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18th Academic Sessions

"Together Towards Excellence"

ABSTRACTS

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University of Ruhuna

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Abstracts

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and

17th Vice Chancellor's Awards

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University of Ruhuna

Matara, Sri Lanka

Abstracts

18th Academic Sessions and 17th Vice Chancellor's Awards

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Foreword

It is a great pleasure to send this message to the abstract book of the 18th Academic Sessions and 17th Vice Chancellor's Awards Ceremony - 2021 of University of Ruhuna as the Chairperson. This year sessions are scheduled to be conducted on March 03, 2021 during a time where the COVID-19 pandemic restricts the movement and gatherings of individuals all over the world. "Together Towards Excellence" the theme of the Academic Session harmonized to highlight the togetherness of academic members of the Ruhuna University to face the enormous challenges to run the undergraduate academic programs without any interruption and in organizing the academic sessions during the COVID-19 pandemic. University Academic Session 2021 is jointly organized by the Faculty of Medicine and Faculty of Allied Health Sciences showing our togetherness after the Faculty of Allied Health Sciences was established from the Allied Health Science Degree Program which was initially conducted in the Faculty of Medicine.

Steering committee had to face the dilemma of possibility of conducting the ceremony this year due to the difficulties and limitations aroused due to COVID-19 pandemic. However, with the great commitment and planning of the Steering Committee and Organizing Committee members, Steering Committee had the courage to take the decision to hold the academic session with the participation of the members physically. The appointment of a special organizing committee to look after every aspect of prevention of transmission of COVID-19 infection during the Academic Session was a timely requirement and was very much useful to take decisions regarding the manner the ceremony should be conducted.

It was a pleasing experience to work with Dr. Amaranath Karunanayake from the Faculty of Medicine as the secretory of the Steering committee. He was instrumental in organizing the event in a successful manner. There are historically higher number of 123 abstracts submitted for the academic session this time. I would like to take this opportunity to thank the academic members representing the faculties in the steering committee for encouraging the academics to submit abstracts and the authors for submission of abstracts to the 18th academic session. I must be thankful to the external reviewers and the committee of Senate members appointed to select the oration for this year.

On behalf of the organizing committee of the 18th Academic Session, University of Ruhuna, I am grateful to Prof. Vasantha Devasiri, Dean, Faculty of Medicine for his enormous support rendered for the success of the ceremony. Further, I am glad to express my sincere appreciation to the Vice Chancellor, Snr. Professor Sujeewa Amarasena for his valuable comments, encouragement, support and the approval of funds for the academic sessions giving us the liberty to organize the ceremony at the highest possible scale.

Professor Imendra Kotapola
Chair- 18th Academic Sessions and 17th Vice Chancellor's Award Ceremony - 2021
University of Ruhuna

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Message from the Dean

It is with a sense of satisfaction I send this message to the 18th Academic Sessions and 17th Vice Chancellors award which is the most important annual academic event of the University of Ruhuna. As the dean of one of the oldest faculties in the university, I am more than happy to co host this function with a relatively young faculty in the university sharing our resources. This collaborative event of two faculties involved in training Health Care Professionals is a positive step taken in to develop an environment where various professions can work together to achieve a common goal.

Whatever the faculties and the departments in the universities may have all of them have one common goal. That is the expansion of the horizons of knowledge and development of professional skills. I am sure that this event will contribute in a significant manner to achieve this goal.

The universities are not expected to deviate from this common goal under any circumstances. That is why the Chairperson and the Committee had worked tirelessly to make this event a reality under extremely adverse conditions. I appreciate all the hard work done by the Chairperson and the Committee to make it a meaningful learning experience.

This year it is not only a learning experience confined to academia but also an act of social responsibility with compassionate behavior for safety of all. I am sure that all who participate in this event sharing the knowledge in a responsible manner will remember it for a long time.

I wish this event will be success and a memorable learning experience for all.

Professor Vasantha Devasiri
Faculty of Medicine
University of Ruhuna

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Message from the Vice Chancellor

It gives me great pleasure to send this message to the 18th Academic Sessions and 17th Vice Chancellor's Awards Ceremony, University of Ruhuna. In this year, the ceremony is hosted by the Faculty of Allied Health Sciences and Faculty of Medicine together. This annual event is second only to the Convocation of the University of Ruhuna. The primary objective of organizing this ceremony is to promote research and developmental activities among entire academic, academic support, administrative, non-academic and student community of University. This is the main academic forum of the University, which allows pooling and sharing of the research findings and expertise among each other and providing the excellent platform to promote the academic and research collaborations within the university community.

On the other hand, it is the most prestigious award ceremony for the university academics. At this ceremony, Vice Chancellor's awards are offered under five titles to appreciate the outstanding and exceptional performances of the academic staff members. These awards particularly evaluate the academic and research profiles, pedagogical competencies, inventions, international partnerships and involvements. In addition, intellectual excitement among undergraduates is encouraged for innovations and inventions.

The theme of the 18th Academic Sessions and 17th Vice Chancellor's Awards Ceremony is 'Together Towards Excellence'. This theme is eternally important for all multi-stakeholder academic fora to provide insights and directions towards achieving excellence in teams elaborating the importance of collective efforts of all the stakeholders of the university.

Excellence is a multidimensional concept which encompasses various disciplines. The notion of excellence could be explored in various perspectives such as educational, economic, social, political and etc. The report, 'The Concept of Excellence in Higher Education ' published by the European Association for Quality Assurance in Higher Education in 2014 provides a robust background and guidance to achieve the excellence of a higher educational institution. As it asserts, four paradigms including management, teaching, research, and student performances should be equally addressed, to accomplish the overall excellence. To enhance the quality, all the aspects including curricula, teaching & learning approaches, industrial exposure, international collaboration and partnerships, research and the accountability of the outcomes are critical.

The excellence in management of the university is crucial in strategic planning and achieving the vision and mission. Several drives are required to achieve management excellence. These include rational decision making, strict execution policies and regulatory mechanisms, good governance, establishing the transparency of managerial processes, managing the external partnerships and internal resources. The teaching excellence is also quite important for the quality and the standard of a university. The pedagogical competencies of the academic staff and their continuous professional development are key factors to enhance the teaching

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excellence. The updating curricula and student centered teaching approaches are also significant. The research profile of a university plays a vital role in its pursuit for excellence. An atmosphere for intellectual curiosity should be created within the university to promote cutting edge research among both academics and students. The quality, originality, significance, applicability and dissemination are the major elements of excellent research.

On the other hand, students should be equipped with demonstrable ability to perform, achieve and excel in scholastic activities. Excellence in student performance is a broader concept rather than achieving higher grades. It essentially deals with stimulating their intellectual and personal growth both in terms of theoretical and practical context. Students' ability to approach for real world questions critically, ethically, and creatively is an indicator of the excellence of the student performances.

Sir Ivor Jennings, the first Vice-Chancellor of the University of Ceylon stated that "A University is a community with a life and spirit of its own". As a community we should work together to achieve excellence. All the stakeholders are responsible to contribute and accomplish the task. Enhancing quality and excellence of a university is a multilevel effort. The way towards the excellence is not easy. It requires strategic decisions and controversial system changes to modify the traditional outdated institutional setup.

We need to believe that, nothing is impossible, although difficult and challenging. Simply, we need commitment, hard work and dedication and most importantly the togetherness to pursue the excellence."Together Towards Excellence!". COVID-19 pandemic has given us that opportunity to pursue the target.

I profoundly appreciate the enormous effort of the organizing committee including the Deans of the Faculty of Allied Health Science and Faculty of Medicine in organizing this ceremony while overcoming the challenges of the COVID-19 crisis.

I would like to extend my warmest greetings to the Academic Sessions and Vice Chancellor's Awards Ceremony 2021 of University of Ruhuna and eagerly look forward to witness the most awaited award ceremony of the University of Ruhuna.

I congratulate all the Vice Chancellor's awards winners.

Senior Professor Sujeewa Amarasena
Vice chancellor
University of Ruhuna

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Conferment of Emeritus Professorships

Prof. R. Senaratne
Faculty of Agriculture

Prof. S.G.J.N. Senanayake
Faculty of Agriculture

Prof. C. Liyanage
Faculty of Medicine

Prof. M. Weerasooriya
Faculty of Medicine

Prof. W.G.D. Dharmaratne
Faculty of Science

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Receipents of the 17th Vice Chancellor's Awards- 2021

The Most Outstanding Scholar
Dr. N.M. Wickramage
Faculty of Science

The Most Outstanding Young Researcher
Dr. A.B. Sirisena
Faculty of Management and Finance

The Highest Recipient of Grants
Dr. S.M. Kumari
Faculty of Science

The Most Outstanding Promoter of International Relations
Prof. K.H.M.A. Deepananda
Faculty of Fisheries and Marine Sciences & Technology

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Receipents of the Best Presenter Awards – 17th Academic Sessions 2020

Best Presenter (Oral) of Technical Session: Agriculture and Environmental Science
Dr. D. Gamage, Faculty of Agriculture

Best Presenter (Oral) of Technical Session: Humanities and Social Sciences
Dr. N. Keembiyahetti, Faculty of Humanities and Social Sciences

Best Presenter (Oral) of Technical Session: Language, Religion and Literature
Dr. A.A.R. Priyanka, Faculty of Humanities and Social Sciences

Best Presenter (Oral) of Technical Session: Management and Entrepreneurship
Mr. G.K.C. Jeewantha, Faculty of Management and Finance

Best Presenter (Oral) of Technical Session: Mathematics, Engineering and Technology
Mr. P.H.P.N. Laksiri, Faculty of Technology

Best Presenter (Oral) of Technical Session: Medicine and Allied Health Sciences
Mrs. K.G.P. Wasana, Faculty of Medicine

Best Presenter (Oral) of Technical Session: Science, Fisheries and Aquatic Sciences
Dr. S. Wanniarachchi, Faculty of Science

Best Presenter (Poster) of Technical Sessions
Dr. M. Fernando, Faculty of Agriculture
Dr. K.A.S. Kodikara, Faculty of Science

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Keynote Speech

Building a Research Culture in Sri Lanka

Professor Shaman Rajindrajith

Faculty of Medicine, University of Colombo

Research is defined as the generation of new knowledge by systematically and rigorously collecting and analyzing information about a topic of interest and documenting the outcomes for others to read. It is believed and expected that distinguished universities must promulgate research and research culture which perseveres their formal right to be the gatekeepers of the future. Therefore it is believed and expected while providing priority for teaching undergraduates, all universities and faculties should encourage their students and teachers to conduct research both with national and international collaborations. In this context, building a research culture in which research is thriving is of utmost importance.

Currently, the track record of Sri Lanka as a nation in the arena of research is not very impressive. The country is placed at 78 in the worldwide ranking in medical research. Among Asian countries, Sri Lanka is placed at 16th place where China, Japan, and India are leading, and Bangladesh, Nepal, and the Philippines are above us. As a country, our contribution to global medical research comprises mainly through case reports and letters. Therefore, it is evident that Sri Lankan contribution to global medical research is a small fraction, and the necessity to build and promote the environment and a culture where research is thriving is urgently needed.

Building a research culture is a daunting task. It is mainly because the majority, even among university academics, do not see the value of research. In addition, time constraints due to teaching and administrative tasks, limited research experience, lack of resources, and not having adequate funding are other contributory factors. However, it is possible to overcome all these barriers through a properly held futuristic vision at the level of the Universities by planning at least five years ahead to boost their researchers. At the individual level, each university teacher should restructure their way of thinking of the value of research. University teachers should develop a strong desire to find the way forward to overcome barriers and become an advantageous position as a researcher.

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Oration

Menopause: A significant milestone in women's life

Dr. R.H.M.P.N. Rathnayake

Faculty of Allied Health Sciences, University of Ruhuna

Introduction

Menopause is a natural process that every woman experiences due to the age-related gradual decline of primordial ovarian follicles, defined as 12-months amenorrhea after the final menstruation (WHO, 1996) with no other attributable cause.

In 1990, there were around 467 million women aged ≥50 years in the world. This number is expected to be increased to 1200 million by the year 2030 (von Mühlen et al., 1995). Align with the world figures, in Sri Lanka, nearly one fourth of women population is over 50years (Department of Census and Statistics, 2014), thought to be are postmenopausal. This number is expected to increase with the advancement of health technology and inventions. Further, worldwide the life expectancy of women is increasing and in most countries, women have to live approximately more than one third of their life after menopause. Apart from that, hormonal changes at menopause create a multitude of structural and functional changes in postmenopausal women (PMW) that have the potential to progress into debilitating chronic diseases and functional disabilities (Atapattu, 2015) in later life. Hence, health and wellbeing of PMW has become an essential component in contemporary healthcare system.

The healthcare of women in menopause requires special attention to identify their health needs to provide competent care. Therefore, identification of irritable menopausal symptoms (MSs), their severity and menopause specific quality of life (MENQOL) is vial (Kothiyal and Sharma, 2013). Menopause rating scale (MRS) (Schneider et al., 2002) and MENQOL questionnaire (Hilditch et al., 1996) have been considered as the most common tools used to assess MSs and MENQOL in PMW. Furthermore, evaluation of lifestyle with health promoting behaviors (HPB) is also important when considering certain disease conditions encountered by PMW. Health Promoting Lifestyle Profile-II (HPLP-II) (Walker et al., 1987) is widely used to measure women's HPBs in many societies to lay the foundation for health promotion activities.

Apart from the MSs and MENQOL, the menopause has multi-organ effect, including changes of anthropometry indices (AIs), especially the anthropometric adiposity indices (AAI) such as body mass index (BMI), waist and hip circumference (WC, HC), and skinfold thickness (SFT) (Mahran et al., 2009), cardiovascular diseases risk (CVDR) indicators, (Papadopoulou and Kaski, 2013), significant changes in structures such as skeletal-muscle-mass (SMM), bone-mineral-density (BMD), bone-mineral-content (BMC) and fat-mass (FM) (Maltais et al., 2009). Furthermore, functional changes such as muscle function especially muscle strength and

physical performance (PP)) are also seen (Kurina et al., 2004). Therefore, consequences such as cardiovascular diseases (CVD), metabolic disorders, obesity, osteoporosis and sarcopenia are seen mostly among the women after menopause. In overall, these consequences of menopause directly affect on impaired health related quality of life (HRQOL) (Waidyasekera et al., 2009) in later stages of life.

Impairment of health and HRQOL in women in their advanced ages has greater social and economic impact. Therefore, health promotion to enhance overall health and wellbeing of PMW have become a major global public health concern (Greendale and Gold, 2005). Hence, health education with adequate knowledge, skills, behaviors and attitude adjustments is a primary strategy of health promotion for PMW (Tiznobaik et al., 2012).

Improving HRQOL and health standards of PMW is imperative for the empowerment of individual PMW in Sri Lanka, for achieving optimum health standards since PMW provide valuable contributions as active labor force and bearing many responsibilities in the extended family system.

Aims and Objectives

Based on this background, the study series presented here are planned in three phases. The overall aim of this presented work was to enhance the health and health standards of women after menopause to achieve the successful old-age and optimum HRQOL.

Phase 1

To validate the tools important to evaluate the health outcomes of women after menopause; cross-cultural adaptation of MRS, MENQOL questionnaire and HPLP-II questionnaire and assess the applicability of the tools in assessing MS severity, MENQOL and HPB of Sinhalese PMW

Phase 2

To determine the effects of menopause on bodily structure, functions and physical health; differences in AI, CVDR and body composition and the influence of such differences on bodily functions and physical health in premenopausal women (PrMW) and PMW

Phase 3

To promote the health of PMW through health promoting lifestyle modifications; impact of a health promoting lifestyle modification education intervention (HPLEI) on the general physical health status and HRQOL in PMW

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Methods

The series of studies were carried out at the Faculty of Medicine, University of Ruhuna after obtaining the ethical clearance from Ethics Review Committee, Faculty of Medicine, University of Ruhuna.

A methodological study to validate three tools, that assessed psychometric properties of MRS, MENQOL questionnaire and HPLP-II with the participation of PMW aged 40-60years, a cross-sectional component that compared bodily structure, functions and physical health between PrMW and PMW aged 30-60 years, and a quasi-experimental study that evaluated the impact of HPLEI on health status and HRQOL of PMW were carried out.

All women were selected randomly from Bope-Poddala medical officer of health (MOH) area, Galle district, Sri Lanka. The statistical analyses were performed using SPSS version 20 and p value <0.05 was considered as a statistically significant.

Phase 1 - Validation of tools important to evaluate the health outcomes of women after menopause

Methods and materials

A standard methodology was followed for cross-cultural adaptation of questionnaires including forward-translation, backward-translation, focus group discussions, reviewing by experts and pre-testing.

The finalized Sinhala versions were administered among randomly selected groups of PMW along with Short form-36 survey (SF-36) with MRS (n=166) and HPLP-II (n=245), and validated MRS with MENQOL questionnaire (n=200). The questionnaires were re-administered among subsamples of women selected from groups (MRS=80, MENQOL=100 and HPLP-II=105) after 2-weeks from first administration.

Psychometric properties of the tools including; test re-test reliability (using intra class correlation (ICC)), internal consistency with Cronbach's alpha, construct validity (using factor analysis (FA) under principle component analysis (PCA)) and concurrent validity (using Pearson correlation coefficient; r) were evaluated.

Results

Study 1 - Validation of MRS

Higher test-retest reliability was observed; ICC; 0.93 (95% CI; 0.87-0.97). MRS showed a higher internal consistency with global Cronbach's alpha of 0.74. FA revealed the presence of three factors with Eigen value exceeding 1, explaining cumulative variance of 59.82%. The correlation observed between the MRS and SF-36 scores was higher; r;-0.53 ($p<0.001$), indicates strong concurrent validity (Rathnayake et al., 2018a).

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Study 2 - Validation of MENQOL questionnaire

Higher test-retest reliability was observed; ICC; 0.93 (95% CI=0.86-0.97). MENQOL questionnaire showed a higher internal consistency with global Cronbach's alpha of 0.95. FA revealed the presence of seven factors, explaining 77.11% of cumulative variance. Correlation observed between the overall MENQOL and overall MRS scores was significantly higher; r; 0.76 ($p<0.001$) assuring the concurrent validity (Rathnayake et al., 2021a).

Study 3 - Validation of HPLP-II

The test-retest reliability was higher, ICC; 0.98 (95% CI=0.97-0.99) and a higher internal consistency with global Cronbach's alpha of 0.98 was observed. FA revealed the presence of seven factors, explaining cumulative variance of 80.65%. Correlation observed between the health responsibility score of HPLP-II and physical health dimension score of SF- 36 (r;0.75, $p<0.001$) and spiritual growth score of HPLP-II and psychological health dimension score of SF-36 (r;0.63, $p<0.001$) were higher indicating strong concurrent validity (Rathnayake et al., 2020a).

Conclusions

The Sinhala version of the MRS, MENQOL questionnaire and HPLP-II questionnaire cross-culturally adapted were valid, practical and well-accepted by Sri Lankan Sinhala speaking PMW.

Phase 2 - Determination of effects of menopause on bodily structure, functions and physical health

Methods and materials

Among the 18 public health midwifery (PHM) division of Bope-Poddala MOH area, Galle, 05 PHM divisions were selected randomly. Then, randomly selected, community-dwelling healthy 184 PrMW and 166 PMW aged 30-60years were recruited. The presence and severity of MS and HRQOL were evaluated using MRS and SF-36 respectively. The PA level was estimated with the International Physical Activity Questionnaire short-version and consumption of nutrients was evaluated with a 24-hour dietary recall.

AI; body weight (kg) and height (m) were measured with calibrated Stadiometer (NAGATA, Tainan, Taiwan), central and limb circumferences (cm) were measured with plastic non-stretchable measuring tape and SFT (mm) were measured using a skinfold caliper (Skinfold caliper - Holtan Ltd, UK). BMI (kg/m2) and waist to hip ratio (WHR) were calculated.

Central-type DXA scanner (Hologic Discovery W, Hologic Inc, Bedford, MA, USA) was used to measure the SMM (kg), BMD (g/cm3), BMC (g) and FM (kg) adhering to the manufacturer's protocol.

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Hand grip strength (HGS, kg) of the dominant side was measured using the Lafayette hand held dynamometer (Lafayette Instrument Co. Ltd, Sagamore Parkway North, USA) as the muscle strength index. The time taken to walk the 4-meters was measured to detect the GS (m/s) as the PP index. Systolic and diastolic blood pressure (SBP and DBP, mmHg) were measured using sphygmomanometer (BOKANG Instrument Co. Ltd, China, CEO 197). Fasting insulin (FI, µU/mL), serum estradiol (pg/mL) and vitamin-D (25-hydroxyvitamin-D(25(OH)D) (nmol/l) levels and fasting blood sugar (FBS, mg/dl), total cholesterol (TC, mg/dl), triglyceride (TG, mg/dl) and high-density lipoprotein (HDL, mg/dl) were analyzed. Low-density lipoprotein (LDL, mg/dl) and Framingham risk score (FRS) and homeostatic model assessment of insulin resistance (HOMA-IR) were calculated.

Independent sample t-test, Chi-square test of independence or the Fisher's-exact test, Correlation and Regression analysis tests were used for data analysis.

Results

Differences in structural and functional changes between PrMW and PMW

PMW were shorter and their central SFT (suprailliac), WC and HC were greater ($p<0.05$). However, limb circumferences and SFT were higher among PrMW ($p<0.05$). Among the CVDR indices; FBS, HDL, HOMA-IR, SBP and DBP ($p<0.05$) and overall 10-year CVDR measured with FRS ($p<0.001$) were higher in PMW (Rathnayake et al., unpublished manuscript 1).

SMM in appendicular region (ASMM) and total body (TSMM) were higher in PrMW compared to PMW ($p<0.001$). Total and regional BMDs and BMCs of different skeletal sites were higher in PrMW compared to PMW ($p<0.001$). FM in total body (TBFM) and trunk region (TrFM) were higher in PMW; however, the differences were not significant ($p>0.05$). Only the total-body-fat-percentage (TBFP) and TrFM were significantly higher in PMW ($p<0.001$) compared to PrMW (Rathnayake et al., 2020b).

Muscle strength and PPs measured as HGS and GS were higher in PrMW compared to PMW ($p<0.001$).

Prevalence of obesity and cardio-metabolic disorders in PrMW and PMW

Prevalence of generalized overweight and obesity based on Asian BMI thresholds between PrMW (66.8%) and PMW (68.7%), central obesity based on WC between PrMW (61.4%) and PMW (62.0%) and central obesity based on WHR between PrMW (78.8%) and PMW (75.9%) were not different ($p>0.05$). However, TBFP based generalized obesity prevalence was higher in PMW (88.6%) compared to PrMW (77.7%) ($p=0.007$) (Rathnayake et al., 2019a; Rathnayake et al., 2020c).

The incidence of diabetes mellitus, hypertension, hypercholestremia, metabolic syndrome and insulin resistance was higher in PMW ($p<0.05$). Almost all PrMW were at low risk level when the 10-year CVDR evaluated through FRS (%). Only 3.6% (n=6) of PMW were at intermediate risk while other PMW were in low risk level ($p=0.009$).

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Prevalence of sarcopenia and factors associated with measures of sarcopenia in PrMW and PMW

Pre-sarcopenia, sarcopenia and severe-sarcopenia prevalence among PMW was higher (4.2%, 3.0% and 1.2%) compared to PrMW (1.0%, 1.0% and 0.0%) ($p>0.05$) (Rathnayake et al., 2019b) based on the cutoff Sri Lankan cutoff values for main three measures of sarcopenia [muscle mass, muscle strength and PP measured as relative appendicular SMM (RSMI), HGS and GS respectively].

BMI, HGS, TBFM and weight showed significant associations with RSMI in PrMW (adjusted $R2=0.85$) while BMI, weight, TBFM, HC and FI were associated with RSMI among PMW (adjusted $R2=0.80$) (Rathnayake et al, 2018b, Rathnayake et al., 2019c, Rathnayake et al., 2021b).

ASMM, total-body-BMC (TBBMC), vigorous PA score, age and weight showed significant associations with HGS in PrMW (adjusted $R2=0.33$) while ASMM and height showed significant associations with HGS in PMW (adjusted $R2=0.23$) (Rathnayake et al., 2021b).

GS in PrMW showed significant associations with height, BMI and energy consumption (adjusted $R2=0.13$) while in PMW, carbohydrate consumption and total-body-BMD (TBBMD) showed significant associations with GS (adjusted $R2=0.11$) (Rathnayake et al., 2021b).

Prevalence and severity of MSs, HRQOL and factors associated with HRQOL of PrMW and PMW

Prevalence and severity of MSs were higher among PMW ($p<0.001$) while overall HRQOL was significantly impaired among PMW ($p<0.001$) (Rathnayake et al., 2017, Rathnayake et al., 2019d).

Psychological and somato-vegetative symptoms scores and GS were associated with HRQOL of PrMW (adjusted $R2=0.36$). In PMW, somato-vegetative and psychological symptoms scores, GS, vigorous and moderate PA scores and monthly income were responsible for HRQOL (adjusted $R2=0.42$) (Rathnayake et al., 2019d).

Conclusions

Most of the changes of bodily structure, functions and general physical health status including the HRQOL were different between PrMW and PMW indicating the effect of menopause on these measures.

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Phase 3 - Promotion of health of PMW through health promoting lifestyle modifications

Methods and materials

The study was carried out with PMW. Of the 05 PHM divisions taken in phase 2, two divisions were selected randomly for the "experimental group" and another two geographically separated PHM divisions were selected randomly for the "control group" to minimize the contamination. One PHM division was excluded from this intervention. The two PMW groups were matched for age, age at menopause, time since menopause and socio-demographic status. Consenting women educated at least up to grade 5, time since menopause ≥2 to ≤ 7years, physically and mentally healthy were included in the study. Finally 37 women from the experimental group and 35 women from the control group completed the study (n=72).

