanobacteria, Food supplement, Protein, Carbohydrate, Sugars*

DEVELOPMENT OF "SPICY OIL" WITH ENHANCED HEALTH BENEFITS, TO SUIT SRI LANKAN CUISINE

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Sri Lanka is a tropical country where almost all the spices are grown rich and naturally. Coconut oil is another commodity which could not be neglected in cooking. Spicy oil is an edible oil product which incorporates flavor and aroma compounds of commonly used six spices (Chillie, Garlic, Onion, Clove, Cinnamon and Cardamom) in Sri Lanka, to the Refined, Bleached, and Deodorized coconut oil or Virgin coconut oil. Solvent extraction method was used in extracting flavor and aroma compounds. The extracted compounds from the six different spices and the coconut oil were mixed together to the most preferred and accepted ratio by 32 members of Semi –trained sensory panel in order to make a composite spice and cooking oil mixture. The shelf life of the product was determined by the tests of Moisture Content (MC - %) at 105 ^{0}C, Peroxide Value (PV - meq/kg), Free Fatty Acid (FFA - mg/g 0.1N KOH) , and Microbial tests E.coli ; MPN/ml, Coliform Count (MPN/ml) , Yeast and Mould Count ; (CFU/ml). Saponification Value (SV – mg/g 0.1N KOH), Iodine value (IV), Specific gravity (SG) at 30^{0}C/30^{0}C, Refractive index (RI) at 40 ^{0}C and Relative percentages of fatty acids profile (Gas Chromatography method) were determined to confirm whether the specifications of the spicy oil complies with SLS 32:2002 standard (specifications for coconut oil). Parameter values were MC 0.24, PV 0.9221, FFA 0.2799, SV 263, IV 11.7981, SG 0.918, RI 1.4554. E. coli & Coliform were not detected. Yeast and Mould count increased up to <4 within 4 months of time period. Relative percentages of fatty acids profile; C6:0 - 4.249 %, C8:0 - 1.791 %, C10:0 - 4.793 %, C12:0 - 49.793 %, C14:0 - 19.006 %, C16:0 - 8.192 % , C18:2 - 0.911 %, C18:1 - 6.656%, C18:0 - 4.606 % .Laboratory experimented shelf life of spicy oil was about 6 months according to the determined physical, chemical and sensory properties. The Spicy oil was highly preferred by a semi trained sensory panel.

Keywords: *Cooking oil, Spices, Solvent Extraction, Sri Lankan Cuisine, Shelf Life*

DEVELOPING A PROTOCOL FOR SOMATIC EMBRYOGENESIS OF POMEGRANATE (*Punica granatum* L.)

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In Sri Lanka, the consumer demand for imported variety of Pomegranates (*Punica granatum* L.) is higher than local varieties due to their high qualities. Cultivating these imported varieties in Sri Lanka is a good solution to fulfil this increasing demand in the local market and to reduce the importation of *P. granatum*. For commercial cultivation, availability of high quality planting material with uniform characteristics is very important and micropropagation using somatic embryogenesis is an attractive alternative for mass propagation of *P. granatum.* Hence, this study was carried out in order to develop an efficient somatic embryogenesis protocol for imported variety of *P. granatum* using leaf discs of *in vitro* germinated seedlings as the explants. Seeds from mature, healthy *P. granatum* fruits were surface sterilized with 30% Sodium hypochlorite for 30 minutes and grown in Plant Growth Regulators (PGRs) free Murashige and Skoog's (MS) medium. Leaf disc explants taken from 45 days old healthy *P. granatum* plantlets were cultured in different combinations of PGRs, 2,4-D and BAP with 500.0 mg/L L-Gluamine in MS medium and kept under dark conditions in order to identify the most effective culture medium for callus induction, embryonic callus formation and embryonic callus growth. Among these treatments, MS medium with 1.0 mg/L 2,4-D and 500.0 mg/L L-Glutamine was the most effective medium for embryonic callus formation and embryonic callus growth. MS medium with different combinations of PGRs, 2,4-D and BAP with Casein hydrolysate and L-Glutamine was used to identify the most effective culture medium for maturation of somatic embryos. The treatment with 0.0 mg/L 2,4-D, 0.25 mg/L BAP, 500.0 mg/L L-Glutamine 0.0 mg/L Casein hydrolysate and 30.0 g/L sucrose under dark conditions gave the highest percentage of matured somatic embryos.