A health education package was designed with the contributions of a group of experts including gynecologist, physician, nutritionist and sport physician using the culturally acceptable content in simple language. It was based on MS management, healthy diet, healthy physical exercises and spiritual support, individualized to each participant. HPLEI comprised of 8-weeks health education sessions and 6-months follow-up. Health education included 8-sessions focused on lifestyle modifications were carried out based on the package and printed health education package was provided at the end of the training for the experimental group. All the sessions were conducted as a group activity with session duration of 1-hour.

After 8-weeks of education sessions, the women in experimental group were invited to follow the given guidelines and they were followed-up strictly for 6-months period. The control group was not exposed to any planned education programme allowed them to proceed with their usual lifestyle during this period, however maintained contacts with them regularly.

Knowledge, attitude, HPB, MS severity, MENQOL and HRQOL were observed in both experimental and control groups, separately at the baseline (Evaluation-1), after 8-weeks from baseline (immediately after the education programme of experimental group; Evaluation-2) and after 6-months follow-up (Evaluation-3), by administering the Knowledge and Attitude questionnaire, HPLP-II, MRS, MENQOL questionnaire and SF-36 Survey. AAI, CVDR indicators, muscle strength and PP were evaluated before the intervention and 6-months after the follow-up.

Repeated-Measures ANOVA test and paired sample t-test was used to detect the differences of changes of parameters evaluated in different evaluations.

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Results

Changes of knowledge, attitude, HPB, MS severity and MENQOL and HRQOL

Knowledge and attitude scores increased in the experimental group during the HPLEI ($p<0.001$). In the control group, while a marginal increase in all dimensions of knowledge scores was seen, scores related to attitude remained unchanged (Rathnayake et al., 2020d). All the subscales scores of HPB were higher at the end of intervention when compared with baseline values ($p<0.001$) in the experimental group. In the control group, increased, decreased and unchanged scores were seen (Rathnayake et al., 2019e).

In the experimental group, all the MS scores showed a reduction at the end ($p<0.001$). In the control group, however, these MS scores increased with time ($p<0.001$) (Rathnayake et al., 2019e). All MENQOL scores decreased during the follow-up in the experimental group ($p<0.001$) except the sexual domain ($p=0.32$). However, scores increased in the control group ($p<0.001$) with time (Rathnayake et al., 2020b). HRQOL scores increased ($p<0.001$) in the experimental group during the study period while in the control group, HRQOL showed a reduction ($p<0.05$) (Rathnayake et al., 2020d).

Changes of structural and functional indices; muscle strength and PP, AAI and CVDR indicators

HGS and GS improved ($p<0.001$) at the end of intervention in experimental group. However, in control group, HGS did not change with time ($p=0.52$) and GS deteriorated ($p<0.001$) (Rathnayake et al., 2019e).

All the measured AAIs showed a reduction ($p<0.05$) in the experimental group whereas in control group, they were increased ($p<0.05$) at the end of intervention. In the experimental group, SBP, DBP and FBS showed a significant reduction at the end ($p<0.05$). Lipids; total cholesterol and triglycerides were also reduced, however, there was no significant difference between the two evaluations ($p>0.05$). In the control group, SBP and DBP increased significantly at the end ($p<0.05$) (Rathnayake et al., 2019e).

Conclusions

HPLEI was positively influenced on improving knowledge, attitude and adherence to HPB, improving of MSs severity, MENQOL, AIs, CVDRI, muscle strength and PPs in PMW that lead to enhanced HRQOL.

Overall Conclusions

The Sinhala version of MRS, MENQOL questionnaire and HPLP-II questionnaire were valid, practical and well-accepted by Sri Lankan PMW. Most of the changes of bodily structure, functions and general physical health status including the HRQOL were different between PrMW and PMW indicating the effect of menopause on such measures. The HPLEI was effective in improving general health status and HRQOL of PMW.

This information is important to empower the Sri Lankan middle-aged and geriatric women to achieve optimum health standards. All subjects were long-term residents of Galle district and the study area has socioeconomic indices such as poverty, mortality, literacy, life expectancy at birth and ethnic composition comparable to the entire country according to the data from the Department of Census and Statistics, Sri Lanka (www.statistics.gov.lk). Hence, findings can be generalized to the entire women population in the country.

Validated tools could be incorporated into the clinical practice and community screening of PMW in health planning and management. Significant changes associated with the menopause specially the changes of AI, SMM, BMD, BMC and FM and the functions including muscle strength, PPs and cardiovascular functions should be properly addressed and preventive strategies should be taken promptly. Health education based on health promoting lifestyle modifications can be used as an effective, clinically manageable therapy for women to improve their health status and HRQOL. Because, it is burden free, economical, simple strategy to enhance the HRQOL and health standards of community.

Since Sri Lanka is still a low-middle income country, it requires cost effective simple strategies yet highly effective for health management of people. Therefore, the findings of this series of studies are important to empower the Sri Lankan women to achieve higher health standards and make them more productive by achieving optimum health status without making a burden to the country's economy.

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Assessment of Pain in Frisian Dairy Cows Reared in Two Upcountry NLDB Farms as Relief from Pain an Indicator of Welfare

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Dairy cows are attended to painful situations either under natural circumstances or management practices. However, pain assessment was not much focused for research. Objective of the study was to get an understanding of occurrence, persistency and associated behavioural changes of and relief from pain induced under natural and on farm management practices.Study was conducted in Bopaththalawa and Manikpalama NLDB farms. Randomize Complete Block Design was adopted. Blocking was done against cow category; calves, heifers, dry cows (DC) and milking cows (MC). Animals those attended pain were purposively selected and identified the causes of pain. In Bopaththalawa farm, calves, heifers , DC and MC (n=171) were assessed for natural pain while for hoof trimming; HT (n= 22) and all for milking. In Manikpalama, calves , heifers , DC and MC (n=228) were experienced natural pain where HT (n=34), dehorning (n=7) and all were assessed for milking. Normal behaviours and behaviours upon induction of pain were assessed by following scan sampling method with direct visual scans at 15 minutes' intervals for 2 hrs. Behaviors observed were; standing, resting, freezing, walking, lying, eating, animal interaction, body shaking, drinking, urination, fecal discharge, running, rumination, kicking, licking own body, licking others, sniffing, lameness and restless. Farm averages for normal behaviors indicated that first, second and third highest behaviors for standing (37%), lying (17%), running (15%) by MC and standing (25%), resting (15%) and walking (12%) by calves respectively. Milking and HT showed significant ($p<0.05$) increase of pain related behaviours. Monitoring changed behaviours in relation to artificial insemination and vaccination were difficult as persistent time was comparatively short. Persistency of pain related to diarrhea in calves was comparatively longer. It is concluded that the calves and milking cows are more frequently attended pain compared to heifers and dry cows. Further research are suggested to investigate different precautions to relief these animals from pain to ensure welfare.

Keywords: Friesian cows, NLDB, Pain,Upcountry farms, Welbeing

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Effects of Dietary Yeast Cell Wall Supplementation on Growth Performance and Feed Cost of Broilers

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Use of sub-therepeutic levels of antibiotics as dietary growth promoters for broiler production has been banned in many countries, including Sri Lanka due to human and environmental health risks. Consequently, search for safe and cheap alternatives to antibiotic growth promoters (AGP) has become a top most research and industry priorities. Yeast (*Saccharomyces cerevisiae)* cell wall (YCW) has been proposed as an alternative growth promoter. This experiment evaluated the effects of dietary YCW on growth performance, feed cost, nutrient retention, serum cholesterol level, ileal microbial count and meat organoleptic properties of broilers. Further the study tested whether YCW has toxin binder (TB) sparing effect. The experiment followed a completely randomized design. There were 7 dietary treatments comprising various combinations of dietary YCW (0, 0.5, 1.0 and 1.5 kg/ton), a commercial growth promoter (GP) (with GP, +GP; without -GP) and a commercial TB (with TB, +TB; without -TB). Treatments were; (i) negative control (TB-,GP-,0 YCW) , (ii) TB,GP,0.5 kg/ton YCW, (iii) TB,GP, 1 kg/ton YCW, (iv) TB,GP, 1.5 kg/ton YCW, (v) TB,GP, 0 YCW, (vi) +TB, GP+, 0 YCW and (vii) TB,GP, -0 YCW. Each treatment had 6 replicate pens of 15 birds. Experimental diets (starter and finisher) were fed from 12 to 44 days of age. Two randomly selected birds from each pen were dissected on day 38 to determine visceral organ weights. Serum and ileal digesta samples were taken and assayed to determine the lipid profile and bacterial count, respectively. A three-day total collection trial was conducted to determne the retention of protein, dry matter and ash. A sensory evaluation on cooked breast meat samples was carried out by 30 untrained panelists. Treatments had no significant effects on live weight on day 44, weight gain and feed conversion ratio (FCR). Weight gain of the broilers fed diets with YCW (1655±11g) was not statistically different from those fed commercial growth promoter (1651±9.3g). Serum lipid profile, ileal bacterial count, nutrient retention, litter N contents and meat organoleptic properties (taste, aroma, color, appearance, overall aceptibility) were also not affected by the treatments. YCW did not report toxin binder sparing effect. Birds fed with TB,GP, 1 kg/ton YCW diet reported the lowest feed cost per bird (262.7 Rs). The study concluded that dietary YCW was as effective as the tested commercial growth promoter in improving the weight of broilers. Considering FCR and feed cost, the study recommends 1 kg of YCW/ton as an effective growth promoter for broilers.

Keywords: AGP, Broiler, Growth, Yeast

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Nuclear Types on the Basidiospores and Mycelia of Edible Mushroom *Oudemansiella aparlosarca* and It's Influence on Basidiospore Diameter

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The *Oudemansiella aparlosarca* is an edible fungi commonly called as Gilly mushroom preferred by consumers for its pharmaceutical properties. Even though there were many reports on cultivation strategies of *O. aparlosarca*, very rare studies have been performed on nuclear types and genetics. Therefore, this study aimed to identify nuclear types in basidiospores, homokaryotic and heterokaryotic mycelia, and find the influence of nuclear types on basidiospores diameter of *O. aparlosarca*. The two parent strains; strain-55, and strain-81 were used in this study and maintained for fruiting body production. Single spores were isolated from spore suspensions. The basidiospores and mycelia were stained and observed under the UV fluorescence microscope. The study showed four kinds of nuclear types on basidiospores, and homokaryotic, heterokaryotic mycelia that included non- nuclear type, mono nuclear type, bi nuclear type, and multi nuclear type of nucleates. In both studied strains, the bi- nuclear type of spores was dominantly observed and the occurence of non- nuclear type of spores was lower than the other nuclear types of spores. The highest spore diameter size was observed in multi nuclear type of sporesand it was 14.78 μm in both of the parent strains while the lowest diameter size of spores was observed in non- nuclear type, and the average sizes were 11.52 μm and 12.15 μm in parents strain-81 and strain-55, respectively. Bi nuclear type was vastly presented in heterokaryotic mycelia, and the multi nuclear type was high in homokaryotic mycelia. The observed binuclear type of spores could be the result of post-meiotic mitosis and most of them are heterokaryons. The diameter size of basidiospores increased with the number of basidiospores nuclei. We concluded that *O. aparlosarca* contains homokaryotic and heterokaryotic basidiospores which revealed an amphithallic life cycle.

Keywords: Life cycle, Nucleate types, Oudemansiella aparlosarca, Single spores

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Effect of COVID-19 on the Education of School Children: A Case Study in Mulatiyana Educational Zone, Sri Lanka

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With the closure of school doors, school children from privileged backgrounds ought to find alternative learning opportunities during the COVID-19 pandemic situation. The lockdown in COVID-19 catastrophe has interrupted the conventional learning in the education system in Sri Lanka. While the government has made concerted efforts to keep learning continuity, students have to depend on their own resources to continue learning remotely. Even though free education assures equal rights to all students, the current crisis seems to cause inequalities in the education system. Therefore, the present study aimed to examine the influence of COVID-19 pandemic on the education of Advanced Level students and ascertain the barriers on their online-education system. Data were primarily collected through a questionnaire survey conducted by the purposively selected 84 Engineering Technology students where their subjects are mainly focused on practical components. The study was conducted in the Mulatiyana Education zone in Sri Lanka as it is an area of limited resources towards online learning. Research findings indicated that only 50% of the students have mobile phones (μ=1.56, SD=0.499) and 44% have personal computers (μ=1.50, SD=0.503) for online access. 88% of the students have engaged with different learning methods while 77% have used online learning as their learning method during the outbreak (w=4.495, p=0.000). Among the students, 48% showed their higher consent to use mobile apps. Most of the students (39%) who engaged in online learning have the capacity to learn 2 hours per day. Results revealed that 59% of the students have satisfied with the online learning. Key barriers identified for the students during online learning were lack of devices (μ=1.66, SD=0.434), network issues (μ=1.75, SD=0.434), lack of digital skill (μ=1.75, SD=0.438) and undesirable weather conditions (μ=1.90, SD=0.307). Therefore, identified problems must be taken into the consideration in designing future online classes in an effective manner.

Keywords: Advanced level students, COVID-19, Online learning

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Undergraduates' Perception towards Online Learning During the COVID-19 Outbreak - A Study at Faculty of Agriculture, University of Ruhuna

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The nobility of online learning influence on multiple aspects particular in the higher education sector considering the ongoing COVID-19 pandemic catastrophic. The booming online learning systems have taken a headway providing a compatible solution for educators an opportunity to implement the use of technology during the lockdowns period for covering the essential course work. The responsible parties are making considerable efforts to optimally utilize the available online learning technology for continuing the process of education and diminishing the gaps that are going to result as a consequence of the current surroundings. However, the perception of the main affected party has not adequately explored yet in the existing literature, in particular with respect to the Sri Lankan context. Therefore, this study was conducted to explore the perception of undergraduates of Agriculture towards online learning during the pandemic. Through an online survey consisting 334 students out of 760 purposively selected students, resulting in a response rate of 44%, the study assessed the preferences of students towards different attributes of online classrooms, perception of online learning and benefits and drawbacks students faced engaging in online learning during the pandemic. Descriptive statistics were used to analyse the data. The study revealed that majority of the students (49%) are satisfied with online learning and they want to recommend it to others (45%) and make online learning a part of the academic curriculum in future (87%). The laptop was the first choice of device for the majority of students (56%) for online learning. Majority of the students wanted to arrange the online classes as per the schedule to the complete the semester (41 %) on weekdays (87%) during late morning (49%) from 8- 10 am {(55%, theory), (47%, practical)} with a duration of 1.5 hours (38%). However, majority of the students (41%) have faced a lack of connectivity/network issues as their main problem during the pandemic. Therefore, the study suggests to match positive attitude of students towards online learning with preferred time and device attributes while addressing the identified barriers in achieving a productive online learning environment to students in future.

Keywords: COVID-19, Online learning, Undergraduates

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Temporal and Spatial Variation of Irrigation Water Quality in a Tank Cascade System in Thanamalwila, Sri Lanka

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A tank cascade is a hydro-ecological system consists of interconnected series of tanks located in a micro catchment. This system plays a major role in irrigation as an efficient water conveyance network in the dry zone of Sri Lanka. Due to the interconnected nature of these systems, there is a risk of accumulating a high level of agricultural pollutants such as inorganic fertilizers, pesticides, other agro-chemicals and sediments in lower (tail) tanks. These pollutants can harm crop production, aquaculture, the environment and ultimately human health. Hence, a study was conducted to assess and compare temporal and spatial water quality parameters in selected tanks of a small cascade system in the Kirindi oya basin in Thanamalwila Four tanks namely Sinhalayagama tank, Maha tank, Jambugas aara tank and Bagmuwa tank from upper, middle and the lower part of the cascade were selected to assess the spatial variability of nutrient dynamic from head to tail. Hydro-chemical parameters such as pH, electrical conductivity (EC), nitrate nitrogen (NO_3^--N), ammonium nitrogen (NH_4^+-N), phosphates (PO_4^{3-}), and alkalinity, were tested before and after the monsoonal rainfalls. In the dry spell, the pH of the tank water was higher indicating increased alkalinity level than in the wet season. The spatial variability maps showed that pH level of the tank water has increased from head to tail of the cascade system. The variation of salinity increment along the cascade system was clearly noticeable during the dry period. Bagamuwa tank which is in the tail of the cascade system had the highest EC values since it was greater than the maximum permissible level of 2250 µS/cm, indicating quality of the water is unsuitable in dry spell. Further, NO_3^--N and NH_4^+-N in the TCS were higher probably due to the excess leaching and accumulation of fertilizer and concentrating by evaporation regardless the rainfall variation. In the case of alkalinity, all the tanks except Jambugas aara tank had higher value than the recommended value of 100 mg/L $CaCO_3$. The Bagamuwa tank and the Jambugas aara tank showed an exceptional highest phosphate concentration in the dry spell exceeding the recommended level of 0-2 mg/L. Most parameters showed an increasing trend along the TCS due to runoff and leaching of the chemicals used in agricultural activities in the wet season and concentrating in the dry season due to high evaporation causing increment of nutrients beyond the recommended level, showing the unsuitability of the water for irrigation. Therefore, proper fertilizer management is essential to avoid any adverse effect of excessive chemical parameters in irrigation water. Further, site-specific fertilizer recommendations would be a better option to reduce nitrogen and phosphorous enrichment in the tank water of the cascade system.

Keywords: Irrigation water, Salinity, Spatial variation, Tank cascade system

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Study on the Suitability of Artificial Floating Wetlands to Purify Eutrophic Water Bodies

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The tropic state of a water body is important to maintain its sustainablity. Nitrogen and phosphorus are the main nutrients which determines the tropic levels. The eutrophic water bodies host large quantities of organisms, including algal blooms (Cyanobacteria). Cyanobacteria is observed in nature similar to the other algae species in all eutrophic aquatic ecosystems. Cyanobacteria is well recognized for its effective toxins such as Microcystins and Cylindrospermopsins. In July, 2020, the Microcystins levels of *Allewella* and *Lenabatuwa* lakes in Kamburupitiya area were 2 μgL^{-1} and 1.7 μgL^{-1}, respectively, which exceeds the WHO recommendation of 1 μgL^{-1}. Therefore, efficient and cost effective method for controlling eutrophication is timely essential. An artificial floating wetland is an innovative method which has been successfully practiced all over the world. The present study focused on the purification of a tank in the Faculty of Agriculture, University of Ruhuna, Kamburupitiya with artificial floating wetland consisted with three plant species; *Ipomoea aquatia (*Kangkung*), Acorus calamus (*Wada kaha*)* and *Bacopa monnieri (*Lunuwila*).*The main objective is to find the most suitable plant species for water purification based on absorption and biomass accumulation of N and P in each species. The experiment was conducted for three and half months as a randomized complete block design with three replicates and 36 plants per each replicate from each species. One week old plants were established in the 2m x 2m styro foam structure. Water quality parameters (pH, Temperature, DO, NH_4^+-N, NO_3^--N, PO_4^{3-}, Zooplankton and Phytoplankton) were tested twice during the study period to identify the water quality in the particular tank. Plant parameters (Total N and P, plant height and root shoot ratio) were measured and were analyzed by one-way ANOVA using SAS software. According to the results Wada kaha has the significantly ($P < 0.05$) highest nitrogen absorption capacity (0.098 ppm) and Kang kung (0.042 ppm) and Lunuvila (0.019 ppm) are followed by more to less absorption capacity. As phosphorus absorption, Wada kaha has significantly higher ($P < 0.05$) capacity (0.21 ppm) and Lunuvila (0.09 ppm) is with second highest absorbance treatment and Kang kung (0.06 ppm) is with the least. The findings of the present study reveal that the artificial floating wetlands are suitable for removing nitrogen and phosphorus from eutrophic water bodies.

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Keywords: Biomass accumulation, Cyanobacteria, Eutrophication, Wada kaha, Water purification,

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Characterizing Spatial Distribution Patterns of Soil Water Repellency in a Eucalyptus Forest Soil Using GIS and Remote Sensing

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Soil water repellency (SWR) is a phenomenon that delays or prevents the entry of water into the soil profile, limiting the infiltration and accelerating the surface runoff. Organic matter (OM), as coatings on mineral particles and intermixed materials, causes soil to be water repellent. Increased soil erosion and reduced groundwater recharge are among the major negative consequences of SWR. This study aimed to characterize the spatial distribution pattern of SWR in a sloped (40º–10º from East towards West) Eucalyptus (*E. grandis*) forestland (~100 ha, >50 years old) in Upcountry intermediate zone, Diyathalawa, Sri Lanka, where water scarcity is becoming an emerging issue. Surface soil was collected from 41 points within the forestland. Moisture contents, OM contents, and other basic properties were determined using standard laboratory procedures. The SWR was estimated using the water drop penetration time (WDPT) test. Boundary maps and elevation profiles were prepared using GIS and Remote Sensing techniques. Distribution maps of soil surface properties were prepared by interpolating the data using inverse distance weighing method. According to the results, OM content in the forestland varied between 5-25%, while ~70% of the forestland area showed 11-20% OM content. Above 95% of the forestland area showed either severe (600 s>WDPT>3600 s) or extreme (WDPT>3600 s) SWR, which would severely limit the surface entry of water into the soil. Slight SWR was observed only in <1% of the area. SWR indicated an increasing trend from East to West direction of the forestland, showing correspondence to the direction of declining slope and increasing OM. Water-repellent litter material and aggregates may move from East to West with runoff water flow, increasing the OM content and SWR in the West parts of the forestland. Dense human settlement in the surrounding area of the forestland is in the West direction, where people have experienced drying up of most groundwater wells and artesian wells. Considering the spatial distribution of SWR, this can be considered as influenced by reduced infiltration and subsequent decline of groundwater recharge.

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Keywords: Eucalyptus grandis, Inverse Distance Weighting, Organic matter, Soil water repellency, Water drop penetration time

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Influence of Biochar Addition on pH and EC of Municipal Solid Waste Composts

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Application of biochar to agricultural lands as a means of sequestrating carbon, improving nutrient cycling, and soil health has gained interest. Application of biochar is often known to increase soil pH and EC and is used as a soil conditioning agent in acid soils. This study paid attention to the application of biochar together with municipal solid waste composts (MSWC), which is generally known to induce high soil pH and EC levels. If biochar increases pH and EC in situations where these properties are already high, use of biochar with MSWC may induce complications in agricultural soils. The objective of this experiment was to determine the influence of biochar on pH and EC of MSWC. The study was conducted as a laboratory incubation experiment for a period of two months (61 days) using MSWC from five different municipalities (Weligama, Baduraliya, Bulathsinhala, Agalawatta, commercial MSWC) treated with five levels of rice husk biochar (0% - control, 5, 10, 15, and 20%, volume basis). The pH and EC of the samples were measured every other day for a week at the beginning, and then weekly intervals. The pH of the compost samples slightly increased during the first two weeks, remained slightly high for about four weeks, and then decreased afterward. However, this pattern showed no significant difference ($p>0.05$) with the control. No increment, but a decline in EC over the time was observed in all samples except one in Weligama and Baduraliya compared to the initial level, where EC of biochar added samples were lower compared with the control. Some MSWC samples showed a higher decline in EC with increasing biochar percentage. Samples with low initial EC levels showed a minimum decline in EC, while those with high initial EC levels showed a higher decline with the addition of biochar. Further experiments are required for understanding the exact reasons. It can be concluded that addition of biochar with MSWC would not cause further increment in the existing high pH and the EC levels.

Keywords: Biochar, EC, Municipal solid waste compost, pH

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Entrepreneurial Perception and Intention of Agribusiness Management Undergraduates: A Case of Faculty of Agriculture, University of Ruhuna

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Unemployment rate of Sri Lankan graduates is 46% and it has become quite difficult task for the governments to find solution for the unemployed graduate crisis. At present the importance of entrepreneurship has increased since it has been identified that entrepreneurial activity is a means of coping with unemployment problem by providing new job opportunities. Therefore, the main objective of this study is to assess the entrepreneurial perception and intention Agribusiness Management undergraduates. The sample was selected using purposive sampling technique and it consisted of 100 Agribusiness Management undergraduates from the Faculty of Agriculture, University of Ruhuna, which is the only faculty that produces Agribusiness Management undergraduates in Sri Lanka. Data were collected using pre-tested questionnaire formed as a Google form. Results revealed that 51% respondents were highly satisfied about the Agribusiness Management degree program and 33% were satisfied. According to the results, the majority (63%) of respondents stated that they are willing to start a business after completion of the degree; however, they were not exactly sure about their idea of starting new ventures. That shows weaker intention among undergraduates to become entrepreneurs. There were 07% of the respondents who have no intention to be an entrepreneur. Majority (86%) of the respondents revealed that they are willing to engage in occupations in Agribusiness sector. Furthermore, 79% of the respondents highlighted that they have perceived the knowledge on entrepreneurship through the university education. Moreover, 65% and 68% of respondents have agreed that they are receiving adequate subject knowledge and hands-on experience on entrepreneurship through Agribusiness Management degree program respectively. The study concludes that Agribusiness Management undergraduates have good perception about entrepreneurship however; they have weak intention in starting their own businesses. Therefore, the results of this study are of great significance for the facilitators such as the curriculum developers and academic staff members in undergraduate programmes to adapt their programmes in order to build strong entrepreneurial intention among Agribusiness Management undergraduates.

Keywords: Agribusiness undergraduates, Entrepreneurship, Intention, Perception

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Impact of Eco-Labelling on Consumer Purchase Intention: The Role of Gender

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In the creation of environmental marketing, eco-labels play a potentially significant role. Eco-labels express relevant social or environmental benefits and enable customers to make more sustainable choices. Eco-label was debated in the related literature as an important method for encouraging certain sustainable commodity information from the manufacturer to the consumer; however, previous studies addressed inadequately the impact of eco-labelling on the consumer purchase intention in Sri Lankan context. Moreover, even gender shapes purchase decisions, the existing literature base has hardly discussed it in this regard yet. Therefore, there is a research gap in this arena in Sri Lanka. In order to fill this research gap exists in terms of theory and knowledge, the current study analysed the impact of eco-labelling on purchase intention of Sri Lankan consumers emphasizing on trust, motive and gender-based perception. The sample of 150 consumers from the total of 939 of Mapalana Magin Pahala Grama Niladari (GN) division was selected through simple random sampling technique for the study. Data were gathered through administering a pre-tested structured questionnaire survey. Results revealed that 82.7% of the respondents' trust and the majority (52%) of them normally purchase eco-labelled products. Furthermore, there was a statistically significant difference in the perceived motive for purchasing of eco-labelled products ($\chi 2$ (3) =146.2, p <0.001). Interestingly, independent samples t-test revealed that there is a significant difference (t (147) = 2.097, p =0.038) in the level of awareness of the eco logo between males and females. Females (M=2.84, SD=1.250) have more awareness of eco labels than their male counterparts (M=2.46, SD=0.921). In addition, independent samples t -test unveiled that there is a significant difference (t (147) = 3.064, p =0.003) in the influence of product information on purchasing decision of eco-labelled products between males and females. Females (M=3.05, SD=1.331) relies more on product information during the purchasing of eco-labelled products than males (M=2.43, SD=1.150). Furthermore, independent samples t-test revealed that there is a significant difference (t (147) = 3.370, p =0.001) in the repeat purchasing of products with eco labels between males and females, while females (M=1.89, SD=0.707) repeatedly purchase eco labelled products than their male counterparts (M=1.51, SD=0.635). Hence, the findings of the study will be instrumental in promoting eco-labelled products while implementing gender-based strategies on eco-friendly attributes and characteristics.

Keywords: Eco-labelling, Gender, Motive, Purchase Intention

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Leaf Proteome Responses of Wheat (*Triticum aestivum* L.) to Elevated Atmospheric Carbon Dioxide during Early Vegetative Growth

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The impact of rising atmospheric carbon dioxide [CO_2] on the proteome of the growing leaf blade was investigated using two winter wheat cultivars: Kukri and RAC875, in the early vegetative stage. Two wheat genotypes were grown at ambient (400 µmol mol^{-1}) and elevated (700 µmol mol^{-1}) [CO_2] in controlled environmental conditions. At 42 days after planting (DAP), total dry mass, carbon and nitrogen content, and gas exchange measurements were determined in both CO_2 treatments and data were analysed using SPSS statistical software version 23 (IBM, Armonk, NY, USA). Elevated [CO_2] increased the rate of photosynthesis and biomass production in Kukri by 16.4 % and 32.6 %, respectively, when compared with 20 % and 48% in RAC875. The nitrogen and protein concentrations in the expanding leaf blades of both cultivars determined through the CN analyzer were high, and RAC875 showed the highest nitrogen percentage (56.3%). Results of the comparative proteomics analysis carried out through liquid chromatography-mass spectrometry (LC-MS/MS) analysis showed that leaf proteome responses at elevated [CO_2] were genotype-dependent, and the proteome composition has been altered at elevated [CO_2]. Most of the differentially expressed proteins at elevated [CO_2] belonged to carbon metabolism, energy pathways, protein synthesis, and cell cycle functions. Additionally, several proteolytic enzymes involved in post-translational modifications of proteins, antioxidant enzymes, and molecular chaperones showed a noteworthy upregulation at elevated [CO_2] in both cultivars. These findings suggest that photosynthetic stimulation and lower stomatal conductance are not the only factors governing plant growth at elevated [CO_2]. In response to increased sugar supply to developing leaves at elevated [CO_2], other key regulatory processes such as cell cycle function, protein modifications, and cell redox homeostasis tend to be modified, significantly altering growth responses at the whole plant level.

Keywords: Carbon metabolism, Expanding leaf blade, Leaf proteome, Plant growth, Protein

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Fisheries Value Network Analysis: Exploring the Relationships and Intangibles

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The fisheries sector is significant in the socio-economic context of Sri Lanka. However, the social dimensions of the fishery industry are not adequately addressed when formulating the policies. This study aims to explore the relationships and interactions among value chain actors; to study the network intangibles such as trustworthiness, information flow and credit flow. These networks were explored based on three value chains that comprised nine categories of economic agents. A minimum of five agents were sampled in each category giving a total of 134 individuals and five exporting companies. Fishers and exporting companies were selected using stratified purposive sampling, and other stakeholders were selected by snowball sampling. Data were collected using semi-structured questionnaires and statistically analysed using the UCINET 6 software. NetDraw software was utilized to illustrate and estimate the network parameters. Size, cohesiveness and centrality measures were used to describe the structural properties of the value networks. The comparison of the node level properties revealed that in-harbour wholesalers are the key intermediaries of the credit sharing network. Suppliers are the key intermediaries of the other two networks. Suppliers purchase fish from fishers or in-harbour wholesalers and distribute to the companies or other regional markets. Based on the degree centrality, it was apparent that the suppliers have the comparatively highest social capital. Many credit relationships in the industry are informal and non-monetary. The relationships between fishers and in-harbour wholesalers for credit is influential. The comparison of network level properties shows that information and credit-sharing network structures are comparatively less-cohesive. The major obstacle to information flow is the unwillingness to share information along the vertical value chains. It is vital to address these social dimensions and market failures carefully to implement efficient industry policies.

Keywords: Economic agents, Fisheries, Intangibles, Social dimensions, Value network

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Farmers' Knowledge and Constraints for Moving Towards Organic Agriculture: A Study with Farmers in Matara District

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Organic farming is a process of crop and livestock production without using pesticides, fertilizers, and genetically modified organisms. Organic farming is a holistic system intended to optimize the productivity and maintain ecosystem balance. The major aim of organic production is to develop enterprises that are sustainable with the environment. Developed countries are practicing organic farming in large scales though Sri Lankan farmers are not practicing it prominently. Sri Lankan farmers show bit reluctant to change their traditional cropping methods and fear to adopt new organic farming practices especially in rural areas. This is mainly due to lack of experience in thinking within the context of organic agriculture. In fact, lack of knowledge may inhibits this movement. Therefore, this study presents views of farmers about organic farming in Mirissa Agrarian Service division in Southern Sri Lanka. The major objectives of the study were to identify the current knowledge about organic agriculture practices among rural farmers, and recognize the constraints of adapting organic farming. Framer interviews and questionnaires were used to collect data by using stratified random sampling method to obtain a sample population that best represents the entire farmers' population. Twenty five (25) farmers were selected from six different Grama Niladari (GN) divisions as a representative sample. A total sample of 150 paddy farmers was selected from six different GN divisions in Mirissa agrarian service division. Descriptive and inferential statistical tools were used to analyze the collected data. According to the results, 46.3% of farmers have not engaged in organic farming activities during their crop cultivation period ever, while 41.5% of farmers have already experienced organic farming. Around 12.2% farmers did not know about organic farming in Mirissa area. Further, the study identified a non-significant difference ($p=0.065$) between the percentage of farmers practising organic farming and not practising organic farming in Mirissa division. When identifying the consequences of organic farming, 25% of farmers mentioned that high cost of organic farming prevent them from practising it. Compared to the chemical fertilizer to practise organic farming need a large amount of organic fertilizer to obtain the highest yield. Above 20% of farmers mentioned this as the reason for not practising organic farming in their cropping fields while, 10% of the farmers stated that lack of yield and scarcity of raw materials refrain them from practising organic farming. High amount of labour requirement and longer response time for organic fertilizer to decay, were identified as other reasons for not practicing organic farming in Mirissa area. As a conclusion, to promote organic farming among rural farmers and reduce the high cost, government subsidy scheme needs to be provided to farmers to adopt organic farming in their own fields.

Keywords: Constraints, Farmers, Knowledge, Organic farming, Rural

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Young Generation's Awareness and Perception on Solid Waste Management: A Case of School Children in Matara District

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Generation of enormous amount of solid waste and improper waste management has become a major national issue in Sri Lanka. It is obvious that an important element of a waste management program is public awareness and participation. Therefore, a quick attention is needed to aware of proper waste management, especially among the young generation in Sri Lanka. Research investigations have not yet explored adequately, in young generation's awareness and perception on waste management. Therefore, this study explores young generation's awareness and perception on solid waste management by using a pre-tested questionnaire survey. A sample survey of 1000 respondents from five randomly selected schools in Matara district, Sri Lanka was conducted in September 2019. The data were analysed by using descriptive and inferential statistics. It revealed that majority (96%) of young generation were aware on solid waste management. Moreover, most of them (79.7%) were engaged in solid waste segregation, however, very few (1%) were aware on electronic waste segregation. The majority (96.3%) had positive perception on solid waste management. Interestingly, they are willing to use the recommended solid waste management practices such as segregation of solid waste, 3R concept, treat and dispose. Hence, the present study sparks a green light of the future of proper solid waste management. However, more awareness programs on disposal of electronic waste should be conducted among school children.

Keywords: Awareness, Perception, Solid waste management

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Development of Herbal Tea Blended with Cinnamon bark powder (*Cinnamomum verum*) and the Leaves of Guava (*Psidium guajava*) and Garcinia (*Garcinia quaesita*)

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Tisanes or herbal teas are a popular beverage in modern days, as it is considered natural, safe, and help in promoting health. Nowadays, consumer patterns and lifestyle modification are in concern regarding the burden of many non-communicable diseases, including diabetes mellitus. Hyperglycaemia is the most predominant condition in diabetes patients and prediabetes patients. This study was intended to develop a herbal tea blend incorporated with selected plant extracts; Cinnamon, Guava, and Garcinia, which are known to have hypoglycaemic effects. The product development involved preliminary evaluation of individual herbal infusions and optimising the best temperature and time combination to obtain the highest preference in organoleptic properties. Initial limits of the ingredients found to be 2 g, 1 g, and 1 g for Cinnamon, Guava and Garcinia, respectively in a green tea base to obtain a 200 mL of the tea brew. The final products' brews were sensorily evaluated using thirty-membered semi-trained panellists on a 5-point hedonic scale, against a well-established commercial green tea product. Based on analysed sensory data, it was found that the selected best brewing temperature-time combination was 95 °C for 5 min. The prepared herbal tea blend was significantly ($p<0.05$) preferred by the panellists for all attributes except the colour, which was due to the opaqueness of the brew. The developed herbal tea blend also received overall preference due to its less astringency, pleasant smell, and the smooth citrusy flavour. The measured Brix and the acidity (pH) of prepared herbal tea blend brew were 0.3 and 5.5, respectively, whereas those were in the commercially available Green tea brew, 0.5 and 6.9, respectively. The shelf-life study (Total Plate Count) was revealed that the developed herbal tea blend powder, packed in a tea bag with double laminated polythene, could be stored for three months at ambient temperature condition. As a conclusion, herbal tea blend with medicinal plant incorporation has been successfully developed in this study that can be used in supporting to improve hyperglycaemia.

Keywords: Garcinia leaves, Guava leaves, Herbal tea, Sensory evaluation

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Optimization of Fermentation Conditions of Jaadi, Made from Indian Scad

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Jaadi is a traditional Sri Lankan fermented fish product where the fermentation process is extended for 3-6 months with salt and goraka *(Garcinia cambogia)*. Commercial-scale production of Jaadi is restricted due to safety issues and lack of product standardization. This research was conducted to optimize the Jaadi fermentation process using Indian Scad. Lack of product consistency, hygienic processing practices and less product attractiveness are the major issues of Jaadi industry. Highest overall liking mean score was received for Jaadi produced in polypropylene vessels than clay and glass vessels, and significant differences observed between three variables ($p<0.05$) at the preliminary study. Then, Jaadi was produced in polypropylene vessels under two fermentation conditions. The solar temperature and room temperature were the treatment and control respectively. The lowest mean pH value (3.6), highest salt percentage (21.07%) and TVB-N level (21.65 mg/ 100 g) within the acceptable limit were recorded in treatment samples. Proximate analysis revealed the good nutritive value in treatment sample while treatment shows the highest crude protein percentage (22.62%) in the 4th month. The microbial loads were reduced to $1X10^1$ at the 4th month in both samples and the lowest number observed in the treatment sample. Mean scores of the sensory evaluation were higher in all attributes tested in treatment samples. There was a significant difference in all attributes of the treatment and control samples of Jaadi other than aroma ($p<0.05$). Fish fermentation involves both indigenous fish enzymes as well as exogenous enzymes of halophilic microorganisms. Growth of microorganisms and enzymes activity depend on the salt content, pH and temperature of the fermentation vessel. Therefore, solar temperature and proper hygienic practices effectively control microflora and enzyme activity of Jaadi in order to result in better sensory attributes and good nutritive value.

Keywords: Goraka, Indian scad, Jaadi, Palatability

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Study on Ergonomic Applications to Design Suitable Furniture for Higher Education Institute

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Lecture room furniture in a higher education institute is considered as an important element for improving comfort and it helps to achieve better study environment. An ergonomic furniture design and its application are very important for its usability and comfort point of views for the students. Ergonomic furniture ensures better comfort and confidence for the students in a classroom environment. This study focused to evaluate the design of lecture hall chairs, drawing room chairs and drawing tables which comply with human dimensions of the selected population and desires in accordance with principles of ergonomics. The study was conducted for Civil engineering students in Institute of Engineering Technology, Katunayake, Sri Lanka. These ergonomically suitable designs were evaluated based on anthropometric measurements of the students with satisfying basic needs in the classroom environment. The 60 students were selected randomly from total 180 first year Civil Engineering students for data collection as it represents anthropometric dimension of undergraduate. In order to design ergonomically suitable furniture, relevant data was collected from the prospective students through face-to face interview and off-line questionnaires surveys during 2019. The 5th and 95th percentile adjustable range of the anthropometric data were used for the relevant measurement. Data were analysed using descriptive statistics. There were more than 30% of mismatches observed with available furniture measurements which leading to physical discomforts to the students during the long lecture hours. So, the proposed furniture needs to implement and feedbacks need to collect for future improvements. This study is concluded with study limitations and future research directions as for the design of ergonomically suitable classroom furniture for all the institutions of higher learning in Sri Lanka.

Keywords: Anthropometric measurements, Ergonomics, Furniture, Higher Education, Study Environment

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Self-Organizing Map with Real-time Updating for Big Data Analysis that Uses Bit Value Addition of the RGB Values of the Overlapped Data Points

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Usually, standard Self-Organizing Maps demand the user to define the number of expected clusters. Most importantly, when there is an update of the data, the data set has to be analyzed using a pre-decided algorithm. Thus, it is required to have a high processing capacity to produce real-time analysis of big data. This paper presents a Self-Organizing Maps with Real-time Updating (SOMRU) which eliminates the above-mentioned drawbacks. The proposed SOMRU uses a bitmap as the plotting area. A suitable marker with pre-determined filled colour is used in SOMRU to represent data points graphically in a manner that they can overlap when adding adjacent points. Data will be added sequentially. If there is an overlap, the existing colour value of each pixel of such overlapped area will be updated using binary addition with the colour value of corresponding pixel of the newly added data point. This process updates only the pixels in the overlapped area with very small processing power and creates regions with different colours. The colour value of a certain point is proportional to the number of overlaps (data density) in any selected point of the plotting area. Because the plotting area is bitmap, the final output is a bitmap which can be considered as a matrix containing colour values that reflects the data density. The proposed method was applied on a dataset of over 35000 data points and the results showed that the method is capable of creating regions separated by automatically generated colour lines which can be considered as isoclines. Thus, the proposed SOMRU can be considered as an efficient algorithm, which is similar to the ones used in the field of artificial neural networks to produce trained data, with low computational cost to analyse big datasets while representing the different clusters visually by creating a matrix of pixels that could be converted to values that reflect the data density.

Keywords: Big data, Cluster identification, Continuous learning, Kohenin's map, Self-organizing feature map

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Leaf Morphology, Protogynous Dichogamy and Leaf Essential Oil Composition of Selected *Cinnamomum* Species in Sri Lanka

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The knowledge gap on morphology, floral behaviour and chemical composition of endemic seven wild relatives of cultivated cinnamon (*Cinnamomum verum* J. Presl) should be addressed for their utilization in cinnamon breeding and industry. This study was carried out to determine the floral behaviour of two wild cinnamon species of *Cinnamomum dubium* Nees (*Cd*) and *Cinnamomum litseaefolium* Twaites (*Cl*) along with *Cinnamomum verum* (*Cv*) variety *Sri Gemunu* (*SG*), leaf morphological characters (LMC) and, leaf essential oil composition of *Cinnamomum capparu-coronde* Blume (*Cc*), *Cd* and *Cl* under *ex-situ* conservation at mid country research station, Dalpitiya, Sri Lanka (GPS: 7.1333031 N, 80.590026 E) along with *Cv* varieties *SG* and *Sri Wijaya* (*SW*) during February 2019. Floral cycles were determined through visual observation for two consecutive days. Protogynous dichogamy was determined: *Cl* and *SG* belonged to type A, while *Cd* was type B. In all species, the first opening was distinguishable with the fresh white stigma and white petals, while the stigma was brown and anthers were dehiscent during the second opening irrespective of time point of the floral cycle. Partial overlappings of functional male and functional female stages were observed in both type A and B plants, which may lead to self pollination. LMC of length, width, shape, apex, base, texture, venation, petiole length and margin varied among species. Gas Chromatography Mass Spectrometry (GC-MS) revealed of 34, 34, 12, 48, 8 and 18 chemical compounds from *Cc*, *Cd*, *Cl*-1, *Cl*-2, *SG* and *SW* respectively. The highest abundant chemical compound varied as Eugenol in *Cc, SG, SW* and *Cl*-1 (33.11%, 82.11%, 90.80% and 42.13% respectively), Eucaliptol in *Cd* (51.19%) and linalool in *Cl-2* (30.93%). Above results will indicate the potential variation among wild relatives of cultivated cinnamon, which needs to be further investigated for insights on future cinnamon breeding.

Keywords:Chemical composition, Cinnamomum capparu-coronde Blume, Cinnamomum dubium Nees, Cinnamomum litseaefolium Twaites, Floral behaviour

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Protective Effects of *Abelmoschus moschatus* Medik. on Adriamycin Induced Oxidative Damage and Inflammation in the Kidney of Wistar Rats

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Adriamycin is an anthracycline anti-neoplastic drug, in which the use in chemotherapy has been largely limited by its dose related multi-organ toxicities. Oxidative stress and inflammation are the main principles explaining the nephrotoxicity induced by adriamycin. The objective of the study was to investigate the protective effects of selected leaf extracts of *Abelmoschus moschatus* Medik. (family; Malvaceae, common name: Kapukinissa) on adriamycin induced oxidative damage and inflammation in the kideny of Wistar rats. Soxhlet extraction protocol was followed in the preparation of extracts of *A. Moschatus*. The experimental rats (n=6/group) induced for nephrotoxicity (adriamycin 5 mg/kg, ip) were administered with hexane, ethyl acetate, butanol, and aqueous extracts of *A. Moschatus* and the standard drug (fosinopril) orally, at 55, 75, 60, 140 and 0.09 mg/kg doses respectively for 28 consecutive days. The kidneys of all experimental rats were excised from the sacrifised animals and kidney homogenates were prepared for the assessment of antioxidant, anti-inflammatory makers and lipid peroxidation. A significant reduction in the total antioxidant status by ABTS method (72%), along with reduced antioxidant enzyme activities; glutathione peroxidase (GPx; 159%) and glutathione reductase (GR; 29%) was observed in the kidney homogenates of the nephrotoxic control group signifying adriamycin induced oxidative damage. These findings were further corroborated with the significant raise in lipid peroxidation (35%) and the level of the inflammatory cytokine; tumor necrosis factor (TNF-α; 36%) ($p<0.05$). Treatment with the four selected extracts of *A. Moschatus* significantly restored the total antioxidant status by 68%, 73%, 95%, 79% respectively and caused an elevation in GPx and GR activities, thereby suggesting potential antioxidant effects *in vivo*. A significant suppression of TNF-α (34%, 34%, 48%, 42%) and lipid peroxidation (29%, 30%, 29%, 30%) was also noted following the treatments ($p<0.05$). These findings support the hypothesis that the nephroprotective effects of the selected leaf extracts of *A. Moschatus* are mediated via antioxidant and anti-inflammatory pathways in adriamycin induced Wistar rats. Further studies are warrented for the isolation of bioactive chemical compounds in the selected extracts for the development of novel nephroprotective therapeutics.

Keywords: Abelmoschus moschatus, Adriamycin induced oxidative stress, Anti-inflammatory markers, Antioxidant markers, Lipid peroxidation

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Antimicrobial Activity and Oral Acute Toxicity Effect of *Cardiospermum halicacabum* Trim Extracts

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The acute respiratory tract infections are the most common illness in humans, with a high global burden. The present study was to determine the antimicrobial activity of aqueous, ethyl acetate and hexane extracts of *Cardiospermum halicacabum* Trim (Family: Sapindaceae, Common name: Wel-penela) against respiratory tract pathogens and to assess acute oral toxic effects of the above extracts in healthy Wistar rats. The antimicrobial activity was evaluated against a Gram-positive organism; *Staphylococcus aureus* ATCC 25923 and Gram-negative organisms; *Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853. The agar disc diffusion method was performed to estimate the antimicrobial activity according to the Clinical and Laboratory Standards Institute (CLSI) protocols and the diameter of inhibition zones were measured. The actively growing culture suspensions were adjusted by visually comparing with the turbidity of the 0.5 McFarland standard. Gentamycin 10 µg was used for Gram positive and ciprofloxacin 5 µg was used for Gram negative organisms as positive controls. A volume of 20 µL of DMSO was delivered onto filter paper discs as negative controls. Acute oral toxic effects/adverse effects were assessed after a single oral administration of the aqueous extract of *C. halicacabum* to healthy Wistar rats and animals were observed for 14 days. They were observed for morbidity, mortality and clinical signs of toxicity. The aqueous extract of *C. halicacabum* showed antimicrobial activity against *S. aureus* in agar disc diffusion method at a concentration of 100 mg/mL. There was no significant inhibitory activity was observed for any of the extract against *E. coli* and *P. aeruginosa*. Hexane and ethyl acetate extractions were inactivated against the organisms that were tested. No acute toxicity effects/adverse effects were observed in healthy rats, exhibiting the *in vivo* safety at the dose of 1000 mg/kg (equivalent therapeutic dose). The results revealed that the aqueous extract of *C. halicacabum* exert antimicrobial activity against *S. aureus*. Further, the aqueous extract at the therapeutic dose is safe to be used in therapeutic applications.

Keywords: Acute toxicity, Antimicrobial activity, Cardiospermum Halicacabum

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Germline Copy Number Variation Analysis in a Cohort of Patients with Hereditary Breast Cancer in Sri Lanka

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Breast Cancer is one of the common cancers among women in the world. Variants in known cancer predisposing genes (CPGs) explain up to half of the familial clustering in breast cancer, thus, for a substantial fraction of women with breast cancer having a positive family history of cancer, the genetic changes contributing, remains unexplained. The discovery of gene variants to explain this "missing heritability" is of clinical relevance. Hence it is important to find out the presnece of other types of variants, such as copy number variants (CNVs) in such patients. The spectrum of CNVs in the Sri Lankan population has not been described, previously. This study aimed to identify the presence of germline CNVs associated with cancer predisposition in a cohort of patients with hereditary breast cancer in Sri Lanka. *SurePrint G3 Human Comparative Genomic Hybridization (CGH) 4x180K Microarray* platform was used to detect CNVs in ten patients with breast cancer (<50 years of age) and who had previously been tested negative for pathogenic germline variants in CPGs by Next Generation Sequencing (NGS) and Multiplex Ligation dependant Probe Amplification assay (MLPA). Four healthy cases (>55 years of age) with no known family history of cancer were used as controls. Extracted data was processed using *Genomoic Workbench v11.0.1.1* software. A total of 141 CNVs in 10 patients were identified. Thirtyseven CNVs were common to both controls and the patients. Out of the 103 unique CNVs, 22 were seen in six affected patients. A 26.37 Kb CNV loss was identified in the *APOBEC3* gene cluster, in 2 patients. Furthermore, 37 novel CNVs which were not previously reported in the *Data base of Genomic Variants* (DGV) were identified. This study shows that CNVs are likely contributors to the breast cancer predisposition in patients affected with breast cancer in this cohort. Further studies have to perform to get a better understanding on the contribution of CNVs to the breast cancer predisposition in the Sri Lankan population.

Keywords: Comparative genomic hybridization, Copy number variants, Hereditary breast cancer, Next generation sequencing

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English Speaking Skills: A Survey of Motivation and Amotivation of Undergraduates at a Faculty Level: Faculty of Allied Health Sciences

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The ability to speak fluently in English is important in many fields of education and employment. However, many learners find multiple reasons that hinder their ability. Among them, learners' intrinsic motivation and extrinsic motivation to practice are crucial. Therefore, compulsion to attract undergraduates the learning based on intrinsic motivation cannot be taken for granted. Hence, this study reports the factors of learner motivation and amotivation among the undergraduates of the Faculty of Allied Health Sciences (FAHS), University of Ruhuna. The study was conducted among the present undergraduates of FAHS using a convenience sampling method following a computer aided web interviewing methodology. To determine the factors of motivation, a likert scale with 25 questions was used. Descriptive data analysis using statistical software, SPSS version 20 was employed to analyse 290 responses received. Responses received from Nursing, Medical Laboratory Science and Pharmacy undergraduates were 42.7%, 22.9% and 34.4% respectively. The majority (86.7%) of the responders accept speaking is the *most difficult skill* to develop. Similarly, 83.3% of the students believe speaking is *the most interesting skill* to improve. Less than 5% of undergraduates trust they are *very good* speakers at present. However, 72.3% think they are at *intermediate level*. English fluency required for the *job opportunities* was the key driving force (85.7%) to improve English speaking. This was followed by the need for *personal development* (78.9%) and improving *self-confidence* (77.6%). As per the Likert scale, the mean intrinsic motivation is 4.17 (n=290, SD=0.67) and the mean extrinsic motivation is 3.75 (n=290, SD=0.81) with a significant difference ($p<0.001$, 95% CI). Similarly, mean intrinsic demotivation is 3.15 (n=290, SD=0.77) and mean extrinsic demotivation is 2.56 (n=290, SD=0.92) with a significant difference ($p<0.001$, 95% CI). Therefore, teaching and learning strategies should match the intrinsic needs of the learners. Equally, they should have an impact on self-motivation.