Keywords*: Embryonic callus, Micropropagation, Punica granatum, Somatic embryogenesis, Murashige and Skoog's medium*

FORMULATION AND EVALUATION OF *in vitro* ANTI-INFLAMMATORY AND ANTI-OXIDANT ACTIVITIES OF A PHYTO-GEL OF LEAF EXTRACT OF *Murraya koenigii*

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Murraya koenigii (Rutaceae) is a multi-potential medicinal plant that has been extensively used in traditional system of medicine in the treatment of oxidative stress associated chronic diseases including inflammation. Our previous studies showed that, the ethanol leaf extract (ELE) of *M. koenigii* has promising *in vitro* anti-oxidant and anti-inflammatory properties. The aim of the present study was to formulate a herbal based topical gel incorporating ELE of *M. koenigii* and to evaluate *in vitro* anti-oxidant and anti-inflammatory properties of the product. The air-dried, powdered leaves of *M. koenigii* was extracted with ethanol using cold extraction technique. Five gel formulations were prepared using different concentrations (0.2-1.0%, w/w) of, carbopol and the formulation that showed good consistency and stability was selected to incorporate ELE of *M. koenigii*. A market sample of diclofenac gel was used as the reference standard. Physical properties such as pH, viscosity and spreadability were maintained in comparable with diclofenac gel. Anti-inflammatory and anti-oxidant activities of the phyto-gel was evaluated using arachidonate-5-lipoxygenase (A5-LOX) enzyme and xanthine oxidase (XO) enzyme inhibitory assays and DPPH free radical scavenging, ferric reducing anti-oxidant power (FRAP) and oxygen radical absorbance capacity (ORAC) assays respectively. Total Polyphenol Content (TPC) and Total Flavonoid Content (TFC) were also evaluated. The gel formulation having 0.8 % of carbopol showed good spreadability (0.83 cm), consistency, pH (6.86 ± 0.01), and viscosity (45879 cps, 10 rpm, spindle no.10) that are comparable to diclofenac gel (spreadability: 0.75 cm; viscosity: 49038 cps,10 rpm, spindle no.7). The phyto-gel was dark green in colour with a characteristic aroma of fresh leaves of *M. koenigii*. Accelerated stability studies showed that there was no phase separation, no change in odour/colour, pH and spreadability. The phyto-gel showed marked, dose dependent (62.5-1000 μg/ml) A5-LOX enzyme inhibitory (IC_{50}:219.27 ± 7.66 μg/mL) and XO enzyme inhibitory (32.94 $\pm$ 2.46 % at 5 mg/mL) activities with pronounced DPPH free radical scavenging (IC_{50}: 392.67 $\pm$4.10 μg/ml), FRAP (1914.58 ± 2.67 mg trolox equivalents (TE)/100 g of gel) and ORAC (3619.05 ± 54.98 mg TE/100 g of gel) activities. TPC and TFC of the gel were found to be 588.68 ± 4.32 mg gallic acid equivalents (GAE)/100 g of phyto-gel and 437.69 ± 11.52 mg Quercetin equivalents (QE)/ 100 g of phyto-gel. All bio-activities were significant at $p<0.05$. This study indicated that, the formulated phyto-gel may be claimed as a natural anti-inflammatory/anti-oxidant product for dermal applications, which supports the traditional claims of *M. koenigii*.

Keywords*: Phytogel, Murraya koenigii, ethanol extract, anti-oxidant, anti-inflammatory*

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EFFECTS OF DIETARY PROTEIN LEVEL ON THE GROWTH PERFORMANCE OF *Garra ceylonesis* (STONE SUCKER)

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G. ceylonensis is one of the major indigenous fish exported from Sri Lanka, and mainly exported as spa fish. Due to its high export demand, it is important to protect the wild population when meeting the customer demand. Aquaculture practices help to minimize exploitation of wild stock and produce larger stocks. A successful aquaculture depends on nutrient requirements. Proteins are the main organic constituent of fish tissues and it is essential for fish to ingest protein to obtain amino acids to synthesize new proteins for growth or replace existing. This comparative study was conducted to determine the influence of different dietary protein level in formulated diets on their growth performance (body indices of body length & weight) and survival of premature of *Garra ceylonensis* in aquarium condition. Premature G. ceylonensis (Mean standard length, total length and body weight were 2.67±0.05 cm, 3.49±0.05 cm and 3.49±0.01 g) were reared, in nine (three replicates) 45×45×45 cm3 similar glass tanks as 11 fish per tank. Feeding trial was conducted for 60 days and the fish were given either three diets with 25%, 30%, and 35% protein levels using fishmeal as the main protein source with 6% lipid level of sunflower oil for each protein levels. No significant difference of growth, and survival of fish were observed. Specific growth rates (SGR) were 0.0022 ± 0.0006, 0.0021 ± 0.00044 and 0.0034 ± 0.00027. Further Food conversion ratios (FCR) were 7.08±1.83, 5.83 ± 0.72 and 4.21±0.26, and Protein efficiency ratios (PER) were 0.55±0.16, 0.48 ± 0.12 and 0.67±0.26 respectively. Though it was not significant, the food consumption of *G. ceylonensis* had an increasing trend from 6% to 12% (2.81±0.16 as percentage body weight). Mortality of fish was very less in study period. It also visible that Survival Rate % were 94.00 ± 10.5, 94.00 ± 5.24 and 97.00 ± 5.24 which indicated the death assessment.

***Keywords**: G. ceylonensis, Aquaculture, Feed conversion ratio, Specific growth rate, Protein efficiency ratio, growth performance*

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