Keywords: English speaking skills, Extrinsic motivation, Factors of motivation, Intrinsic motivation

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Fear of COVID-19 among People Living in High Risk Zones in Sri Lanka; Preliminary Data

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People experience fear on COVID-19 in different ways including disruption of day-to-day life, somatic symptoms, anxiety and fear of loss of life. These can lead to severe mental health sequelae in some. This study assessed the validity of the Sinhala version of Fear of COVID-19 scale (FCV-19S) and determined the fear of COVID-19 among people living in high risk zones in Sri Lanka. The FCV-19S was cross culturally adapted and validated using 148 subject aged 42.1±16.7 years, selected randomly from Galle. The Depression, Anxiety and Stress Scale-21 Items scale (DASS-21) also was used in validation. FCV-19S was re-administered among same subjects after two weeks and the psychometric properties were evaluated. The validated FCV-19S was administered among 225 people aged 36.0±13.8 living in high risk zones. FCV-19S showed a high test re-test reliability measured with intraclass correlation=0.86 (0.81-0.90). The initial Cronbach's alpha was 0.85 but, the item 3 "My hands become clammy when I think about the coronavirus-19" did not meet satisfactory consistency criteria. After deleting the item 3, Cronbach's alpha was 0.87. Remaining 6 items showed single factor structure with Eigen value exceeding 1, explaining 60.8% of cumulative variance, observed in Factor Analysis with Principal Component Analysis. Concurrent validity was confirmed by observing a strong positive correlation between FCV-19S score and the DASS-21 score ($r=0.63$, $p<0.001$). Only 43.6% (n=98) experienced high level of fear. Advancing age (OR=1.74, CI=0.96-3.15, p=0.04), low level of education (OR=0.52, CI=0.28-0.96, p=0.03) and being positive or suspected of COVID-19 or exposed to a COVID-19 patient (OR=3.0, CI=1.58-5.70, p=0.001) were associated with high level of fear. FCV-19S modified 6-item Sinhala version showed adequate psychometric properties to be used in clinical settings. The fear experienced by people in high risk zones was relatively low and advanced age, low education and history of exposure were associated with fear.

Keywords: COVID-19, Fear, High risk zones, Sri Lanka

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Evaluating the Ability of Sri Lankan FRAX Algorithm to Predict Fracture Risk Without Femoral Neck Bone Mineral Density

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The application of Fracture Risk Assessment Tool (FRAX) to predict ten-year probability of fragility fractures is restricted in Sri Lanka due to limited availability of Dual Energy X-ray Absorptiometry (DXA) scanners to assess femoral neck bone mineral Density (BMD). The objective of this study is to evaluate the ability of Sri Lankan FRAX algorithm to predict fracture risk of postmenopausal women without using femoral neck BMD data. Postmenopausal women (n=339) were detailed about the research and their written consent was obtained before enrolling into the study. Individual interviews were performed using a content validated datasheet to gather data on clinical risk factors associated with fractures. DXA scans were performed adhering to manufacturer's protocol. Ten-year risks of major osteoporotic fracture (MOFR) and hip fracture (HFR) were calculated including BMD (FRAX-A) and without including BMD (FRAX-FN_0). They were compared to assess the predictability. $P<0.05$ was considered statistically significant. Mean (SD) age and body weight were 63.8 (9.3) years and 51.7 (0.4) kg respectively. Approximately 36% of the study sample were at high risk of fragility fractures according to FRAX-A. Mean difference (SD) between MOFR-A and MOFR-FN0 was 0.11(5.63) while it was 0.37 (4.98) between HFR-A and HFR-FN0. FRAX-FN0 had 79.2% sensitivity, 80.1% specificity, 68.8% positive predictive value (PPV) and 87.4% negative predictive value (NPV). Area under the ROC curve of MOFR-FN0 was 88% (95% CI 0. 85 to 0.92, $p<0.001$) and HFR-FN0 was 89% (95% CI 0.85 to 0.92, $p<0.001$). Both MOFR-FN0 ($R2 = 0.58$, SEE= 3.96, $p<0.001$) and HFR-FN0 ($R2 = 0.38$, SEE= 2.76, $p<0.001$) have high ability to predict MOFR-A and HFR-A respectively. Sri Lankan FRAX algorithm can be used without femoral neck BMD to predict ten-year probability of hip or major osteoporotic fracture in postmenopausal women. It is an acceptable alternative to use in areas with limited DXA facility.

Keywords: Bone mineral density, Fracture risk, FRAX algorithm, Postmenopausal women

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Grey Theory Based Approach for Time Series Forecasting: Application to Rainfall Data in the Ginigathhena Area

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Analysis of time series is an important research direction that attempts to understand the underlying context of the data points to make forecasting future behaviors. The ability of forecasting is a difficult task and represents a major challenge with traditional time series mechanisms, because of the nonlinear data patterns. Therefore, this study proposes a combined model to forecast time series data with high volatility and complex nature. The proposed model is a combination of a Fourier series and Nonlinear Grey Bernoulli model (NGBM), constructed in three stages. In the first stage, NGBM (1,1) model is used to obtain one step ahead forecast. Then residuals are calculated and modified with the Fourier series in the second stage. In the last stage, it combines results of the first and second stages to determine the final forecasting results. The monthly rainfall data in the Ginigathhena area from 2009 to 2015 are used as a case study. The forecasting results of the proposed model are compared to the other three models; Grey (1,1), Back Propagation Neural Network, and Seasonal Auto-Regressive Integrated Moving Average. The results reveal that the proposed Grey theory based combined model outperforms all the other models and is effective for forecasting nonlinear time series data.

Keywords: Back propagation neural network model, Fourier analysis, Nonlinear grey bernoulli model, Seasonal autoregressive integrated moving average model

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Optimal Locations for Ambulance Service Stations – A Case Study in Galle District

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"1990 - Suwaseriya" is a pre-hospital emergency ambulance service that has been introduced in 2016 in Sri Lanka to provide pre-hospital emergency care and transportation to hospitals for free of charge. According to the statistics, 297 ambulances have been deployed in police stations covering all of Sri Lanka to provide the fastest pre-hospital medical services upon the arrivals of 1990 phone calls. But, there is a reasonable doubt, whether the ambulances are located in optimal locations in service areas to provide a faster service. Since the ambulance locations might not be centralized to the demand areas, the actual response time might be higher than the expected response time of the emergency service requesters. The consequence of this delay can be led to loss of lives of many individuals in critical conditions. The aim of this work is to propose an optimized solution for the ambulance location-allocation problem in order to provide an efficient pre-hospital emergency care to the public. Here, the main objective is to minimize the service response time for 1990 phone calls. The problem is formulated as a location optimization problem with the population and distance weighted cost function. Here, Ant Colony Optimization (ACO) algorithm is used to solve the optimization problem. ACO is an optimization algorithm inspired by the natural behaviour of depositing pheromone by ants while directing each other to resources. In this study, Galle district which get the service of 18 ambulances for 96 cities is selected as the case study area . The results show that the existing locations of the ambulances must be revised in order to provide efficient pre-hospital emergency care service. Although this research is limited to Galle district, given the importance of the ambulance service in saving lives, optimization of the service covering the whole country is highly recommended.

Keywords: Ant colony optimization (ACO), Emergency ambulance service, 1990 – Suwaseriya

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Competitive Interactions Between Alligator Weed and Mukunuwenna When Nutrient Availability Varies

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Spread of invasive species may destruct natural resources in an ecosystem as well as threaten the human use of the ecosystem resources. Riparian and wetland ecosystems are vulnerable to invasion because of the nutrient rich runoffs entering into them. Alligator weed (*Alternanthera philoxeroides*) is a dense mat-forming aquatic plant, which may spread to adjacent terrestrial systems such as riparian ecosystems and wetlands. It is observed that this species is able to invade habitats used to be occupied by Mukunuwenna (*Alternanthera sessilis*), which is a native species and a popular leafy vegetable in Sri Lanka. Therefore, this study is focused on the competition between these species in colonisation stage, under three nutrient conditions. Each pot had total of 4 plants, either monoculture of one of the species or different combinations of the species. Plant community composition was decided according to a replacement series. Accordingly, plant community compositions used in the study were 4:0, 3:1, 2:2, 1:3 and 0:4 plants (*A. sessilis: A. philoxeroides*). Planted pots were dipped in a large concrete tank filled with water and crushed rock to mimic wetlands and riparian conditions with water table on top of the ground. Alluvial soil was used as the substrate in the pots (total nitrogen – 1.2 mg/g dry weight of soil and total reactive phosphorous – 0.02 mg/g dry weight of soil). Nutrient conditions were generated adding commercial fertilizer (Albert solution), 5 g, 2.5 g and 0 g weekly to the large tank. The experiment lasted for six weeks with regular monitoring of growth and biomass accrual. Obviously, when the nutrient availability is high, the biomass accrual of both species increased irrespective of the community composition. However, total relative yield did not vary with nutrient availability and community composition in the given conditions.

Keywords: Biological invasion, Competition, Nutrient

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Numerical Simulation of Pile Dynamic Analysis Test

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Estimation of bearing capacity is a vital component in pile foundation design. There are various analytical and empirical methods to predict bearing capacity of piles which provide a quick approximation for foundation design. The results obtained through analytical and empirical approaches rely on empiricism and are site specific. Therefore, the results obtained should be validated by an in-situ load estimation method. In this scenario, Pile Dynamic Analysis (PDA) test is a widely used method for in-situ bearing capacity estimation of piles. However, validating theoretical bearing capacities of each and every pile through PDA test is not practicable due to its high cost. As such, only very limited number of piles are tested using PDA in very large projects. However, in relatively small projects, due to economic constraints, it is really difficult to conduct field load tests. As such in this this research study, PLAXIS-2D was used to model piles to estimate the carrying capacity of piles. PLAXIS-2D program has been performed on driven piles by the assistance of site investigations data. Soft soil and Mohr-Coulomb models were adopted for soft soil and completely weathered rock respectively, whereas linear elastic model was used to simulate piles. The data corresponding to the 0.5 m diameter spun concrete piles driven at Godagama Interchange in Southern Expressway Extension Project were used for this research study. Further, it can be noted that the ultimate bearing capacities obtained by analytical method, PDA test results and PLAXIS analysis are in good comparison with each other. However, bearing capacity obtained through analytical method is 10% lower than the PDA test results even though PDA test results do not represent the ultimate value. The bearing capacity obtained through PLAXIS analysis is very close to the field load test results indicating the applicability of the PLAXIS modelling for bearing capacity calculations.

Keywords: Analytical method, Bearing capacity, Pile dynamic analysis test, PLAXIS-2D

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The Influence of Pre-consolidation on Undrained Shear Strength Characteristics of Peaty Clay in Sri Lanka

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The undrained shear strength is a key parameter in the estimation of the stability of embankments constructed on soft soil. In Sri Lankan context, many embankments constructed on peaty clay were failed due to incorrect estimation of undrained shear strength parameters of peat. Therefore, it is important to determine the operative strength of the peat. There are several factors affecting the shear strength of peaty clay such as soil composition (shape, size and distribution), soil structure (undisturbed, disturbed, compacted, void and cementation), initial density (loose or dense) and type of loading (drained or undrained). The pre-consolidation pressure is another factor which contributes to vary the shear strength of peaty clay. As such, this research study has provided an opportunity to study the effect of pre-consolidation pressure on the shear strength parameters from laboratory Triaxial tests in peaty clay. Peaty clay collected from the Nilwala river basin subjected to series of Consolidated Undrained (CU) Triaxial tests. Remoulded peaty clay specimens with diameter 50 mm and height 100 mm were pre-consolidated using an especially fabricated device at the oedometer apparatus. The pre-consolidation pressures vary from 0 to 100 kPa in the interval of 20 kPa. The CU triaxial testing program consists of 15 tests, 3 tests under each pre-consolidation pressure with varying cell pressure of 50 kPa, 100 kPa and 150 kPa. According to the CU triaxial test results, it can be observed that peak deviator stress decreases with the pre-consolidation pressure irrespective of the cell pressure. As such, shear strength parameters of peaty clay decrease with increases of pre-consolidation pressure. This is clearly illustrated that peaty clay is very sensitive for disturbance. Once the peaty clay is disturbed or natural micro structure has been changed, it needs sufficient time to gain shear strength.

Keywords: Peaty clay, Preconsolidation pressure, Triaxial test, Undrained shear strength

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Modelling the Total Cooking Process of Two Local Rice Varieties

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In a fast-changing world, rice (*Oryza sativa*) remains to be the staple food for billions of people. Rice cooking is an energy-intensive activity. Energy efficient cooking methods can therefore largely improve the household economy. Despite a few literatures has suggested pre-soaking as a means to reduce the cooking energy, understanding the precise cooking kinetics largely remains elusive. Nevertheless, this knowledge is paramount to design energy efficient cooking processes. In this study, pre-soaking and cooking behaviour of local rice varieties, Suwandal and White raw rice were examined. Seven samples of each variety were considered. Rice (20 g) was soaked in 50 ml of water. Soaking was conducted for 0.5, 1.0, 2.0, 3.0, 3.5, 4.0 and 8.0 hours durations. Moisture intake in each experiment was calculated, and hydration curves were constructed. Experimental results and Peleg's (1988) predictions were in good agreement. Cooking experiments were conducted using six samples from each rice variety with water to rice ratios of 1:1, 1.25:1, 1.5:1, 2:1, 2.5:1, and 3:1. Each sample weighed 250 g and was pre-soaked for 30 mins. Dimensions of the cooked grains measured using stage microscope, were used to calculate the volume of the grains after each experiment. This volume was considered as a representation of the degree of cooking. Degree of cooking thus obtained showed good agreement with the first order reaction equation proposed by Suzuki et al (1976). The present study confirms that Peleg's equation and Suzuki equation are capable of predicting the soaking and cooking behaviour of Suwandal and White raw rice.

Keywords: Cooking, Modelling presoaking, Rice, Suwandal and white raw rice

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Numerical Modelling and Simulation of a Bottom-hinged Flap type Oscillating Wave Surge Converter for Performance Optimisation

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Extracting energy from sea waves for power generation applications has become one of the leading research areas in the present time, due to the increasing demand for cleaner renewable energy sources. This paper presents a numerical modelling and simulation work towards performance optimisation of an Oscillating Wave Surge Converter (OWSC). Here, the specific objectives were to identify the optimum density and optimum thickness of a flap to be used in the OWSC for maximum power take off moment (Mpto) to increase the energy conversion efficiency of the OWSC. A series of Smooth Particle Hydrodynamics based 3-D numerical simulations were carried out using the DualSPHysics open-source simulation software. The model was validated using published experimental data on waves generated in a 18 m long and 4.58 m wide wave tank with a flap of 1.04 m wide, 0.48 m height and 0.12 m thick. After the successful validation of the numerical model based on the rotation angle of the flap, further set of numerical simulations were conducted to study the effect of density and the thickness of the flap, which are critical factors governing the performance of the OWSC. It was found that, when the flap density was increased from 250 kg/m^3, the average Mpto also increased and reached a peak value of 40.8 Nm at 750 kg/m^3 of flap density, which records a 18% increment of average Mpto and decreased again. Similarly, when the flap thickness increased from 0.01 m, average Mpto increased and reached to its peak of 40.2 Nm at 0.15 m of flap thicknesses which records a 12% increment of average Mpto and decreased again. Hence this study shows, choosing the optimum flap density and flap thickness is critical to improve performance of OWSCs, in order to effectively use them in next generation renewable energy applications.

Keywords: DualSPHysics, Hydrodynamics, Oscillating wave surge converter, Smoothed particle wave energy

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Development of Design and Manufacturing Guidelines to Produce Fibre Reinforced Plastics (FRP) Boats Using Vacuum Assisted Resin Transfer Moulding (VARTM) Technique

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The main objective of this paper was to form "design and manufacturing guidelines" for composite laminate structure of boats, which are produced by using Vacuum Assisted Resin Transfer Moulding (VARTM) technique. Four categories of design guidelines were formed to improve the laminate structures, thermal response of laminates, holes and cut-outs and bonded joints. Six guidelines related to the designing of laminate structures were developed to improve the mechanical properties, quality, and stability of the boats. It was highly focused on the thermal response of the laminates, and four guidelines were presented to avoid defect formations which result in extreme temperature fluctuations. Holes and cut-outs were identified as unavoidable features of the boat manufacturing, and five guidelines were defined to overcome significant structural damages and compressive strength reductions. Joining several structural components were required to finish boat as a marketable product. Consequently, it was identified and categorised twelve essential guidelines to develop bonded joints of boat structures. The existing research literature and analyzed observation in the manufacturing of three boat prototype structures were used to develop manufacturing guidelines specifically for VARTM technique integrated boat building.

Keywords: Composite boats, Designing guidelines, Fibre reinforced plastics boats, Manufacturing guidelines, Vacuum assiste resin transfer moulding,

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Non-Contact Heart Rate Monitoring using Impulse-Radio Ultra-Wideband (IR-UWB) Radar Technology

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Vital signs, heart rate and respiratory rate, are considered as the key parameters when assessing the medical conditions of a person. The continuous monitoring of these parameters of critically ill patients, elderly and infants in intensive care units or at homes is very important to identify anomalies. Electrocardiogram (ECG), Photoplethysmogram (PPG) and Phonocardiogram (PCG) are the conventional technologies that have been using for this purpose in the medical field. The requirements such as permanent wiring and skin contact of these technologies limit the mobility, comfort and independency of patients. Furthermore, this can also cause other serious problems such as spreading infections and false fatigue. Therefore, there is a high demand for non-contact vital sign monitoring technologies that can provide medically acceptable accuracy levels. With the advances in electrical engineering discipline, novel engineering solutions are proposed to fulfill this requirement. In this work, Impulse-Radio Ultra-Wideband (IR-UWB) radar technology is considered with the advanced signal processing techniques. In particular, we developed an advanced signal processing algorithm to extract information from IR-UWB radar signals to estimate heart rate with desired accuracy level. The proposed algorithm is initially tested using a publicly available radar data set. It was observed that the estimated heart rate of the radar based contactless approach is 72.11 bpm whereas the ECG recorded value of the data set is 72.96 bpm. This result confirms that the proposed signal processing algorithm can estimate the heat rate accurately by extracting the relevant information in the given radar data set. The next step of this work is to test the proposed algorithm in real time. We will use IR-UWB radar sensor platform from Novelda for this purpose as it shows a very good signal penetration power. Due to the good penetration power, IR-UWB radar sensor technology can detect heart motions from outside.

Keywords: Electrocardiogram (ECG), Impulse-radio ultra-wideband (IR-UWB) radar, Non-contact heart rate monitoring, Vital signs

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Burnt-Bricks with Extracted Clay and Fly Ash

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Use of earthen materials for civil engineering construction has a long history worldwide with different forms. Among such materials, burnt-bricks play a major role. The availability of raw material for brick production is short; hence, alternatives are needed. Fly ash, rice husk and ash, industrial and agricultural waste are such alternatives. The present study suggests clay extraction from a clayely soil through washing as a new raw material for burnt-bricks production with fly ash addition. Extracted clay shows high platicity index and high linear shrinkage. Hence, 20%, 25%, 30%, 40% and 50% fly ash from total weight of the soil were mixed with clay to form more desireable mixture. Since fly ash is a industril waste, use of fly ash for this kind of production would give a sustaianable solution for waste management. Atterburg test was performed for every clay-fly ash mixture to check the mixture properties mainly plasticity index and the linear shrinkage. For the handmade bricks, (220 x 115 x 75) mm size mold was used. Burnt-bricks were tested for compressive strength, flexural strength, water absorption, density, efflorescence and dimension variations. Results were compared with SLS 39: Specification for brunt clay bricks. Wire cut bricks were also made with clay and 25% fly ash addition. First, the prepared bricks were checked for the dimension variation after firing and the results showed, dimensional variation is reducing with the increase of fly ash percentage. Also, bricks showed that slight efflorescence. Bricks made with 25% fly ash addition showed compressive strength of Grade 2 category as in SLS 39. According to above results, addition of 25% fly ash gives more desirable properties for the burnt bricks made with extracted clay and fly ash. Further it reflects that the use of fly ash gives light-weight bricks. The wire-cut bricks made with this selected mixture give Compressive strength of 10.64 N/mm^2 and it satisfies the SLS 39 requirements for wire-cut bricks. Also, its water absorption was nearly 16% which is below the SLS required value (18%). Surface appearance of the bricks with handmade bricks was fairly uneven, but wire-cut bricks were with acceptable appearance.

Keywords: Burnt-bricks, Extracted clay, Fly ash-added bricks

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Comparison of Biomechanics of a Tea Worker in Ascending and Descending Tea Plucking in Sri Lanka

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Sri Lankan tea the industry is still using the traditional tea plucking method i.e. selective plucking that makes higher quality tea. The main three tea growing regions classified based on the elevation as high grown, middle grown and low grown are naturally found with uneven terrains, high slopes and narrow footpaths. Most of the fieldworks in the tea industry Sri Lanka are performed manually and mostly by women. The tea plucking and carrying of tea leaves till the end of the collection journey is laborious and time-consuming. The body movements of a tea worker during the field working is consisted of ascending and descending the terrain, lateral walking and repetitive flexion, extension and rotation of the spine during the plucking. Tea workers have to maintain static awkward posture during the plucking to support the weight of the tea basket. A proper motion study and analysis of biomechanics will help to identify various work-related deceases and thereby design systems to improve the worker productivity, safety and comfort. The main objective of this study is to analyse the biomechanics of tea workers. A field study was carried out in *Udu Pussallewa* tea growing region to collect data about tea workers, their health issues, walking paths while plucking, tea baskets, plucking and collection rate, and field conditions. Biomechanics analysis is carried out for typical anthropometric values of two subjects. Our study also compares the tea plucking in ascending and descending that are in practice in different tea growing regions. The result of the analysis shows the variation of the ground reaction force and the joint forces of a tea worker in ascending, descending and lateral walking while carrying the tea basket. Our final aim of the study is to develop various supporting mechanisms to tea workers to ease their job in the field.

Keywords: Biomechanics, Ceylon tea, Tea plucking, Tea workers

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Analysis of Emissions of a CI Engine at Varying Load Conditions with Diesel Blended Liquid Fuel Extracted from Waste Polypropylene

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An alternative fuel extracted from waste Polypropylene (PP) using a semi-batch type reactor system was analyzed for feasibility of using in a compression ignition (CI) engine based on engine performance and emissions. The liquid fuel extracted was blended with diesel (varied from 10% to 70% by volume) and used in the study. The variation of CO and CO_2 percentages, NO_x and NO amounts in the emissions at different engine loads (varied from 1000 W to 5000 W) for pure diesel and the blends were investigated. CO percentage was found to be 0.03% at the low load (1000 W load on the engine) and 0.01% at the high load (5000 W load on the engine) for pure diesel whereas for the blended fuel mixtures it was varied between 0.03% and 0.21% at the low load and between 0.01% and 0.06% at the high load. For pure diesel, CO_2 percentage was observed to be 2.6% at the low load and 4.0% at the high load, whereas for the blends it was varied between 2.4% and 2.8% at the low load and between 3.9% and 4.2% at the high load. The average NO_x amount was found to be 84 ppm at the low load and 170 ppm at the high load for pure diesel whereas for the blends it was varied between 33 ppm and 58 ppm at the low load and between 147 ppm and 173 ppm at the high load. Almost similar percentages of CO_2 emissions were observed for all blends and diesel. NO_x and NO emissions were decreased and CO emissions were slightly increased with increasing concentration of waste PP derived fuel in the blends. Performance of waste PP derived fuel in terms of NO_x and NO emissions is acceptable and further improvements of fuel quality is required to reduce CO emissions.

Keywords: Diesel engine, Emissions, Engine performane, Pyrolysis, Waste polypropylene derived fuel

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Determination of Fundamental Characteristics of Unsaturated Residual Soils in Sri Lanka

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The complex behaviour and limited studies of unsaturated soil leads to difficulties in implementing effective design procedures, mainly in slope stability. As Sri Lanka is a tropical country mostly consist of residual soil, it experiences drying and wetting conditions. Methods available for slope stability and landslides prevention techniques in Sri Lanka are not cost effective and accurate. As such, in this research study, Soil Water Characteristic Curve (SWCC) was developed for residual soil available in Sri Lanka using tensiometers and which may useful in the slope stability analysis. Disturbed residual soil samples collected from a landslide in Southern expressway near Beliatta area was used for this research study. The Soil Water Characteristic Curve (SWCC) and permeability function were developed for the residual soil by conducting a series of laboratory tests using tensiometers. The continuous drying and wetting paths were developed to represent the natural soil under dry and rainy seasons. Further, shear strength parameters under different moisture contents were determined using a series of direct shear tests. As such, shear strength parameters corresponding to different matric suctions were obtained. Further, SWCC was developed for the residul soil using available empirical methods such as Arya-Paris model. The results obtained depicted that cohesion kept decreasing and friction angle kept constant with the increasing of saturation of soil on wet side and a slight increment on dry side. Further, cohesion and the suction show a non linear relationship. The SWCC obtained through tests and empirical methods were approximately equal for the considered suction range. Permeability results shows a rapid increment when suction reduces.

Keywords: Direct shear test, Matric suction, Permeability, Soil water characteristic curve (SWCC), Tensiometers

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Development of a Small-scale On-shore Sea Wave Energy Extraction Device for Electricity Generation

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Under the backdrop of non-renewable energy sources being depleted rapidly at ever-increasingly consumption rates, renewable energy technologies have to be developed to meet future energy challenges. Out of many conventional renewable energy sources, sea wave energy is one of the least developed renewable energy sources in the world, which has a higher energy density and availability when compared with many other renewable energy sources. Accordingly, this work is aimed to develop an efficient and low-cost sea wave energy converter (WEC), customised to on-shore deployment as a scaled-down model. The capacity of the WEC is 35 W (wave to the device), and converts wave energy into electricity. The device was designed based on a novel concept to extract both the kinetic and potential energies from the sea waves via a set of flaps and a floater connected rigidly to each other, fitted to a bottom-hinged 3-DOF frame via a universal joint. The frame is mounted on the sea bed and it can move in a 3D space covering an inverted conical working envelope as sea waves interact with the device from different directions. Potential energy contained within sea waves is captured by the floater in a translational heaving motion while the flaps capture the kinetic energy in a surge motion. The device was fabricated locally and deployed at a coastal location at Ginthota, Galle as an on-shore setup facing the waves of about 1 m wave height and wave period of 20 seconds. After several trials, it was observed that 1.450 W of stable electrical power could be extracted from the device, yielding an overall efficiency of 4.14%. However, wave irregularities, sand particle interaction and frictional losses in mechanical links were observed to hinder the device performance. Future works of this research will focus on further optimisation of the device by employing both numerical simulations and experimentation.

Keywords: Renewable energy, Sea wave energy, Sea wave energy conversion, Wave energy converter

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Study of the Impact of Particle Resolution on the Computational Efficiency of a CPU-GPGPU Hybrid Running of a Single Plant Cell Model

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Modelling of plant has been an ever challenge to the numerical modelling community and so far, researchers have developed different types of numerical models to simulate such cell and tissues for the predication of different physical mechanisms. However, the main limitation of most of such models is the higher computational cost when mainly relying on Central Processing Unit (CPU) based running. As an alternative, literature suggest the possibility of using the General Purpose Graphical Processing Units (GPGPUs). Therefore, this research focused to develop a Smoothed Particle Hydrodynamics (SPH) based numerical model for running in CPU-GPGPU hybrid mode with the aid of CUDA (Compute Unified Device Architecture) programming language. The research aimed to investigate the relative computational advantages and sensitivity of the computational performance of the model to particle resolution of cellular models. Accordingly, a single cell model was developed using different particle resolutions such that wall particle number is changed to 24, 48, 96, 120, 150, 180 and 210, respectively. The simulations were run on a High-Performance Computer (HPC) having Intel® Core™ i7-6700, 3.4 GHz processor having 32 GB RAM and NVIDIA® QUADRO K1200 GPU with 4 GB RAM (512 CUDA cores), in Ubuntu 14.04 platform. The CPU-GPGPU hybrid running of the model was compared with the original CPU running of the model and found that the CPU-GPGPU hybrid running on above resolutions reduced the computational time by 38%, 40%, 56%, 57%, 57%, 56% and 56%, respectively. So, it is overserved that with higher number of particles in the model, the CPU-GPGPU hybrid running can lead to more computational savings, which can be significant in modelling large tissues with many cells. Accordingly, future works of this research will focus on modelling large tissues with the developed CPU-GPGPU hybrid running mode and such computationally efficient models will contribute largely for the advance analysis of morphological changes of plant tissues in different physical conditions.

Keywords: Computational efficiency, CUDA (Compute unified device architecture), General purpose graphical processing unit (GPGPU), Parallel processing, Smoothed particle hydrodynamics (SPH)

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Oxygen Minimum Zone in the Southwestern Bay of Bengal: Observations during the Pre-summer Monsoon

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The occurrence of a strong Oxygen Minimum Zone (OMZ) is known in the Bay of Bengal (BoB). Studies have suggested that the intensity of the OMZ in the BoB is relatively weak compare to the prominent OMZs in the Arabian Sea (AS) and the Eastern Tropical Pacific (ETP), which is attributed primarily to the differences in productivity in the region. A field survey was conducted along 85° E, between 6° - 10° N onboard *R/V Shi Yan 3* from 25th April to 28th April 2018 during the pre-summer monsoon in the Southwestern BoB to examine its OMZ. The main objective of this study is to explain the characteristics of the OMZ with respect to the observed physical and biological parameters. In the present study, boundaries of the OMZ are determined considering the waters with [DO] ≤ 1 mg/L. Findings reveal that the depth of the mixed-layer (ML) is around 50m with a dissolved oxygen concentration (DO) of ~6 mg/L. The oxycline locates just below the ML with a thickness of ~75 m, and coincide with the thermocline, halocline, and the Deep Chlorophyll Maximum (DCM). The highest concentrations of chlorophyll (> 0.2 mg/m^3) are limited to the oxycline. The OMZ is evident in the Southwestern BoB with a thickness of ~675 m, and located between 125 m – 800 m. The average [DO] of the OMZ is 0.58 mg/L, and it is relatively high compared to the known [DO] of the OMZ in the AS (0.06 mg/L) and the ETP. In agreement with previous studies, the low productivity (consumption) observed in the OMZ (< 0.1 mg/m^3), rapid sink of organic matter (incomplete oxidation), and the presence of an anticyclonic eddy (ventilation) may be the reasons for the observed higher level of DO in the OMZ in the Southwestern BoB compared to that in the AS and the ETP.

Keywords: Bay of Bengal, Oxycline, Oxygen minimum Zone, Productivity

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Characterization of Biofilm Formation by Vibrios Isolated from *Penaeus monodon*

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Biofilm formation by pathogenic Vibrios has now become a major constrain of aquaculture causing substantial economic losses due to high virulence of those bacteria in cultured shrimps. This study assesses the biofilm formation ability of eight different *Vibrio sp.;*(*Vibrio campbellii, Vibrio alginolyticus* (1) and (2), *Vibrio anguillarum, Vibrio parahaemolyticus, Vibrio* sp. (1), (2) and (3)) isolated from *Penaeus monodon*. The ability to form biofilms was tested at two different temperatures (27˚C and 37˚C) in different nutritional conditions (undiluted Tryptic Soy Broth (TSB), 1:10 diluted TSB and, 1:100 diluted TSB) at three different post-incubation periods (24h, 48h and, 72h). Selected two temperatures are ambient for shrimps and humans respectively. Diluted nutrition media were used to determine whether there is any effect of the nutrient conditions on the biofilm formation. The biofilms were quantified and categorized into strong, moderate, weak, and non-adherent biofilm formers. Phenotypic assays were done by culturing the colonies in Congo red and Coomassie Blue to detect the presence of β–polysaccharides and proteins respectively whilst the fluorescence microscopic observations were done after staining with Calcofluor White to detect the biogenesis of cellulose in biofilms. An antibiotic sensitivity assay was conducted against Amoxicillin, Ciprofloxacin, Enrofloxacin, Erythromycin and Oxytetracycline. The study revealed that the most *Vibrio* species were able to make strong biofilms in an undiluted TSB at 27°C over to 37°C. Only *V. campbellii* has the ability to form strong biofilms at 37 °C. According to the results of the antibiotic assay, all the tested bacterial strains showed higher resistance to Amoxicillin whilst they showed the lowest resistance to Ciprofloxacin. These results attest that the most effective antibiotic against tested Vibrios is Ciprofloxacin. Strong biofilm formers have given positive results for Calcofluor white supplemented Trypticase Soy Agar (TSA), Coomassie Brilliant Blue supplemented TSA and Congo red agar method. This study concludes that the different Vibrios have the capability of producing biofilm at varied degrees.

Keywords: Antibiotic assay, Biofilm formation, Nutrients, Vibrio sp

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Feeding Preference of Sea Urchin *Tripneustes gratilla* in Ahangama Rocky Reef, Southern Coast of Sri Lanka during Southwest Monsoon

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Sea urchins play a vital role as grazers in shallow marine ecosystems throughout the world. Among tropical sea urchin species, *Tripnuestes gratilla* is common in many shallow benthic habitats of the southern coast of Sri Lanka. *Tripnuestes gratilla* is a delicacy in Southeast Asian countries and is used as a biological control agent against invasive algae. However, the economic benefits of this species are not fully realized in Sri Lanka. Although they are both ecologically and economically important, so far, no baseline data are available in Sri Lanka on the biology and feeding habits of this species. Therefore, the main objective of this study is to determine the feeding habit of *T. gratilla* population in the Ahangama rocky reef. Fifteen urchins were collected during the Southwest monsoon in 2020. Samples were transported the laboratory, dissected and gut contents were analysed for organic and inorganic components using standard methods. The gut contents of *T. gratilla* were composed of organic materials (66.47±2.73%), calcium carbonate (26.99±3.06%), and sand (6.53±0.43%). The most abundant dietary items in the gut contents were *Thalassia hemprichii* (28.03±4.99%), Red fleshy algae (23.74 ± 1.02%) Red filamentous algae (22.71 ±1.02%), and *Sargassum* sp (19 ± 0.55%). These groups were highly abundant in *T. gratilla* habitats in the Ahangama reef during the southwest monsoon period. Even though *Helimeda* sp. was highly abundant in the high tide zone, it was absent in the gut contents of *T. gratilla* probably be due to less palatability due to the calcified nature of *Helimeda* sp.. *Tripnuestes gratilla* is a generalist herbivore and prefers red algae and seagrass. The impact of seasonal changes in algae cover on the food selectivity of *T.gratilla* is needed to be studied further.

Keywords: Algae, Gut contents, Seagrass, Tripnuestes gratilla

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ලෝකයේ භාවිත වන ලේඛන හා භාෂණ මාධ්‍යයක් සහිත භාෂා බොහෝමයක ලේඛනයත් භාෂණයත් අතර ප්‍රතිරෝධයක් දක්නට ලැබෙයි. ලේඛනයත් භාෂණයත් අතර වන මෙම ප්‍රතිරෝධය අවබෝධ කර ගැනීමෙන් තත් භාෂාව හදාරන ස්වභාෂක අන්‍ය භාෂක දෙපිරිසට ම තත් කාර්යය පහසු කරවයි. වාග්විද්‍යාවේ දී පදිම යටතේ අධ්‍යයනය කෙරෙන විධි ක්‍රියා අනුසර්ගක අංශයෙන් ලේඛන සිංහලයේ හා භාෂණ සිංහලයේ දක්නට ලැබෙන ප්‍රතිරෝධය අධ්‍යයනය කිරීම මෙමඟින් සිදුවෙයි. ලේඛන සිංහලයේ විධි ක්‍රියාවක් ගොඩනැගීමෙහි ලා භාවිත අනුසර්ගක පදිම හඳුනා ගැනීමේ දී ලේඛන සිංහලය සම්බන්ධයෙන් මෙතෙක් සිදු වී ඇති ප්‍රාමාණික විද්වතුන්ගේ අධ්‍යයන උපයෝගී කර ගත් අතර භාෂණ සිංහලයේ භාවිත විධි ක්‍රියා අනුසර්ගක හඳුනා ගැනීමේ දී ස්වභාෂිකයකු වශයෙන් ඇති දැනුමට අමතර ව පොදු සිංහල භාෂකයින් අතර සිදු වූ සංවාද නිරීක්ෂණ හා අවිධිමත් සම්මුඛ සාකච්ඡා භාවිත කරන ලදි. එහි දී හඳුනා ගත් අනුසර්ගක පදිමවලට කිසියම් බලපෑමක් කිරීමට සමත් වූ අවස්ථාවල දී පමණක් ප්‍රාදේශික උපභාෂා හා භාෂා ප්‍රකරණ තත්ත්වයන් පිළිබඳ ව ද අවධානය යොමු කර ඇත. හඳුනා ගත් අනුසර්ගක විශ්ලේෂණය කිරීමේ දී ප්‍රතිරෝධාත්මක වාග්විද්‍යාවේ සමානතා - අසමානතා සංකල්පය උපයෝගී කර ගන්නා ලදි. අධ්‍යයනයෙන් හෙළි වූ ආකාරයට ලේඛන සිංහල විධි ක්‍රියාවෙහි /-හි/, /-හු/, /-ව/, /-න්න/, /-නු/, /-වු/, /-ග/, /-න්නේ/, /-න්/, /-ɸ/ ලෙස අනුසර්ගක 10ක් පමණ භාවිත වෙයි. එසේ ම භාෂණ සිංහලයේ භාවිත වන විධි ක්‍රියාවන්හි /-න්න/ (/-න්ට/, /-න්ඩ/), /-නව/ (-නවා), /-නවල/, /-පන්/, /-යන්/, /-ලා/, /-පිය/, /-වු/ (-ව්), /-කො/ (/-කෝ/), /-නො/ (/-නෝ/), /-ɸ/ ලෙස අනුසර්ගක 11ක් භාවිත වෙයි. මේ අනුව ලේඛනයෙහිත් භාෂණයෙහිත් ස්වාධීන ආකෘතියක් සහිත විධි ක්‍රියා අනුසර්ගක 18ක් භාවිත වෙයි. මෙම අනුසර්ගකවලින් ලේඛනයේ හා භාෂණයේ සමාන ව භාවිත වනුයේ /-න්න/, /-වු/ හා /- ɸ/ යන අනුසර්ගක තුන පමණි. ඉතිරි අනුසර්ගක 15 අතුරින් අනුසර්ගක 7ක් (/-හි/, /-හු/, /-ව/, /-නු/, /-න්නේ/, /-ග/, /-න්/) ලේඛනයට සීමා වෙමින් හා අනුසර්ගක 8ක් (/-නව/, /-නවල/, /-පන්/, /-යන්/, /-ල/, /-පිය/, /-කො/, /-නො/) භාෂණයට සීමා වෙමින් ලේඛනයත් භාෂණයත් අතර ප්‍රතිරෝධයක් ඇති කරයි. මේ අනුව විධි ක්‍රියා අංශයෙන් ලේඛනයත් භාෂණයත් අතර වන සමානතාව 17%ක් වන විට ප්‍රතිරෝධතාව 83%ක් බව හෙළි විය.

ප්‍රමුඛ වචන: අනුසර්ගක, අසමානතා, භාෂණය, ලේඛනය, සමානතා

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Mixed Model Approach: A Climate-adaptive Protection Paradigm for Vulnerable Coasts of Sri Lanka

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Coastal protection measures in Sri Lanka have largely disregarded the important aspect of aggravating impacts of climate change. The current study utilized unpublished data on shoreline geomorphology, community perceptions, published reports, personal experience and expert knowledge to "conceptually design" the climate-adaptive, long-standing protection paradigm; "Mixed Model Approach (MMA)". The MMA comprises of Hard, Soft and Green barrier structures, positioned as respective 1st, 2nd and 3rd line defenses from the seaward limit, at coasts which are vulnerable for sealevel rise. The extent to which these structures are applicable for a particular vulnerable coast is decided based on a calculated Vulnerability Index (VIn) achieved through comprehensive analysis of shoreline physical factors (geomorphological slope, type of coastal ecosystem, degree of coastal erosion and artificial constructions) using high resolution satellite imagery and GIS techniques followed by field verification. The resulting, VIn score can be used to prioritize the urgency for protection, thus suggests the most appropriate structure/s that should be established as the defence/s at a specific stage of protection. Accordingly, the study applauds establishment of all three defences for highly vulnerable stretches, i.e. coastal areas with high Vın score (coastal areas with less slope and less barrier effects), soft and green defences for moderately vulnerable stretches (coastal areas with less slope, high barrier effects or high slope, less barrier effects) and green barriers for the least vulnerable stretches (coastal areas with high slope and/or high barrier effects). Subsequent application of non-structured schemes (restricted coastal extractions and community awareness) is mandatory for successful implimentation of this conceptual design. The authors believe, the conceptual MMA will have the potential to provide long-standing coastline protection ensuring the climate adaptability. However, further research need to be carried out to investigate the validity of the VIn and practicability of such implimentation covering the entire coastal strech of the country.

Keywords: Climate change, Coastal protection, Defence, Mixed model approach, Vulnerability index

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Forecasting Inflation Rate in Sri Lanka Using Supervised Machine Learning Techniques

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The general approach for forecasting is to use linear statistical methods such as ARIMA, ARCH, and GARCH models. Because of the availability of a large amount of historical inflation data, people need more advanced statistical techniques to accurately forecast the future behavior of the inflation rate which helps the economic development of a country. In this research, we used supervised machine learning models namely Random Forest regression, Lasso regression, Kernel Ridge regression, Bayesian Ridge regression, Support Vector Machine, and Elastic Net regression models for forecasting inflation rates in Sri Lanka. Monthly mean inflation data in Sri Lanka for 30 years from 1988 to 2018 were used in this study. In simulation studies, we divided the whole data set into two parts, namely, the training data set consisting of 358 data points and the test data set with the remaining 10 data points. All of the above models were trained by using the training data set and we used the k-fold cross-validation technique to estimate the parameters and hyperparameters of the models. All simulation studies were performed by using the GridSerachCV algorithm in Python programming. We also compared the model performances by using mean square error (MSE), root mean square error (RMSE), and mean absolute error (MAE) for the test data set. According to these performance measurements, we obtained the highest accuracy for the prediction of the inflation rate from the Support Vector regression model (RMSE-0.6261) and then Bayesian Ridge regression (RMSE-0.6263), Kernel Ridge regression (RMSE-0.6645), Lasso Regression (RMSE-0.7139), Elastic Net regression (RMSE-0.7396) and Random Forest regression (RMSE-8157) respectively.

Keywords: Cross-validation, Forecasting, Inflation, Machine learning, Regression

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Effects of Recent Land-Use Changes on the Livelihood of the Displaced Residents in Hambantota Urban Area

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Dramatic land-use changes have taken place in Hambantota urban area in the Southern province, Sri Lanka in the recent past, after the Tsunami in 2004 and war eradication in 2009. Development projects (e.g. Hambantota port and Mattala airport) contributed to changes in land-use architecture, while affecting some communities to be displaced. Therefore, a questionnaire survey was conducted in 2019 to investigate the effects of land-use changes on the environment as well as on residents' well-being. Data were collected randomly from 36 resettled families in the two Grama Niladhari Divisions in Hambantota urban area, Siribopura and Keliyapura, through interviewing the heads of households. The survey questions aimed at four main areas; peoples' perspectives, economy, goods and services and environment. A Principal Component Analysis (PCA) was performed on the 'Likert scale' questionnaire. Demographic data reveal that all respondents are provided with grid electricity in their houses and 97.2% are supplied with tap water. PCA discloses that people appreciate the progress that the city has made in new businesses, development projects, in the fishery industry and in the agriculture sector. Improvements in many public and private sector services in the city are acknowledged whereas agriculture and fishery industry are recognized as main economy boosters. Public transport system and facilities for education are two major sectors that need to be improved further. Though many programmes function to keep the environment healthy, respondents voice (91.7%) that environment has been compromised to recent development projects. Google earth satellite images prove this by revealing that 380ha of scrub forest had been cleared to establish housing schemes in the city. Hence, it is necessary for authorities to take prompt action to recover the green cover loss by implementing replanting programmes/urban forestry to turn the city into a sustainable green city.

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Keywords: Environmental degradation, Green city, Land-use change, Urban development

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Ganapati, the God of the People: An Archaeological and Ethnographical Study

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The 2nd century sculptural work of two-armed Gaṇapati has been found on the frontispiece of Mihintale Kaṇṭaka Cētiya shows that the concept of Gaṇapati has been known to Sri Lankan Buddhist society since early historical time. During the Polonnaruwa era (1070-1200 CE) many four-armed images of Gaṇapati seems to have become popular due to the cultural interaction between Sri Lanka and South India. It also appears that four-armed Gaṇapati continued to be popular among Sri Lankan Buddhists until today. Worshipping Gaṇapati by the name of Pullaiyār in North-Central and Northern Provinces of the island by Sri Lankan Buddhists demands special attention owing to the simple aniconic form he had acquired. In these areas, he is often depicted as simple symbolic chalk drawing on a flat surface drawn as the English letter 'J' with two dots on either side of it. Thus, three major forms of representing Gaṇapati in the area from historical periods can be identified. It is challenging to discern why the aniconic figure is limited to a specific area while the four-armed figure is still being the common representation in other parts of the country. Therefore, the paper seeks to examine the sociocultural conditions that would have caused the transformation of the Gaṇapati sculpture from iconic to aniconic in that particular area. The in-situ evidence of *Gaṇapati* figures, as well as those, are exhibited in archaeological museums are examined. The causative factors for the sculptural productions are discussed concerning the changes in tangible and intangible assets resulted from the process of cultural interactions. Our study shows that accepting and believing him as the governing deity of the region by Sinhalese Buddhists of the area have caused this transformation. Perhaps, this aniconic representations, reveals a widespread and localized form of a Gaṇapati cult that had spread over the region than a traditionally specific purpose to worship Gaṇapati as in other parts of the country.

Keywords: Aniconic, Gaṇapati, Iconic, Pullaiyār, Sociocultural

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ජෝන් කීට්ස්ගේ "**Ode to autumn**", සරෝජිනී නායිඳුගේ "**Indian weavers**" සහ මහගම සේකරගේ "**සන්නාලියනේ**" යන නිර්මාණ පිළිබඳ තුලනාත්මක අධ්‍යයනයක්

ඩී.එම්. එම්. එච්. දසනායක, ඩී. ලියනගේ *සහ* ආර්.කේ.ඒ.එන්. එන්. රත්නසිරි

සිංහල අධ්‍යයනාංශය, මානව ශාස්ත්‍ර සහ සමාජීය විද්‍යා පීඨය, රුහුණ විශ්වවිද්‍යාලය

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ජෝන් කීට්ස්ගේ "Ode to autumn", සරෝජිනී නායිඳුගේ "Indian weavers" සහ මහගම සේකරගේ "සන්නාලියනේ" ගීතය එක ම තේමාවක් විෂය කරගන්නා නිර්මාණ ත්‍රිත්වයකි. මහගම සේකරගේ "සන්නාලියනේ" ගීතය, සරෝජිනී නායිඳුගේ "Indian weavers" හි ඍජු පරිවර්තනයකට වඩා එයින් අභාසය ලබා කරන ලද ස්වීය නිර්මාණයක් ලෙස සැලකීමට තරම් මහගම සේකරගේ කවිත්වය විසින් එය සංස්කෘතිකගත කෙරෙයි. මේ අධ්‍යයනයේ අරමුණ වන්නේ ජෝන් කීට්ස්ගේ "Ode to autumn" කාව්‍යය, සරෝජිනී නායිඳුගේ "Indian weavers" කාව්‍යය සහ මහගම සේකරගේ "සන්නාලියනේ" ගීතයෙහි පදපෙළ පිළිබඳ සංසන්දනාත්මක ව අධ්‍යයනය කිරීම යි. එසේ ම එහි උප අරමුණක් ලෙස සරෝජිනී නායිඳුගේ "Indian weavers" සහ මහගම සේකරගේ "සන්නාලියනේ" ගීතය අතර සංස්කෘතිකාර්ථ වශයෙන් වන වෙනස කෙරෙහි ද අවධානය යොමු කෙරෙයි. ඒ අනුව, පොදු තේමාවක් සංස්කෘතික සුවිශේෂතා ප්‍රකට කරමින් ඉදිරිපත් වන ආකාරය විමසුමට ලක් කිරීම මගින් විශ්වීයත්වය සහ සුවිශේෂත්වය අතර දාර්ශනික සබඳතාව මේ නිර්මාණාශ්‍රිත ව හඳුනාගැනීම මේ අධ්‍යයනයෙහි සංකල්පීය රාමුව වෙයි. මේ සංකල්පීය රාමුව ඇතුළත ප්‍රස්තුත නිර්මාණ ත්‍රිත්වයේ දී විශ්වීය තේමාවක් සංස්කෘතික සුවිශේෂතා ප්‍රකට කිරීම, ඒ විශ්වීය තේමාවෙහි "විශ්වීය ගුණය" සංස්කෘතික සුවිශේෂය මගින් යටපත් කිරීමට වඩා එය තීව්‍ර කිරීමට තුඩු නොදෙන්නේ ද? යන ගැටලුව මේ පර්යේෂණයට විෂය වෙයි. මෙම ගැටලුව පරීක්ෂා කරන ලද්දේ ඉහත මූලාශ්‍රය සමීප ව සහ සංසන්දනාත්මක ව කියවීමෙනි. මේ නිර්මාණ හා සබැඳි ද්විතීයික මූලාශ්‍රය ද අධ්‍යයනය කරමින් "පොදු විශ්වීය" තේමාව සහ "සුවිශේෂ සංස්කෘතික ප්‍රකාශනය" අතර සම්බන්ධය විශ්ලේෂණය කෙරෙයි. මේ නිර්මාණ ත්‍රිත්වය පිළිබඳ සංසන්දනාත්මක අධ්‍යනයෙන් පැහැදිලි වන්නේ "විශ්වීයත්වය" සහ "සුවිශේෂත්වය" අතර ඇත්තේ ප්‍රතිවිරුද්ධතාවකට වඩා අන්‍යෝන්‍ය හා අවියෝජනීය සම්බන්ධයක් බව යි. "පොදු විශ්වීය" තේමාවක් "සංස්කෘතික සුවිශේෂතාවක" ප්‍රකාශනයක් වීම යනු ඒ තේමාවෙහි "විශ්වියමය" ගුණය තනුක කිරීමක් නො වේ. සැබවින් ම ඒ සංස්කෘතික සුවිශේෂත්වය මගින් ප්‍රකාශ නො වී ඒ විශ්වීයත්වයට ප්‍රකාශනයක් ලබා ගත නො හැකි ය. ඒ අනුව, සැබවින් ම සංස්කෘතික සුවිශේෂත්වය මඟින් කරනුයේ විශ්වීය තේමාව තීව්‍ර කිරීම ය.

ප්‍රමුඛ වචන: අන්‍යෝන්‍ය, සංස්කෘතිකාර්ථ, විශ්වීයත්වය, සුවිශේෂත්වය

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Socio-cultural Determinants Affecting Early Childhood Care and Education Policy in the Estate Community of Sri Lanka

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Early Childhood Care and Education (ECCE) has been an instrumental frontline strategy for both social development and poverty reduction. Given that the facilitation for childcare and education alongside its outcomes follow a social gradient, differences in the socio-cultural and economic situation may translate into inequalities in overall child wellbeing. It is thus taken for granted that culture and values are required to be at the centre for policies on ECCE to become well implemented and outcomes are achieved at local levels. This qualitative study thus inquires how sociocultural determinants affect early childhood care and education in the estate sector of Sri Lanka. The grounded theory analysis indicates that the impact of the socio-cultural environment on which the ECCE policies are implemented is twofold: as an ideational system and adaptive system through which policies are shaped either by relatively stable cultural characteristics or intent participation of community members with cultural dynamics. Established inequalities and persistent multidimensional disadvantaged position seem to disrupt the effective ECCE policy implementation, moreover. Besides, institutionalized cultural capital is both challenging and encouraging for early childhood care and education. It sometimes can inhibit mainstreaming on child care and education, as it is less likely to prioritize child wellbeing over other concerns such as conserving subculture-identity. The unique multidimensional administrative system (Government, Plantation Companies, Community) with conflicting responsibilities in the estate community is another determinant that prevents effective ECCE policy implementation. Overall, this study highlights that the success of ECCE policies at local levels follow a social gradient, and neglecting sociocultural determinants in implementing such policies may further the existing inequalities while jeopardizing the child wellbeing.

Keywords: Childcare, Child education, Early childhood, Sociocultural determinants, Social development

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දාර්ශනික භාෂාවේ සීමා සංකල්පය පිළිබඳ ආදි බෞද්ධ දාර්ශනික විග්‍රහය

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ඥානයේ සීමා සංකල්පය දාර්ශනික ඥානවිභාගය නම් විෂය තුළ සාකච්ඡා කෙරෙන ප්‍රධාන ප්‍රස්තුතයකි. ඥානයට සීමා පැනවෙන්නේ යම්කිසි බාධාවක් නිසා ය. භාෂාවේ හෙවත් තාර්කික සීමා, ප්‍රායෝගික සීමා, නෛසර්ගික සීමා, හා සදාචාරාත්මක සීමා යනාදිය ඥානයට සීමා පනවන ප්‍රධාන සාධක ය. සෙසු සීමා සංකල්ප අතරින් මෙහි තාර්කික සීමා හෙවත් භාෂාවේ සීමා යටතේ අදහස් කරන්නේ භාෂාත්මක බාධා ද ඥානයේ සීමා සඳහා කොතෙක් දුරට බලපාන්නේද? යන්න පිළිබඳව යි. භාෂාත්මක සීමා නම් සංකල්පය කෙරේ බෞද්ධ ප්‍රතිචාරය මෙහි දී අධ්‍යයනය කෙරෙන්නේ ඥානයෙහි සීමා නීර්ණයෙහි ලා භාෂා භාවිතයේ සීමා පැනවීමේ උපයෝගීතාව විමර්ශනාත්මකව අධ්‍යයනය කරනු පිණිස ය. ප්‍රාදේශීය භාෂා ව්‍යවහාර හෝ භාවිතවල එල්බ ගැනීමවත්, සම්මතය ඉක්මවා යාමවත්, යමෙකු විසින් නොකළ යුතු බව බුදුන්වහන්සේගේ මතය වූ බව පෙනේ. එමෙන් ම පදනම් සහිත, සත්‍යාක්ෂණය කළ හැකි භාෂාත්මක යෙදුම් පමණක් භාවිත කිරීමේ වැදගත්කම ද සූත්‍රදේශනා ගණනාවක දී අවධාරණය වී තිබේ. භාෂාත්මක සීමා තුළ සාකච්ඡා කෙරෙන අධිභෞතිකවාදී මතවාද බැහැර කරන මුල් බුදුසමය යථාර්ථයේ සීමාව භාෂාවේ ද සීමාව බව පෙන්වා දෙන්නේ භාෂාවෙහි සීමාවෙන් ඔබ්බෙහි පවත්නා දේ පිළිබඳ නිශ්චිත නිගමනයකට පැමිණීම අනුමත නො කරමින් හා එලෙස නිශ්චිත නිගමනයකට පැමිණීමේ අනවශ්‍යතාව ද මතු කරමිනි. මෙම පර්යේෂණ ගැටලුව වනුයේ දර්ශන විෂයේ සාකච්ඡාවට ලක්වෙන භාෂාවේ සීමා සංකල්පය පිළිබඳ බෞද්ධ ප්‍රතිචාරය කෙබඳුදැ'යි අධ්‍යයනය කිරීම පමණක් නොව භාෂාවේ සීමා සංකල්පය පිළිබඳ ආදි බෞද්ධ විවරණයෙන් පැනෙන උපයෝගීතාව අධ්‍යයනය කිරීම යි. ඒ අනුව මෙම පර්යේෂණයේ දී මූලික උපන්‍යාසය වන්නේ භාෂාවේ සීමා සංකල්පය පිළිබඳ බෞද්ධ විවරණය නිර්වාණ පදනම් කරගත් යථාර්ථමය පදනමක් නියෝජනය කරන බව යි. මෙය මූලාශ්‍රය පදනම් කරගත් අධ්‍යයනයක් වන අතර ප්‍රාථමික මූලාශ්‍රය ලෙස සූත්‍ර පිටකයේ සූත්‍රදේශනා ගණනාවක් කෙරේ අවධානය යොමු කෙරේ. ඥානයෙහි සීමාවෙන් ඔබ්බෙහි පවත්නා දේ පිළිබඳ ආදි බුදුසමය නිශ්චිත නිගමනයකට පැමිණීම අනුමත නො කරන අතර ම එලෙස ඒ පිළිබඳ දිගින් දිගට ම සිදු කරන නිශ්ඵල උත්සාහ ප්‍රතික්ෂේප කරයි.

ප්‍රමුඛ වචන: ඥානය, භාෂාව, නිර්වාණය, සත්‍යාක්ෂණය, සීමා

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An Enquıry into Theravada Abhıdhammıc Phılosophy on Paññattı and the Concept of Truth

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The truth is two devisions in Abhidhamma: such as conventional truth and ultimate truth, based on state of understating. The symbolic word is true due to worldly convention. The ultimate word is true due to the apparentness of *Dhamma-s*. A truth that cannot be easily grasped by the sense organs is described in *paramattha*. In practice, psychological designation (*paññatti)* is used as medium of communication. In this regard, the use of psychological designation to obtain the wisdom of conformity with truth can be recognized in various instances. What is the functional value basis of dividing the truth as conventional and ultimate truths? What support will be given by this for the realization of *Nibbāna,* is the main research problem here. The research depends mainly on library survey and textual analysis. *Abhidhamma* texts, its commentaries and sub commentary will be utilized here as primary sources. Furthermore other canonical texts are also utilized as pertinent with the context of discussion to go deep into concepts. Psychological designation, truth, language, concept and other phenomena related with this work are expected to analyze referring to relevant secondary sources on the particular subject. *Paññatti* is free of time, similar to the *Nibbāna*. Thus, *paññatti* is mind originated. What is called the truth, or reality also has a mind based process. This why, even *Nibbāna* is analyzed as an emptiness. Emptiness or with nothing that can be taken as self, in the Theravada Buddhism. According to this, an accurate understanding of *paññatti* will result in a proper understanding of what is really existing or non-existing. Similarly, to explain the above mentioned understanding and to describe how to realize the truth also the psychological designations is to be utilized. Thus the person who enlightened that is taught in Buddhism, deals with society, free from clinging, based on *paññatti*. Language, concepts truth, and reality are controlled by these psychological designations.

Keywords: Abhidhamma, Convention, Paññatti, Truth, Ultimate

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The Impact of Interaction Effect of Education and Work Experience into Earnings: An Application of Mincer Equation

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This study employs the Mincer equation approach to identify the impact of education and working experience into earnings in Sri Lanka. The key question which has studied here is, how to invest on education and training according to its contribution into earnings in Sri Lanka. Mincer equation was first created by Jacob Mincer to explain wage income as a function of schooling and experience. The logerithm of earnings is modelled as the total years of education and a function of work experience. Researchers have used cross section data for years of education, years of work experience, income and other demographic information which were collected by using a questioner. The sample size was 299. STATA 13 and Minitab 19 softwares were used to analyze the data. The descriptive statistics of the variables shows the mean value of the education is around 11 years of the sample and working experience is around 23 years and income of all the respondents is around Rs 45287. According to the multiple regression analysis, results shows a negative value for interaction variable (Education*Experience). Although the coeffient of interaction is minus the overall effect is not resultig a decrease in income, it only does slowing the rate of change. Since the results reject the null hypothesis, there is an interaction between education and work experience into earnings. That means the change in education and work experience together can be affected to the returns of education. This study suggests the need of higher efficiency in education sector in Sri Lanka to decrease the years of education of each individual to obtain the relevant qualification which needs to enter the labour market.

Keywords: Interaction, Labor market, Mincer equation

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Quarantine and Social Isolation During the COVID-19: Sociological Perspective

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Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease and cancer are more likely to develop serious illness (WHO). To control the transmission several factors were taken governments such as quarantine, social distancing among the people washing of hands, wider the running water and wearing face marks. Quarantine implies the restriction on the movement of people and goods which is intended to prevent the spread of COVID-19. To prevent the spread of COVID-19, Infected people were sent to isolation centers for medical treatment by the governments and encouraged them to maintain physical distance as well as social distance. When it comes to define in quarantine it's a state of social isolation in which people from elsewhere or who have been exposed to infectious disease are placed. The main objective of this study was to investigate quarantine an social isolation measures in the midst of COVID-19 in sociological perspective, and also understand the significant relationship between quarantine and social isolation. Besides, to identify the main areas to be targeted by supportive social psychological intervention for different categories of people exposed to the pandemic. The result of this study will help governments to know the appropriate and effective practices to use to control the spread of COVID-19. It will also help them to examine the social psychological impacts of the pandemic. Phenomenological methodology was employed in this research and the analysis comparatively found that, the second wave quarantined people were discriminated, labeled and marginalized in society than the first wave quarantined people because of the irregular fear of disease. The situation of quarantine has created a social stigma during the quarantine period. Overall, the study argues that quarantined person is defined that in social context as an illness or an attempt to stay healthy while being sick. Moreover, it is quite evident that quarantined person is constantly being marginalized, isolated, discriminated and labelled, final neglected by others.

Keywords: COVID-19, Isolation, Quarantine, Social impacts

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The Role of Tradition, Modernization and Economic Factors for the Strengthening of Ethnic Identities

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It is globally acknowledged that all the societies in the entire world comprise various social strata and different ethnic, racial, cultural and religious groups. These differences breed antagonistic interactions which are familiar with ethnically heterogeneous societies. With the advent of Marxism and liberal ideologies in the 20th century, human society has placed lesser emphasis on ethnicity. Marxism advocates that the economic factors, class interests and class conflicts are the foundational sources of the society. In contrast, the liberal ideology is of the view that man is expected to enjoy more freedom at the advanced stage of human social evolution. Apart from this theoretical standpoint of social reality, the issues related to ethnic and religious identities have convincingly begun to emerge. The ethnic, religious and linguistic identities have taken the initiative of the violent or non-violent conflicts not only in developing countries but in developed countries as well. The research problem of the study is how trditionlism, modernaization and economic factors contribute to stragthen ethnic identities. The main focus of this research is on finding out the role of tradition, modernization and economic ambition in strengthening ethnic identities, which are assumed to disappear during a progressive growth phase of social evolution. this paper is based on secondary sources of data. The data has been analyzed using the thematic analysis method. Thematic analysis is the process of identifying patterns or themes within qualitative data. Still, it has given rise to new dimensions. Besides, the educated elites and the urbanites who emerge from the process of modernization, are supposed to go beyond the boundaries of confirmed traditions and distance themselves from traditional ethnic biases. Furthermore, the economic factors to provide the necessary background to support in strengthening ethnic identities in the context of the globalization, as well. The so-called modernization has led to the creation of risky areas of ethnic identity, in other words, to create conflicts to reinforce ethnic identities and contradictions.

Keywords: Economic factors, Educated elite, Ethnicity, Modernization, Traditions

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Strategies Used by English Language Teachers to Enhance Learner Autonomy - A Review

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According to scholars, learner autonomy is the ability to take charge of one's learning. Nonetheless, autonomy or learner independence does not mean that the learners are isolated in education, and there is no role to be performed by the teachers. In reality, developing learner autonomy is a two-way process in which the teacher has to contribute 50% by creating a learner supportive environment while the student has to take charge of the other 50% by developing and organizing their learning process. However, at present most language learners are not autonomous, that the teachers have encountered several challenges in fostering autonomy in the language classrooms. Therefore, this study focused on 14 'YouTube' videos as the sample, presented by English language professionals from various countries. In-detail, the presenters explain the practical strategies and methods they use in their ESL classroom to enhance autonomy among language learners, especially in the classrooms with mixed ability groups. Those videos were thematically analyzed to collect data based on five major categories: talking to students about autonomy and its value, encouraging learners to engage in autonomous practices, getting learners to reflect on their learning, using activities in class that promotes autonomy, and assigning activities out of the classroom which further enhances autonomy. As for findings, the presenters emphasize the need to give more decision-making power to the learners. Consequently, the learners can carry their learning experience beyond the classroom to build up autonomous personalities. Even though the teaching-learning methodology has shifted from teacher-centered to learner-centered, the teacher's multiple roles as an organizer, resource supplier, monitor, and facilitator cannot be undermined. As Sri Lankan ESL education also being exam-oriented, teacher-centered, and often follow a rote learning practice, this analysis of the videos has presented many relevant implications for the ELT context in Sri Lanka.

Keywords: Autonomy, Second language learning, Strategies

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Factors Influence to The Use of Urban Home Gardens for Householder's Food Security in Galle Municipal Area in Sri Lanka

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According to the UN projection, two-third of the world's population is expected to live in urban areas and the global food production will have to increase by 70% to meet the average daily caloric requirement in year 2050. With the increase of urbanization, the available resources as land, water and labour for food production are becoming scarce in urban centers. Reducing food wastage, addressing unsustainable consumption, creating rural-urban supply chains and supporting urban agriculture will strength the urban food security. there is much attention towards the use of home gardens as a strategy to enhance the household food security. Home garden provides easy access to fresh vegetables, fruits and leads to improve the nutrition, health and create job opportunities for the inhabitants. Home gardening was a primitive practice in Sri Lanka and ensured the stability of food security at the village level. But limited case studies have conducted to assess the use of home garden to address the food security in urban municipalities in Sri Lanka. The objective of this paper is to identify the factors effect to the use of home gardens for food production by urban dwellers in Sri Lanka. Every housing unit (n=280) in the selected urban residential zone were surveyed to collect the data and regression analysis was applied to analyze the data. Findings from our quantitative research showed that only 3 percent of the residences are highly used their gardens for food production and they produce 50 percent of food supply from their garden. The study revealed the factors such as land extent, residence's perceptions about advantages receiving from farming in their gardens, occupational status (housewives are not occupied) and their educational level (higher than degree) are significantly influenced to the use of home gardens for householders food production in urban cities in Sri Lanka.

Key words: Food security, Home garden, Householders food production, Residential garden, Urbanization

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An Analytıcal Study on Whether Physıcal Torture or Psychologıcal Tactıcs Were Caused ın Defeatıng the Second Armed Struggle of the Janatha Vımukthı Peramuna (JVP)

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Every human being is born with dignity and every citizen has the right to respects and protect it. also every person has the right to life ,and no one has the right to harm anyone in violation of the law. However, when the people or a political party or organization rises up against the existing legitimate government in an anti-democratic and anti-democratic manner, criminal acts such as arrests, torture, killings, and disappearances are carried out under repressive laws. In the course of history, we find many examples of how even ordinary people have been greatly affected by the failure of government officials to consider to life, especially when there is a civil war in a country of when deciding to start a war. Also since the inception of the monarchy in Sri Lanka the perpetrators have been torturing opponents and punishing those accused of various offenses. They have been described as the thirty tow tortures of our history (Maitipe,1981:148). Accordingly it appears that dangerous punishment systems have been in place in this country since ancient times. The second armed struggle launched by the JVP against the government in during from 1986 – 1989 was crushed down by the army using measures beyond legal limitations a large number of JVP members were arbitrarily detained island wide in the police and army camps and in other places for lengthy periods. There the detainees were treated with harsh punishments. Many were put to death after severely torturing them without any court trials or post mortems. Although the security forces and un-official armed groups inflicted deterrent punishments and inhuman torturing, JVP movement could not be destroyed. Subsequently the government newly employed psychological war tactics to eradicate the JVP. This paper attempts to examine which way was more effective in defeating the JVP.

Keywords: Armed struggle, Psychological tactics, Security units, Suppression, Torture

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Significance of Sexual Counselling for Married Couples: Sociopsychological Perspective

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Sex is one of the most fundamental drives in human being, and thus a universal human need. Marriage on the other hand, is the institution within which this need is institutionalized and regularized. The main objective of this study is identifying sexual crises faced by spouses in the Sri Lankan Family Corporation and the study followed the research question, why sexual counseling is not popular in solving sexual problems in the Sri Lankan family corporation? Having understood this ground reality, authors tended to conduct a field study to unveil empirical findings in relation to the said matter, to investigate whether there would have been a need of sexual counselling in Sri Lankan family context. Almost all of them had some period of 'intense relationships' based on love in the initial period of marriage despite whether the type of marriage was belonged to love or proposed category. What is most imperative in this period to observe was that all couples except few cases studied, had made several adjustments so as to meet with the interests of their partner, and the use of affectionate words had made it more easier. Under this circumstance, they spent relatively a "peaceful" life reporting only insignificant few troublesome situations. This "gorgeous" picture was observed to be turned into a totally adverse direction initiating mostly after the first year of marriage according to study. Financial scarcity, child affairs, household chores interference of family members, job related matters, social responsibility, widening attitudinal gap, loss of attraction of spouse, had eventually restricted the aforementioned interest in sexual relationships among couples. The sensitivity, compassion, sympathy, thoughtfulness, empathy, and companionship towards their counterpart had thus lost drastically among couples over the years after marriage. Overall, despite the restriction of the sample, the data vehemently unveiled the cumulative need of a well-organized sexual counselling service in Sri Lankan family context that would be a prime proposal of the point of view of the authors. This service would be benefitted by married partners in guiding the resolution of their sex related complications that would eventually lead to a happy and peaceful relationships.

Keywords: Case studies, Family, Marriage, Sexual counselling, Sexual relationships

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Agrisilviculture for Improved Food Sovereignty and Enhance Livelihood Development: Monaragala District, Madulla Divisional Secretariat Araluwinna Village

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Araluwinna Village in Madulla Divisional Secretariat of Monaragala district is an agrarian village. One of the objectives of this research is to explore livelihood development avenues in its rich ecological and cultural resource base. The research question was set as how efficient is the current agricultural practices in improving peoples' quality of life and what alternative lively hood strategies could help them in doing so. The case study method was utilized to explore the socio-cultural and economic realities of people living in this village.In-depth and semi-structured interviews, field observations and secondary data sources were the main methods used to collect data. Among the 38 families living in the village 33 families are Samurdhi beneficiaries. The socio-economic conditions of the people and infrastructure development in the village are at a low level. The economic status has recently been degraded further with the loss of opportunities to conduct Chena cultivation. The current land issues pertaining to the village farming has been identified as a manifestation of governmental policies towards land use and crop cultivation. Land issues in Monaragala district have been at the forefront of many environmental and agricultural forums held in past decades. In this background, this study identified the traditional farming systems in the village as having features of Agri-silviculture. There have been positive aspects of this way of agri-silviculture for improved food sovereignty. The economical, environmental and psychological benefits of the Agriculture have been elicited from Araluwinna village. The potential for agro-tourism in this variety of agriculture was identified with many other potentials to develop eco-tourism and adventure tourism in the village. Today we are facing many hazardous effects of myopic practices of agriculture introduced following the green revolution. Food sovereignty is now shown by research for sustainable agricultural development. This research found that the Araluwinna village had food sovereignty achieved through agro-silviculture and now they are being dragged to a disadvantageous position from precluding their yearlong practices. It also discusses how the country's neoliberal land use and agriculture policies brought about this transformation.

Keywords: Agrisilviculture, Araluwinna village, Food sovereignty, Livelihood development, Monaragala district

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Impact of the Exchange Rate on USA-Sri Lanka Bilateral Trade

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USA is the topmost export destination for Sri Lanka. USA solely provides market place for 24% of Sri Lanka's total exports. USA's contribution in Sri Lankan export market is even bigger than the combined market share of the next three top trading partners, namely; UK, Italy and India. In terms of imports, USA stands at the 6th place sharing 2.5% of the total imports of Sri Lanka. Also, the USA is the prime export destination of Sri Lanka's textile and garment industry solely buying 45% of the total exports. Sri Lanka has been maintaining a substantial trade surplus in the bilateral trade with USA over decades. This study attempts to answer the research question whether the bilateral exchange rate is a decisive factor determining the USA-Sri Lanka trade controlled for the other economic fundamentals, with the objective to examine whether Sri Lanka will gain or lose by the continuous currency depreciation in USA-Sri Lanka trade. Using quarterly data from 2004Q1 to 2019Q4, obtained from the Central Bank of Sri Lanka and IMF, the researcher estimated the standard real export (RXP), real imports (RMP), and trade Balance (TB) functions developed by Rose (1989) with slight modifications to include dummy variable to capture structural breaks. The empirical results suggest that 1% increase in domestic price level causes 0.8% drop in real exports to USA, while 1% depreciation of local currency causes to improve real exports to USA by 0.01% in the long-run. The two conclusions drawn above are effectively endorsed by the estimated TB function too. It suggests that 1% increase in domestic price level causes nearly 0.7% drop in bilateral TB ratio, while 1% depreciation of local currency causes to improve TB ratio by 0.9% in the long-run. Accordingly, the study concludes the depreciation of Sri Lankan rupee against US Dollar is beneficial for Sri Lanka provided the local price level is under control.

Keywords: Bilateral trade, Currency depreciation, Excahnge rate, Sri Lanka, USA

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A study of the Influence of Buddhist Rituals for Mental Health (Regarding the *Sripāda* in Sri Lanka)

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Good health and well-being are influenced to build up a great personality. Health is not only physical well-being but also mental well-being, social well–being and spiritual well-being. Although some scientists have found many solutions or treatments for physical problems, it is not easy to solve problems related to the mentality of humans. The Buddha found a path to it and advised to grow up with good qualities with great mental strength and happiness. The Buddha stated that Nibbāna is a word that can be used to express mental or spiritual happiness. It cannot be achieved without practicing the middle path and the first step of this path is moral conduct. It is defined by right speech, right action, and right livelihood. These all are covered by the meaningful Buddhist rituals related to Buddhism. Therefore, Buddhist rituals are caused to protect and develop mental health. As reported by some scholars with dogmatic views, no need to perform rituals, since they are related to mythologies and folklores. They refuse intangible cultural values, ancient beliefs, and cults. Nevertheless, Buddhist rituals are focused the mental health and different from other God-centered religious views. Sri Lankan Buddhist society is engaged with many kinds of historical and traditional Buddhist rituals related to sacred Buddhist leaders, things, and places. Srīpāda (Adam's Peak) is such kind of place and there are literature and archaeological evidence and folklores related to it. Rituals and rites related to the religious culture of Srīpāda in Sri Lanka are very famous among the devotees in many religions. It is a very attractive, historical, and sacred religious heritage which is situated in Ratnapura District of Southern province in the country. According to the Buddhist view in Sri Lanka, the footprint of the Buddha is situated at the peak of the Samanala Mountain. Why people believe that these rituals are caused to protect mental health? It was the reaserch problem here. People believe that they can get a healthy and prosperous life by performing special rituals for Srīpāda every year. This attitude is very useful to develop their good conduct. Especialy, these rituals help to handle stress. Therfore, it caused to be a healthy person in mind. This research paper will reveal it and indicate the value of these kinds of Buddhist rituals. Many researchers' attention is not focused on the influence of Buddhist rituals on mental health-related to Srīpāda. The main objective of this research is to highlight it in the revelation of the facts based on this sacred place.

Keywords: Buddhism, Handle stress, Mental health, Rituals, Srīpāda

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Impacts on Natural Resources in the Southern Coastal Area of Sri Lanka after 1980s

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Coastal areas are abundant in natural resources that are important economically, socially and environmentally. The area consists a very high biodiversity such as fish, mangroves, seagrass, water and coral reefs. However, rapid population growth and its associated development over recent decades have led to severe loss and degradation of these important habitats in the coastal area. The main objective of the study is to examine the impacts on natural resources in the Southern coastal area. Specie objectives are to examine the quantity and scale of the impacts on above natural resources. Research was done in 2015 and a structured questionnaire used for primary data collection, using random sampling and also field observation method was used. 2154 respondents were interviewed. Findings disclose that large amount of fish resources has been caught from the coastal sea by the fishermen for a long period. Correlation coefficient values represent positive relationship between the increase of fish production and increase of active fishermen in Matara and Galle District coastal areas (R^2 = 0.87 and R^2 = 0.53 respectively). Hikkaduwa, Rumassala, Weligama and Polhena reef areas live coral cover was reduced from 1985 to 2015 period by different percentages (30% - 70% range). Galduwa, Mahamodara kalapuwa and Polwatumodara River mouth area mangrove cover also decreased through the last few decades especially from 1994 to 2017 period, (-49.43, -57.65 and -34.83 respectively). Seagrass degraded due to destructive fishing practices (20.9%), used to catch fish (29%) and solid waste (10.9%). According to the distance from the sea (>100m), different pollutants dumped into the sea (pastic 39.1% and solid waste 22.3%). Correlation of distance to sea and different pollutants dumping by distance revealed the positive relationship between each pollutant dumping situation and the distance to the sea in which pollutants were dumped highly within the low distance area. The coastal resources of Sri Lanka are declining and degrading due to a combination of rapid population growth, urbanization, coastal developments, overfishing and destructive fishing methods. Such declines have increased poverty among coastal fishermen's who are directly affected by changes in demography and development in the coasts.

Keywords: Biodiversity, Correlation, Destructive, Pollutants, Solid waste

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An Ethno-archaeological Study of the Kinnara people in Sri Lanka

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Sri Lanka is home to many communities who have contributed to developing its multicultural character. Kinnara is one such small ethnic group, whose settlements are clustered in restricted geographical regions in Sri Lanka, although a small number of non-practicing Kinnaras may live in other areas in the island. Known as '*Karmanta minissu*, '*Karmantakarayo'*, and '*Karamantayo'* they are a distinct ethnic group undertaking decorative craft industries which provide their livelihood and identity. Kinnaras have been studied since the 19th century, but never received serious attention as *Veddas* have. Meanwhile, the lifestyles and cultural practices of Kinnaras are transforming due to the influence of modernization, demanding their immediate record before they disappear irretrievably. Whathe historical significance of Kinnaras in the wider context of Sri Lankan culture is, and how they are coping with the contemporary social changes are the main research questions that concern this study. Consequently, the objective of this research is to record the historical background, geographical distribution, material culture and social aspects of the Kinnaras. To achieve these objectives, 19 Kinnara families from the Kurunegala and Gampaha Districts were studied, recording their material culture, settlement and traditional crafts. Additionally, an individual from a family, the eldest or the person involved in crafts, was interviewed. It was revealed that while the number of families that practice traditional crafts has declined, a considerable number still continues to make mats (*Kalala*). The number of families involved in other traditional crafts, such as *chamara* and *havari* making, are limited. However, there is also a new tendency to make new non-traditional items, such as handbags and purses. Kinnaras use a specific vocabulary for their tools and the process of making crafts that differ from common Sinhala. Endogamy is the most prominent form of marriage prevalent among those studied, while marriages outside their own caste were rarely recorded. These rigid social practices are changing, as marriages between Govigama and Kinnara were observed. This study illustrates the continuity of certain cultural practices amidst social transformations which provides analogies to interpret past societies.

Keywords: Chamara, Ethno-archaeology, Kalala, Kinnara people, Intangible heritage, Traditional crafts

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Knowledge and Attitude Towards Pre-Marital Counselling among Newly Married Couples

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Background Preparation for marriage has become a popular intervention for many individuals planning to marry. One of the basic components of premarital counseling is family life education; it provides the couples with knowledge about individuals as sexual beings, as well as addressing family roles and responsibilities, parenting, human development and interpersonal relations. Due to it's importnce, around the world many countries have encouraged premarital counseling as an important part of primary Health Care Services. In this Background, the main objective of this research was to explore the knowledge and attitudes of the newly married couples towards premarital counseling. Based on purposive sampling, the field study was conducted in this regard in five (05) Grama Niladhari Divisions in Hambantota district. In-depth interviews were conducted for primary data collection. The study revealed that more than 70% of newly married couples have marital problems such as sharing household responsibilities, overcoming economic problems, job insecurity, irritating habits, relationship problems, sexual problems and personality problems. But it was only 20% of couples who believed that these problems are directly affected for their marital satisfaction. However, 35% of couples had the knowledge regarding pre-marital counseling gained from their formal education (especially in university education) and from infromal ways like peer education. In addition, it was revealed that the myths and beliefs regarding pre-marital counseling are nurtured by culture. When comparing gender differences of the attitudes towards pre-marital counseling, the study revealed that married women have negative attitudes about pre-marital counseling than male. About 54% of the sample preferred to seek advice and experiences from their married friends to manage the problems they face in married life and 20% couples strongly believed that marital issues should not be referred to a third party for any reason. As a result of lack of systematic and formal knowledge towards pre- marital counseling services, newly married couples have become a vulnerable group. Hence, it can be concluded that the family counselor can be an educator, guider, advocator, trainer and motivator for enhancing their marital satisfaction. In this background pre- marital counseling has become a predominant need for marriage.

Keywords: Intervention, Marital relationship, Marital satisfaction, Married couples, Pre-marital counseling

The Structure and Usages of Optative Verbs in Classical Sinhalese Era

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The optative mood is traditionally named *āsi kiriyə* (Skt. *āśīrvāda kriyā*) in Sidat Saŋgərāvə. The Optative mood expresses a wholesome wish in future. Basically it gives good or bad wishes. But the Sidat Saŋgərāvə emphasizes only the good wishes under *āsi kiriyə*. This verbal category in Sinhalese has not undergone considerable changes in the history of the language. Mostly the same phonemic and structural value continues in the eras of Sinhalese language evolution. The ancient forms of optative are observed in the inscriptions of Prakrit Sinhalese era. The usage *veqʰə vayu* (Skt. - *bʰavətu*, Pāli - *hōtu*/*bʰōtu*/*bʰavətu*, Sin. *-vayu*) 'may increase' is found in Ruvanvælisāyə pillar inscription. The optative suffix '*-vay*' is found in Mediaeval Sinhalese period in Gærəŋḍigalə rock inscription. *budenā bat no læbet*(*vay*) *para danməye balu kavuḍu vetvay* 'may they not receive food to eat; may they be born as dogs and crows in their next birth'. The optative suffix '*-vā*' was attested in Morəgodə pillar inscription also. *kavuḍu balu vetvā* (və-et-vā) '(may they) become crows or dogs'. Four suffixes are identified in Sigiri Graffiti which were used to make optative verbs in the classical Sinhalese era. They are '*-va*, *-vay*, *-vayu*' and '*-vayə*'. Two types of optative forms (benedictive and vituperative) are observed in traditional grammar whereas four types were identified in classical Sinhalese. They are Benedictive, Vituperative, Precative and Desirous. This research mainly based on qualitative research method. Primary data are quoted from inscriptions and classical Sinhalese literature and secondary data extracted from books, articles and other sources. The main objective of this paper is to identify and categorize the optative mood formations which were found in this era. The research problem of this paper is to observe 'which type of optative formations were found in the classical Sinhalese era'. The history and the usages of the optative mood were discussed according to the data of the classical Sinhalese. Traditionally established two types of usages of optative mood extended up to four types in classical Sinhalese language.

Keywords: Benedictive, Imperative, Optative, Precative, Vituperative

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‘හයිකු’ යනු මාත්‍රා 17කින් (5-7-5) යුත් ජපන් කාව්‍ය සම්ප්‍රදායේ හමුවන කෙටිම කාව්‍ය ආකෘතියකි. එය ක්‍රි.ව. 7වන සියවසයේ සිට 12වන සියවස දක්වා මාත්‍රා 31කින් (5,7,5,7,7) යුත් තන්ක, රෙන්ගා, හයිකායි, හොක්කු යන කාව්‍ය සම්ප්‍රදායන් ඇසුරෙන් පෝෂණය වූවකි. හයිකු කවිය සෙන් දහමේ ආභාසයෙන් ස්වාධීන, විශිෂ්ට හා දාර්ශනික අගයෙන් යුත් කාව්‍ය ආස්ථානයක පිහිටුවන ලද්දේ මත්සුවෝ බෂෝ (Matsuo Bashō ක්‍රි.ව. 1644-1694) කවියා විසිනි. තවද බහුශාබ්දිකත්වය (polyphony) යනු මිඛායෙල් බක්තීන් විසින් වඩාත් පැහැදිලි කරන ලද සාහිත්‍ය නිර්මාණවල අර්ථය හා සෞන්දර්ය කියවීමේදී වැදගත්වන න්‍යායික සංකල්පයකි. සාහිත්‍ය නිර්මාණයක එන කථන නොහොත් ශබ්ද හා සිදුවීම් කතුවරයාගේ මැදිහත්වීමකින් තොරව රසිකයාට ඇසෙන්න සැලැස්වීම බහුශාබ්දිකත්වයයි. එය කතුවරයා විසින් චරිත හා සිද්ධි ගැන පැහැදිලි කිරීමකින් නොව පාඨකයා විසින් නිර්මාණයේ චරිත හා සිද්ධි පැහැදිලි කරගැනීමෙන් උපදින්නකි. එනම් කතුවරයාගේ මැදිහත් වීමකින් තොරව පාඨකයාට නිර්මාණය රසවිඳීමට ඇති හැකියාවයි. කතුවරයා සිදු කරන්නේ නිර්මාණයෙහි සැලැස්ම හා රාමුව අප්‍රකාශිත ව්‍යූහමය තලයක රැඳවීමයි. නිර්මාණයක ව්‍යූහය (රාමුව) සහ ආකෘතිය යනු දෙකකි. ආකෘතිය යනු අන්තර්ගතය බහාලන භාජනයක් වැනි දෙයකි. එහෙත් රාමුව යනු අන්තර්ගතය බහාලන්නක් නොවේ. නිර්මාණයේ කලාත්මකභාවයේ සහ සෞන්දර්යයේම කොටසකි. එහිදී එක් ආකෘතියක විවිධ රාමු නොහොත් අප්‍රකාශිත ව්‍යූහ කිහිපයක් තිබිය හැකිය. (උදාහරණ වශයෙන් දැව යනු ආකෘතියකි. එකී දැව යන ආකෘතිය යටතේ පුටු, අල්මාරි, මේස, ඇඳන් ආදි විවිධ රාමු නිර්මාණය කරගත හැකිය. නිර්මාණයකද එවැනි ව්‍යූහ කිහිපයක් පැවතිය හැකිය.) එය හදිස්සිකාර පාඨකයන්ට නොපෙනෙන්නකි. කතාවෙහි කලාත්මක බව හා සෞන්දර්ය උපදින්නේ වහා නොපෙනෙන හොඳින් සැලසුම් කර නිපදවන ලද අප්‍රකාශිත ව්‍යූහ හේතුවෙනි. මෙම පර්යේෂණයේ අරමුණ වන්නේ නූතනයේ පරිසේවිත මෙම න්‍යායික සංකල්පය මත්සුවෝ බෂෝ කාව්‍ය නිර්මාණ ඇසුරෙන් අධ්‍යයනය කිරීමයි. බහුශාබ්දිකත්වය යනු කුමක්ද? එම න්‍යාය මත්සුවෝ බෂෝගේ හයිකු කාව්‍ය විචාරයට යොදාගත හැක්කේ කෙසේද? යන්න මෙහි පර්යේෂණ ගැටලුය. මත්සුවෝ බෂෝ තෝරාගත් හයිකු කාව්‍ය නිර්මාණ හා බහුශාබ්දිකත්වය යන න්‍යායික සංකල්පය මෙහි පර්යේෂණ සීමාවයි. මෙම පර්යේෂණය ගුණාත්මක පර්යේෂණයකි. මත්සුවෝ බෂෝගේ නිර්මාණ, හයිකු කවිය හා බහුශාබ්දිකත්වය සම්බන්ධයෙන් ලියවුණු න්‍යායික කෘති මෙහි ප්‍රාථමික මූලාශ්‍රය වන අතර පුස්තකාලය හා අන්තර්ජාල මූලාශ්‍රය ඔස්සේ ඒ සඳහා කරුණු ගවේෂණය කරනු ලැබේ.

ප්‍රමුඛ වචන: අප්‍රකාශිත ව්‍යූහය, බහුශාබ්දිකත්වය, මත්සුවෝ බෂෝ, සැලැස්ම හා රාමුව, හයිකු කාව්‍ය

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ආඛ්‍යාන කාව්‍යයෙහි කථාවින්‍යාසය පිළිබඳ ඇරිස්ටෝටලියානු විග්‍රහයක් (ගුත්තිල කාව්‍යය ඇසුරෙන්)

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කවිය මාධ්‍ය කරගනිමින් කිසියම් කථාවක් කලාත්මකව ගොඩනැගීම ආඛ්‍යාන කාව්‍ය වශයෙන් හැඳින්වේ. ආඛ්‍යාන යන පදය බටහිර 'Narrative' පදය ආශ්‍රය කොටගෙන බිහි වන්නකි. ආඛ්‍යාන කාව්‍යයෙහි සන්දර්භමය ගති ලක්ෂණ පිරික්සීමේදී හුදෙක්ම කාව්‍යමය ලක්ෂණ පමණක් නොව නාට්‍යමය, ප්‍රබන්ධමය ගති ලක්ෂණද ඒ කෙරෙන් විද්‍යමානිතය. කථාවින්‍යාසය යනු සංවිධානාත්මකව සකසන ලද සිද්ධිදාමයකි. ඇරිස්ටෝටලියානු විග්‍රහයේදී කථාවින්‍යාසය යන්න පැහැදිලි කරනුයේ ශෝකෝත්පාදකය (Tragedy) ආධාරවය. ඇරිස්ටෝටල් විසින් නාට්‍යමය ශෝකෝත්පාදකයෙහි අන්තර්ගත විය යුතු අංග හයක් දක්වනු ලබයි. එනම් කථාවින්‍යාසය, චරිත, වාග්විලාසය, චින්තනය, ප්‍රේක්ෂාව සහ සංගීතය යන්නයි. එමෙන්ම ඇරිස්ටෝටල් විසින් ස්වීය කාව්‍ය ශාස්ත්‍රය කෘතියෙහි (Poetics) කථාවින්‍යාසයට ප්‍රමුඛ ස්ථානයක්ද චරිත නිරූපණයට ද්විතීය ස්ථානයද ලබා දී ඇත. කෝට්ටේ අවධියෙහි ලියවෙන ගුත්තිල කාව්‍ය වනාහි ඇරිස්ටෝටලියානු ශෝකෝත්පාදකයක් නොවුණද, ගුත්තිල ජාතකයෙහි දැක්වෙන කර්ම සංකල්පයෙන් පරිබාහිරව, කථාවින්‍යාසය ආශ්‍රිත ඇරිස්ටෝටලියානු විග්‍රහයන්ට අනුකූලව ගැඹුරු කියවීමකට ලක් කළ හැකි නිර්මාණයකි. සම්භාව්‍ය පද්‍ය සාහිත්‍යයෙහි බොහෝ ආඛ්‍යාන කාව්‍යවල සිද්ධි ගැළපීමේ අනෞචිත්‍යය සම්බන්ධ විවිධ මතවාද පැවතියත් ගුත්තිල කාව්‍යයෙහි සංවිධානාත්මක ස්වරූපය බහුතරයකගේ ඇගයුමට පාත්‍රව තිබේ. මෙම අධ්‍යයනයේදී සිදු වූයේ ගුත්තිල කාව්‍ය නමැති සම්භාව්‍ය ආඛ්‍යාන පද්‍යයෙහි කථාවින්‍යාසයෙහි පවතින ශිල්පීය ලක්ෂණ ඇරිස්ටෝටලියානු සෞන්දර්ය න්‍යායන්ට අනුව විශ්ලේෂණය කර බැලීමකි. බටහිර සාහිත්‍ය විචාරයත් සම්භාව්‍ය පද්‍ය සාහිත්‍යයත් මෙහි අධ්‍යයන ක්ෂේත්‍ර විය. ඇරිස්ටෝටලියානු න්‍යායෙහි දැක්වෙන කථාවින්‍යාසයෙහි අංග ලක්ෂණ ගුත්තිල කාව්‍ය කෙරෙන් නිරූපණය වනුයේ කෙලෙසද යන්න මෙම පර්යේෂණයේ අධ්‍යයන ගැටලුව වුණි. අපරදිග සාහිත්‍ය විචාරයත් සම්භාව්‍ය පද්‍ය සාහිත්‍යයත් ආශ්‍රිත තුලනාත්මක අධ්‍යයනයක් සිදු කිරීම, කථාවින්‍යාසය භාවිතයෙහිලා ඇරිස්ටෝටලියානු න්‍යාය පැහැදිලි කිරීම සහ ගුත්තිල කාව්‍යයෙහි මුල, මැද, අග යන ත්‍රයෙහි විධිමත් ගැළපීම හඳුනාගැනීම මෙම පර්යේෂණයේ අරමුණු විය. මෙහිදී ගුණාත්මක දත්ත ආශ්‍රය කොට ගැනුණු අතර පුස්තකාලය ගවේෂණය සහ අන්තර්ජාලය පරිශීලනය ඔස්සේ දත්ත ගවේෂණය කරනු ලැබුණි. ගුත්තිල මූසිල වාදය, වීණා තරඟ මණ්ඩපය සැකසීම, තරඟය නැරඹීමට පැමිණි මැති ඇමති පිරිස් වර්ණනය, ගුත්තිලගේ වීණා වාදනය අතිශයෝක්තියෙන් වර්ණනය හා ගුත්තිලගේ සුරලොව ගමන යන මෙකී සියලු සිද්ධිවල මනා අවයව සංස්ථාපනයක් පවතී. ඇරිස්ටෝටලියානු න්‍යායෙහි දැක්වෙන ආකාරයට 'කාරුණ්‍ය' වැනි භාව ගුත්තිල කාව්‍යයෙහි කථාවින්‍යාසය ආශ්‍රිතව ගොඩනැගේ. කථාවින්‍යාසයෙහි අන්තර්ගත විය යුතුයැයි ඇරිස්ටෝටල් විසින් දක්වනු ලබන සම්භාව්‍යතාව (Probability), භවිතව්‍යතාව (Possibility) සහ අවශ්‍යතාව (Necessity) යන ලක්ෂණ ගුත්තිල කාව්‍ය කෙරෙන් විශද වන බැව් පර්යේෂණ සමාලෝචනයේදී ගම්‍ය විය.

ප්‍රමුඛ වචන: ආඛ්‍යාන කාව්‍ය, ඇරිස්ටෝටලියානු න්‍යාය, කථාවින්‍යාසය, ගුත්තිල කාව්‍ය, ශෝකෝත්පාදකය

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A Critical Study of Grammarians' Ideologies on Amukhyattha (Subsidiary Meaning) with Special Reference to the Saddasāratthajālinī and its Ṭīkā

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The world depends on the communication and it is impossible anybody without words. Each and every word we talk has a specific meaning. There are several kinds of meanings for a word. Main meaning and hidden meaning are very common in the usage. But Grammarians are of the opinion that various kinds of subsidiary meanings for combination of words. They have named them as *'upacāra'*. 'Upacāra' means the fixing (placing) the one word's nature to another for there is a similarity between the qualities of two things. On the other hand, combination of two words gives sort of meaning which they don't give the same meaning when separating. Akshapāda, a Sanskrit grammarian mentions ten kinds of subsidiary meanings of words in his 'Nyāya Shāstra'. Other Sanskrit grammarians said that there are thirteen kinds of subsidiaries. According to Pali grammarians, Pañcikāpradeepa, which related to Moggallāna tradition, explains 13 kinds of subsidiaries as explain by the many of the Sanskrit grammarians. But the author of Saddasāratthajālinī like Akshapāda, shows only ten kinds of subsidiaries. Saddasāratthajālinī, which represents the most popular grammar tradition of Sri Lanka and other Pali scholars, is explaining grammar points in phonological view. Therefore, it has mentioned there are two kinds of meanings in a word as the main meaning and subsidiary meaning *(Mukhyāmukhyavaseneva – Saddo dvidhā pakāsitā).* As well as there is one type of main meaning and ten types of subsidiary meanings called *'Dasavidha upacāra'.* These types of subsidiaries help to understand the clear meaning of a word or phrase. Therefore, this research was done by contextual analysis method to identify the importance of subsidiary meaning for a purposive or a meaningful communication.

Keywords: Subsidiary meaning, Saddasāratthajālinī, Sanskrit grammarians, Sāramañjūsā upacāra

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An Assessment of Success and Failures of Resettlement in Disasters ; Special References to ‘‘Oshinton Estate” in Bulathsinhala DS Division

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A disaster is the occurrence of an extreme hazard event that impacts on vulnerable communities causing substantial damage, disruption and possible casualties, and leaving the affected communities unable to function normally without outside assistance. In Sri Lankan context Flood and landslide are caused to significant impact in the community who are living the hazard prone areas. According to DS division reports has shown few of GN Divisions of Bulathsinhala DSD are vulnerable to the disasters. The main objective is to assess of success and failures of the resettlement project in “*Ossington estate*”. Primary data were collected through the Semi-structured interviews, questionnaire survey and field observation. Gramanildari Reports and reliable research papers were selected as a secondary data source. Data were analyzed using mixed method. According to the results 100 households have been constructed since 2018 but 85 families are recently living this estate because they haven’t any income sources within the new area yet because they had to leave their previous villages. Their income sources are basically dependent on the primary activities due to that their income sources are lost. That is caused to bring the negative consequences and have developed the different type of social problems within the household. Householders (95%) were not satisfied about the new settlement because they were not able to lead their livelihood with limited space within the 10 perches. Major disturbance of the resettlement project hasn’t proper mechanism for distributing drinking water sources within the estate due to this matter community are facing great difficulties and they have to spend an extra income for buying the water and there is no proper mechanism to distribute the postal letters within the village. Already they have categorized as disaster vulnerable people although, recent situation isn’t change as well community are socially isolated yet because there are no harmony and cooperation because all of them are coming from different GN divisions and they are leading their lives as differently. Even though have established resettlement project for community wellbeing have arisen different significant issues. Therefore, government or any responsible agencies should pay their attention to build up the living states of the community.

Keywords:. Disturbances, Hazard, Resettlement, Social issues, Vulnerabl community

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The Relationship between Carbon Dioxide Emission and Gross Domestic Production of Sri Lanka

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Environmental pollution is a major problem in every country in the world. The metirials which are taking from the environment using as the row materials for the industrial sector very often. Rapid increase of global temperature has become a one of burning problem in world pararal to the rapid industrialization. Those are directly relates to the behavior of the human. All countries in the World have paid their attention for the sustainable development recently, but now it turnes to green growth economy. The study objected to find short run and long run relationships between the gross domestic production of Sri Lanka and Fossil Carbon Dioxide emission in Sri Lanka. The study is based on quantitative approach and secondary data. Time series data were used for the empirical analysis of the study. Line graphs used to examine the behavior of the variables. Unit Root Test has used to test the stationarity of the data. Vector Auto Regressive model has used to find the short run relationship among the variables and co-integration has used to test the long run relationship between variables. The empirical findings of the study give enough evidence to conclude that there is a long term effect of carbon emission on gross domestic production of Sri Lanka. So, It is important to increase the Green economic concepts should promote in Sri Lanka with the rapid industrialization situation.

Keywords: Fossil carbon dioxide emission, Gross domestic production, Time series data, Short run relationship, Long run relationship

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The Effect of Corporate Governance on Corporate Social Responsibility: Evidence from Sri Lanka

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Motivated by the stakeholder theory and legitimacy theory, this study looks at the causal effect of Corporate Governance (CG) on Corporate Social Responsibility (CSR). The study utilized a sample of 100 companies listed at the Colombo Stock Exchange during 2017 and 2018. The sample excluded banking, finance and insurance and investment trusts sectors due to its' inherent nature of being highly regulated. This research was conducted in two parts. First the empirical association between CG and CSR was studied based on secondary data gathered from annual reports. CG and CSR was measured based on disclosure indexes. Further, firm size, profitability, and firm age were used as control variables. Secondly, five in depth interviews were carried out to uncover the nature of the relationship between CG and CSR. The interviewees included senior managers attached to the accounting function or CSR program of five companies of the selected sample. The results from the regression analysis shows a significant positive relationship between CG and CSR. This implies CSR increases as governance quality improves. The in-depth interviews with top managers complemented this result. Accordingly, all the managers conceive CG as an essential component for a successful CSR drive. The findings from the study implies that Sri Lanka is moving towards counterbalancing the dominance given to CG by giving some attention to CSR. This study makes two important theoretical contributions. First, it adds to the limited number of studies that has been done in the Sri Lankan context to determine the relationship between CG and CSR. Secondly, it gives a basis to the future researchers to explore the nature and the extent of the relationship between CG and CSR in a deeper level. Finally, the researcher expects the findings will have a practical implication for future policies in CSR and CG.

Keywords: Corporate governance, Corporate social responsibility, Legitimacy theory, Stakeholder theory

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The Impact of Consumers' Attitudes on Green Purchase Intention

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The purpose of this paper is to investigate the impact of consumers' attitudes on green purchase intention in Sri Lanka, due to the lack of consensus exists in the causal ordering of either antecedent or mediating variables. Additionally, the literature provides mixed results for the effects of consumers' intention on green purchase intention in the global context while there are few studies in the Sri Lankan context. Therefore, there is an empirical research gap to fulfil in Sri Lanka considering other countries and this study is an attempt to fill this research gap. Four hypotheses were developed based on the constructed conceptual framework derived from the consumer behavior literature. The data were collected over randomly administering structured questionnaires from 100 green product buyers in Galle district, Sri Lanka. The partial least square path modelling (PLS) was used to measure the impact of social influences, environmental consciousness, environmental responsibility and health consciousness, on green purchase intention. The tested hypothesis on purchase intention was not statistically significant with environmental responsibility and health consciousness and other two hypotheses on social influences and environmental consciousness were statistically significant. It suggested that social influence was the most significant variable towards purchase intention. The study unveiled that to enhance customers' attitudes towards green products, government and organizations should take necessary actions by providing positive information about green products and advocating green lifestyles. The findings of the study provided new ways to develop green marketing strategies for organizations by considering environmental concern, environmental responsibilities, health consciousness and social influences. Hence, future study can be outlined to further examine the impact of consumers' attitudes in different dimensions, especially including human variables. Moreover, this study was based on the consumers in the Galle district and sample was limited, the future research should focus on other districts in the country.

Keywords: Environmental consciousness, Environmental responsibility, Green purchase intention, Health consciousness, Social influence

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The Impact of Job-Related Stress on Employee Performance: With Special Reference to Banking Sector of Kalutara District

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Job-related stress is a controversial phenomenon among most researchers in today's turbulent business world. Since business organizations are operating in a complex and volatile competitive environment, it creates stress among employees. Some scholars argue that stress is essential up to some extent to perform well and others may argue the minimal level of stress drives for high performance. Employee job performance is the prime interest of the organization, because of the importance of achieving high productivity in the workplace. Therefore, the purpose of this study is to identify the impact of job-related stress on job performance concerning the banking sector of the Kalutara district. Moreover, this study is trying to address job-related stress under three main dimensions such as role overload, role conflict, and role ambiguity over employee job performance. The dependent variable of job performance operationalized based on task performance, citizenship behaviour and counterproductive behaviour. When considering the context of this study, the banking sector plays a significant role in the economic development of Sri Lanka. Although it has a significant contribution, empirical evidence reveals employees of the banking sector are experiencing a high level of job-related stress due to contextual factors. A research design entails a descriptive research design in a cross-sectional nature. In this study, the researcher collected data through a self-administrated questionnaire from 100 employees representing both private and state banks in Kalutara district by using a convenient sampling method. The study results revealed that job-related stress (dimensions including role overload, role conflict, and role ambiguity) has a significant negative impact on employee job performance. The regression model is significant and the independent variables predict 60.4% of job performance. Based on the coefficient values, the researchers identified the most impacted dimension of job stress is role overload, since it records a high beta value compared to others. The least impacted dimension was identified as role conflict. Therefore, this study will give ample reasons to practitioners in order to consider the stress of employees as an important factor when increasing employees' performance.

Keywords: Job performance, Job-related stress, Role ambiguity, Role conflict, Role overload

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Revitalizing Grassroots Democracy: A Failed Attempt from a Sri Lankan Municipal Council

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Participatory budgeting promotes grassroots democracy, and social justice so as to empower civil society. Such a budgeting practice creates a new space for citizens to raise their voices. As demonstrated in the literature, the intended outcomes and effects of PB could be different by its design, socio-economic and political context, and legal background in which a local authority operates. Similarly, many studies demonstrate how PB is used by local governments in different international contexts. However, one particular study has paid attention to PB in Sri Lanka. Drawing on Bourdieu's relational approach, this study aims to explore how the PB practice becomes instrumental to revitalize local democracy through the budgeting process at a Sri Lankan Municipal Council. This qualitative study is based on semi-structured interviews, document analysis, and field observation. This study reveals that local politicians do not interfere in the collection of the council's revenue. However, they utilize various forms of capital to pursue political gain. This means that PB could particularly be exploited by the local politicians for their personal advantage. In contrast to grassroots politicians, bureaucratic leadership emphasizes the importance of prioritizing the social well-being of residents in the process of budgeting. Bureaucracy is not leaned to organize the public meetings to obtain resident's proposals as they perform duties on the basis of the regulatory procedures. Such behaviour keeps the citizen participation away from the budgetary process and does not contribute to promoting and revitalizing grassroots democracy.

Keywords: Citizen participation, Local democracy, Participatory budgeting, Sri Lanka

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The Challenging Role of Street Vendors: The Untapped Resource in the Informal Economy

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Street vending is pervasive across the globe while the magnitude of its impact on the society is imperative especially in developing countries in the context of the informal economy. Street vending is an unexplored phenomenon in the Sri Lankan business context where only a handful of studies are available and there are many aspects yet to be explored. Accordingly, the study was conducted to evaluate the challenging role of street vendors as an untapped resource in the informal economy within the context of Sri Lanka. The qualitative approach was adopted to explore the phenomenon and street vendors who are operated in two main provinces namely, Western and Southern, in Sri Lanka were selected for the data collection purpose. The in-depth interviews were employed as a data collection tool. Accordingly, 120 street vendors comprising 60 male and 60 female vendors were selected and interviewed. The peculiar features of street vending in Sri Lanka were evaluated. The role of street vendors was evaluated in terms of key aspects; ascertaining the motives behind the selection of street vending as an occupation, recognizing the key challenges confronted by them and appraising the empowerment of street vendors for poverty reduction. Among the motives behind the selection of street vending as an occupation, the positive attitudes and mind-set, the lack of employment opportunities, the lack of skills for formal types of occupations, ability to enjoy freedom and intention to enjoy profitability were identified as key motives. The main challenges faced by street vendors were disclosed as the lack of financing, less support from banks, lack of infrastructure, less support from the government, instable conditions and insecurity. Based on the views of street vendors and scholar literature on poverty, a new conceptual model was developed indicating the worth of empowering street vendors in applying micro-entrepreneurship approach as an effective tool for poverty reduction.

Keywords: Challenges, Informal economy, Motives, Poverty, Street vendors

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Customer Loyalty and Its Antecedents: The Context of Mobile Phone Telecommunications Service Industry

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In the contemporary marketing context, marketers have a substantial interest in studying the nature of customer loyalty and understanding the factors affected customer loyalty in formulating strategies to enhance the level of customer loyalty. Moreover, building and measuring customer loyalty and evaluating the nature and impact of antecedents of customer loyalty have drawn a higher attention in the field of marketing. The study was conducted to evaluate the impact of the major antecedents of customer loyalty in the mobile phone telecommunications services industry in Sri Lanka since the industry plays a pivotal role in the Sri Lankan business context. The quantitative research approach was adopted and a customer survey was employed as the main research method to collect data. The population consists of mobile phones subscribers and the sample comprises 424 mobile phones subscribers. Convenience sampling technique was employed and the data were collected using a structured questionnaire. Customer satisfaction, perceived value, trust, corporate image, service quality, loyalty programmes and switching costs were identified as the key antecedents of customer loyalty. Factor analysis was employed to purify the scale items and identify the underlying antecedents of customer loyalty. The sampling adequacy was measured using KMO value and the reliability was measured using Cronbach Alpha where all variables reported the values above the threshold level. The results of the regression analysis indicate that perceived value, customer satisfaction, service quality, loyalty programmes and switching costs have significant positive impact on customer loyalty while corporate image and trust are non-significant. Also, perceived value has the highest impact on customer loyalty among the loyalty antecedents.

Keywords: Customer loyalty, Mobile phone telecommunications services industry

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Impact of Entrepreneurship Training on Performance of Small and Medium Enterprises in Southern Province

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Small and Medium enterprises are vital to the success of the economy. Today small and medium enterprises enjoy more and more esteem and prestige. To remain competitive and for survival of Small and Medium Enterprises (SMEs), it is suggested to gain higher and broader skills and competencies. In order to achieve this objective, many government and non-government organizations are providing training for micro enterprises and small enterprises. Therefore, entrepreneurial training can be considered as the one of most important aspect related on improving performance of SMEs. The main focus of this study was to identify the impact of entrepreneurship training on performance of small and medium enterprises. Southern province in Sri Lanka was selected as the research site of the study. Population of the study is Small and medium enterprises in southern province. Out of the population, 100 Small and medium enterprises were selected as the sample from southern province of Sri Lanka. Pearson correlation and regression analysis were applied to analyze the data. The study reveals, there is a positive impact of entrepreneurial training on firm performance. Training on business skills, risk management, marketing management, financial management and strategic planning are the key factors which affect entrepreneurial firm performance whereas training on risk management approaches has huge role. To make the training more meaningful to beneficiaries, it is necessary for the trainees to be closely monitored after the training to ensure that they are properly making use of the learnt skills. Based on that, it can be concluded unskilled employees who are recruited by SMEs enhance their competencies through the entrepreneurial training. As a result of enhancing competencies, business performance is increased.

Keywords: Business skill, Entrepreneurial training, Marketing management, Risk management, Small and medium enterprise (SME)

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Antecedents of Employee Engagement among Machine Operators in Apparel Industry

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Employee engagement is considered as one of the most vital factors of the organizational success as engaged employees boost productivity, increase customer satisfaction and inculcate strong organization culture. Despite organizations expect utilizing highly engaged employees, the majority of employees are disengaged at work. Apparel industry is the largest foreign currency earner and a main employment opportunities generator In the Sri Lankan economy. High degree of Employee engagement is important in the apparel industry as the industry often deals with overseas partners. Low level of employee engagement among machine operators has become the grave concern of the Human resource practitioners particularly in the Sri Lankan context. The purpose of this paper is to explore the antecedents of the employee engagement of the machine operators with special reference to Kash Garments (Pvt) Ltd. Based on the extant literature, five antecedents were identified: working environment, leadership, employee loyalty, team performance and internal communication. The theoretical population for the study is all machine operators in the apparel sector and the study population is machine operators in the Kash Garment (Pvt) Ltd. Simple random sampling was used to select the respondents and a total of 275 questionnaires were distributed and 204 valid responses collected. Regression analysis was used to estimate the relationships. It was found that all the identified factors were predictors of employee engagement ($r2 = 0.295$), however, the variables that had major impact were working environment, senior leadership and team performance. Special attention is required to pay specifically on the factors of working environment, team performance and senior leadership as they have shown significantly higher impact on employee engagement. Organizations shall focus on presenting the conducive working environment for employees to work and promoting programs that would enhance leader member relationships. Moreover, it is required to inculcate a culture that fosters team performance.

Keywords: Employee engagement, Internal communication, Leadership, Team performance, Working environment

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The Relationship between Breadth of Outreach and Financial Sustainability of Microfinance Institutions in Sri Lanka

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The prime objective of the microfinance institutions (MFIs) is outreach to the poor communities, who do not have access to formal financial services.The breadth of outreach is the one of the major way to serve the poor communities and simply it can be define as number of poor clients served or reached by MFIs.The literature reveals that ability to reach poor and the poorest segment of the population through outreach with financial sustainbility by MFIs in Sri Lanka is remain unclear and dearth.Therefore, this study is passage to fill this knowledge gap,focusing on MFIs in Sri Lanka. Moreover, it provides comprehensive evidence of the breadth of outreach activities and sustainability by using cross country analysis with panel data of Microfinance Information Exchange, the data gathered by Microfinance Practitioners' Association in Sri Lanka, and other web-related information sources. Two major variables were used to measure the breadth of outreach: number of active borrowers(main proxy) and number of geography locations, and financial self sufficiency was used to measure the financial sustainability of MFIs. It can be concluded that there is a positive and statistically significant relationship between number of active borrowers and the financial sustainability of MFIs in Sri lanka. Further, it describes that, if MFIs increased the number of borrowers it will leads to reduce the cost per borrower and further it helps to recieved economies of scale as well as sustainability. Moreover results illustrated that there is a positive but satistically insignificant relationship between geographic location with financial sustainability of MFIs in Sri Lanka. Study recommends to conduct future studies of this lesser-known area using more proxies to measure the outreach and sustainability of MFIs in Sri lanka.

Keywords: Active borrowers, Breadth of outreach, Financial sustainability, Female borrowers, Microfinance

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Would you help a Charity? The Case of Sri Lankan Millennials

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As a result of the advancement of technology and the origin of the internet the way of funding and operating the business around the world has drastically revolutionized. Crowdfunding is one of emerging effective methods of fund raising for many new projects and start-ups via internet nowadays. This so-called "crowd-funding" concept has become a trend and it is now widely used by non-profit organizations in the world to raise funds through the internet for their charity projects. It is important to understand the donors' intention to support the project as in many cases the success of the charity crowd-funding projects depend on the degree to which the participation of their donors. This study presents an integrated model of UTAUT model and perceived credibility theories to understand the behavioral intention of potential donors in crowd-funding charity projects. According to the conceptual framework this research study investigates the impact of Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitate Condition (FC) on Perceived Credibility (PC) and in turn on Intention to Accept (IA) the crowd-funding platform and charity projects. Research data were collected through an online survey and a mediation analysis was conducted to analyze 70 responses from potential donors in Sri Lanka. The results indicate that Performance Expectancy (PE), Effort Expectancy (EE) Social Influence (SI) and Facilitating Condition (FC) affect Perceived Credibility (PC) and in turn affect Intention to Accept (IA). Findings of this research study are helpful to understand the donors' behavior and decision making process in participating in a charity crowd-funding projects. This research also contributes to the expansion of the knowledge of theories of new technology acceptance and the theories of credibility in the context of online. Thus this study should be of interest to both academia and practice.

Keywords: Effort expectancy, Facilitate condition, Performance expectancy, Perceived credibility, Social influence

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Effect of Online Purchase on Customer Satisfaction With Special Reference to Online Lotteries of Development Lotteries Board, Sri Lanka

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Due to the lack of application of online purchase factors to determine customer satisfaction, this study aims to investigate the effect of online purchase variables (i.e., trust, convenience, price sensitivity, and environmental pollution) on customer satisfaction with special reference to the online lotteries at Development Lotteries Board, Sri Lanka. Four hypotheses were developed based on the constructed conceptual framework derived from the online purchase-related literature. The data were collected over through a survey technique by purposively administering structured questionnaires from 100 buyers of online lotteries in Colombo district, which serves as the largest lottery selling district in Sri Lanka. First, multiple regression analysis was performed to explore the impact of four variables on customer satisfaction, and the analysis was carried out the factor analysis to explore the significance of factors affecting the online purchase. The results of the regression analysis indicated that three hypotheses were accepted and one hypothesis was rejected. It suggested that convenience and trust were the most significant variables of online purchasing. Hence, it suggests that the online purchasing acceptability is depending on customers mind and it should be created through managerial implications. Price sensitivity was the least significant variable toward customer satisfaction, while customer satisfaction was not positively affected by environmental pollution. The results of this study provide new insights to online marketers to better understand the factors affecting online purchases on customer satisfaction in Sri Lanka. The study finding stresses the need to investigate the influence of environmental pollution as the main force to determine customer satisfaction due to empirical pieces of evidence is limited. Because of the complexity of the variables and the research approach adopted to measure the online purchase variables, the study findings may lack generalizability. Future studies are required to test the suggested framework in different online settings and contexts.

Keywords: Convenience, Customer satisfaction, Environment pollution, Online purchasing, Price sensitivity, Trust

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Predictors of Relapse Following Institutional Rehabilitation among Male Drug Addicts in Selected Rehabilitation Centers in Sri Lanka

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Relapse is defined as 'return to drug use after a period of abstinence often accompanied by reinstatement of dependence symptoms'. After a successful rehabilitation program, drug addicts face many challenges in integration with the society and many of them may end up with relapse. This study aimed to identify possible predictors of relapse after drug rehabilitation among male drug addicts managed in selected rehabilitation centres in Sri Lanka. A nested case-control study was conducted among 108 cases (drug addict who had a relapse within six months after discharge from rehabilitation centre) and 74 controls (drug addict who had no relapse within six months after discharge from rehabilitation centre). Data were collected using an interviewer-administered questionnaire and analysed using SPSS software**.** Mean (SD) age of the sample was 29.8(7.8) years. Six factors were associated with relapse after rehabilitation among drug users, of which only two remained predictive of relapse after controlling for confounding. Use of alcohol and tobacco after discharge posed a high risk for relapse (OR=15.16, 95%CI=6.24-36.79, $p<0.001$), while having adverse consequences in social relationships following drug use before rehabilitation demonstrated a lower risk (OR=0.35, 95%CI=0.12-0.98, $p<0.05$) in multivariate analysis. Follow up status after discharge from rehabilitation centre, service satisfaction of client during rehabilitation and after discharge from the rehabilitation centre and having a history of previous rehabilitation did not emerge as significant risk or protective factor in multivariate analysis. Use of alcohol and tobacco after discharge from rehabilitation centres increased the risk for relapse while experiencing adverse consequences in social relationships emerged as a protective factor against relapse. The study recommends to address, use of other psychoactive substances including alcohol and tobacco and social issues of drug addict during management of drug addicts.

Keywords: Illicit drug users, Predictors, Rehabilitation, Relapse

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Newborn Screening for Congenital Hypothyroidism in Sri Lanka: Economic Impact Assessment

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Economic evaluations will determine policy decisions on any screening programs. Systematic approach on estimations of long term clinical and economic outcomes are necessary in project evaluations. The Newborn Screening Information System Database (www.nsisd.ruh.ac.lk) was retrospectively analyzed to assess key performance indicators of the program. Then total cost calculated for the screening program, including sampling, forms, hormone tests, diagnosis, treatments and care was identified and calculated up to the age of seventy-five years. The well-being is calculated by multiplying disability adjusted life year (DALY) by GDP per capita. Total benefits to the society and disability adjusted life year is calculated for each year. In 2019, the program achieved 92% coverage with 160,000 samples received. 126 babies were confirmed as having congenital hypothyroidism with an annual incidence of 1 and 1200 live births with the positive predictive value of 66%. The cost per baby for sample analysis was LKR 344.34 per sample received in 2019. The instrument maintenance, recall tests, confirmatory and follow up tests with the treatment costs were considered to calculate total cost of the program. The calculated cost for screening in 2019 was LKR 54,942,072 with follow up management cost of LKR 42,237,563. The total benefit to the country with the program in 2019 was LKR 356,553,781 resulted benefit/cost ratio 3.60. Considering high incidence of hypothyroidism, screening has a huge impact where improving health and welfare of the society that will ultimately improve the potential future economic impact on public health perspective. The national CH screening program has been able to prove it is effective in both timely detecting at-risk babies as well as appropriately effective in economic impact to the society. The improved health outcomes constitute a critically important part in both health outcomes and short-term as well as long-term costs when considering screening expansions and policy decisions.

Keywords: Congenital hypothyroidism, Cost-benefit, New born screening

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Validation of Sinhala Version of Psoriasis Epidemiology Screening Tool

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Psoriatic arthritis (PsA) occurs in one third of patients with psoriasis and mostly remains undetected leading to debilitating deforming arthritis, eventually. The Psoriasis Epidemiology Screening Tool (PEST) consists of five items and a mannequin for patients to mark the joints that cause pain and discomfort and score ranges from 0-5. It is a quick and valid tool, widely used to detect PsA in clinical practice and has been validated to many languages. In this study, we intended to assess the psychometric properties of Sinhala version of the PEST (PEST_sv). The PEST_sv was formulated according to the process of cross-cultural adaptation described by Beaton, et al. It was tested on 199 psoriatic patients attending the dermatology clinic at a tertiary care National Hospital in Sri Lanka. Patients who were detected to have PsA previously and those with other rheumatologic conditions were excluded. Demographic data, disease characteristics as well as Dermatology Life Quality Index (DLQI) were obtained. All patients were examined by a dermatologist to determine the psoriasis area and Psoriasis Area Severity Index (PASI) score. All patients were assessed by two rheumatologists who were blinded to the answers provided in the PEST_sv questionnaire and the diagnosis of PsA was made based on CASPAR criteria. We observed that the total PEST score of 3 or more was the best cut-off value to screen for PsA. This cut-off value showed the highest Youden index (sensitivity = 0.89, specificity = 0.95). In the ROC analysis, the area under the curve of the PEST_sv was 0.95 (SE 0.02, $p < 0.001$). PEST_sv total score showed a significant correlation with body surface area involved but not with DLQI or PASI score. The Sinhala version of PEST demonstrated satisfactory performance as a screening tool for detecting PsA.

Keywords: Psoriatic arthritis, Psoriasis, PEST, Validation study

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Clinical Utility and Safety of *Coccinia grandis* Extract in Patients with Newly Diagnosed Type 2 Diabetes Mellitus: A double Blind, Placebo Controlled, Randomized Clinical Trial

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Preclinical studies (*in vitro* and *in vivo*) have demonstrated the antidiabetic effect of the aqueous leaf extract of *Coccinia granids* (Linn.) Voigt (Cucurbitaceae). This study determined the clinical utility and safety of the herbal capsule of *C. grandis* (HCC), which consisted freeze dried powder of the hot water extract of *C. grandis* leaves, in patients with newly diagnosed type 2 diabetes mellitus (DM). Newly diagnosed type 2 DM patients (n=158), belonging to age group of 30-60 years, were recruited for three months long double blind, randomized, placebo controlled clinical trial. Patients with known hyperlipidemia, hypertension, renal, liver, cardiac, respiratory, thyroid, psychiatric and any other chronic or acute diseases, and pregnant women were excluded. Recruited patients were randomized into two groups (1:1 ratio) either to receive HCC (500 mg/day) or placebo capsules of corn starch (500 mg/day). Percentage of glycated hemoglobin (HbA_{1C} %), fasting plasma glucose (FPG) concentration, insulin and homeostatic model assessment for insulin resistance (HOMA-IR), serum concentration of fructosamine and safety parameters were estimated at the base line and at the end of the intervention. Intention-to-treat analysis, the "gold standard" for analyzing data of clinical trials, was performed. The mean (SD) changes between the groups were assessed using unpaired sample t-test and Mann–Whitney U test for normally and non-normally distributed data respectively. Mean (SD) changes of variables from the baseline to the end of the intervention in the test and the placebo groups were 0.66 (0.52) and 0.06 (0.64) for HbA_{1C} % ($p<0.001$), 1.91 (2.95) and -1.28 (9.32) for insulin ($p<0.001$), 0.02 (0.03) and -0.01 (0.03) for fructosamine ($p<0.001$), 1.43 (0.55) and 0.04 (0.48) for FPG ($p<0.001$), 1.73 (1.31) and -0.37 (3.22) for HOMA-IR ($p<0.001$) respectively. Hematological parameters, renal and liver safety parameters and blood pressure were within the normal physiological reference ranges at the base line and at the end of the intervention. In patients with newly diagnosed type 2 DM, administration of HCC (500 mg/day) for three months was well tolerated and significantly improved glycemic control.

Keywords: Clinical trial, Coccinia grandis, Diabetes mellitus, Herbal drug, Safety

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Effect of a Pre-Designed Exercise Program and Metformin on Sub-clinical Atherosclerosis Among Individuals with Impaired Glucose Tolerance

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Pre-diabetes is associated with a high risk of atherosclerosis which can be detected by measuring sub-clinical atherosclerosis. We studied the effect of pre-designed exercise program or metformin on the progression of subclinical atherosclerosis among individuals with impaired glucose tolerance (IGT). One hundred and twenty people with IGT, determined by 75 g oral glucose tolerance test (OGTT) were recruited. They were allocated to four groups; pre-designed exercise (IGT-E), metformin 500mg once daily group(IGT-M), combined intervention group (IGT-EM), control group without any intervention (IGT-C), by block randomization method. Interventions were continued for six months, and carotid artery intima-media thickness (CIMT) was measured at the baseline, at the end of six months of intervention and at18 months after an intervention-free period of one year. Mean(SD) age of IGT-C (n=30), IGT-E (n=30), IGT-M (n=30) and IGT-EM (n=30) at baseline were 43.9(8.7), 41.0(8.7), 50.6(8.2) and 48.8(8.4)years. The CIMT difference in right posterior wall at six months when compared to baseline in IGT-C, IGT-E, IGT-M and IGT-EM were [{-0.004mm, (p=0.63)}, {0.047mm,(p<0.001},{0.034mm,(p<0.001)} and {0.046mm,(p<0.001)}] respectively. The CIMT difference in left posterior wall at six months when compared to baseline in IGT-C, IGT-E,IGT-M and IGT-EM were [{-0.014mm, (p=0.23)}, {0.051mm, (p<0.001}, {0.056mm, (p<0.001)} and {0.073mm, (p<0.001)}] respectively. The CIMT difference in right posterior wall at 18 months when compared to baseline in IGT-E, IGT-M and IGT-EM were [{0.019mm, (p=0.004}, {0.016mm, (p=0.03)} and {0.046mm, (p<0.001)}] respectively. Further, the CIMT difference in left posterior wall at 18 months when compared to baseline in IGT-E, IGT-M and IGT-EM were [{0.026mm, (p=0.004}, {0.029mm, (p<0.001)} and {0.048mm, (p<0.001)}] respectively. Significant reduction of posterior wall CIMTs was observed in all intervention groups at six months and at 18 months when compared to the baseline. But, right and left posterior wall CIMTs showed a significant increase [{0.044mm, (p<0.001)} and {0.04mm1, (p<0.001)}] in IGT-C during 18 months of follow-up. Pre-designed exercise program, metformin monotherapy or the combination of the two were effective in reducing the progression of sub-clinical atherosclerosis among individuals with impaired glucose tolerance.

Keywords: Exercise, Impaired glucose tolerance, Metformin, Pre-diabetes, Sub-clinical atherosclerosis.

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Evaluation of Photoprotective Potential in Sunscreen Formulations Prepared from Methanolic Extract of *Mollugo cerviana* (L.) Ser.

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Sunscreens are capable of reducing solar ultra violet (UV) radiation-mediated detrimental conditions such as erythema, wrinkling and photocarcinogenesis. Synthetic sunscreen-related side effects are hindering the commercial success of these products. Several *in vitro* and *in vivo* studies have suggested that these side effects occur due to the synthetic photoprotective molecules. The importance of natural photoprotective molecules is therefore underlined. The present study is aimed at quantifying the photoprotective potential of sunscreen formulations prepared from a methanolic extract of *Mollugo cerviana* (pathpadagum) plant. Firstly, the cytotoxicity of the methanolic extract was determined using MTT assay. Thereafter, three different sunscreens formulations were prepared from the extract by incorporating different concentrations (25%, 50% and 75%) into an aqueous cream base. The initial photoprotective activity of these formulations was evaluated by measuring the UV absorbance and the sun protection factor (SPF) was subsequently calculated. The extract displayed over 90% cell viability in the MTT assay, indicating its suitability to develop into a herbal sunscreen. The SPF values of the prepared formulations revealed that the one with 75% of extract has the highest photoprotective activity of 27.59±0.15. In addition, 25% and 50% of extract-incorporated formulations displayed SPF values of 15.83±0.22 and 22.91±0.14 respectively. The photostability of all these formulations was confirmed by the insignificant deviation of SPF values during a three-week time span. Moreover, the negative control failed to display any photoprotective activity while the positive control displayed an activity below the proclaimed level.

Keywords: Mollugo cerviana, Photoprotection, Sun protection factor, Ultra violet

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Diverse Inhibition Pattern of a Group of Phytochemicals on Selected Human Pathogenic Bacterial Species

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The emergence of bacterial resistance to existing antibiotics has become a global crisis and there is an urgent need for the development of alternative antimicrobial agents with different chemical composition and/or mechanisms of action. In these circumstances, natural products such as phytochemicals play a crucial role in novel antimicrobial drug discovery. Since medicinal plants have been widely used to treat infectious diseases in folk medicinal systems worldwide, rationalizing their ethnobotanical significance is a timely requirement. Therefore, the present study was carried out to investigate the antibacterial activity of five different phytochemicals isolated from plants grown in Indian subcontinent namely stigmasterol, bixin, lupeol, andrographolide, and maslinic acid against selected bacterial strains. All compounds were tested against common bacterial pathogens; *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 25923), and *Pseudomonas aeruginosa* (ATCC 27853) by broth micro-dilution method using ciprofloxacin as the positive control. The results indicated that all tested phytochemicals do not possess any antibacterial activity against *S. aureus* and *P. aeruginosa* except maslinic acid which showed bactericidal activity on *P. aeruginosa* with a minimum inhibitory concentration (MIC) of 0.4 mg/mL. Surprisingly, a diverse inhibition pattern was observed with stigmasterol, bixin, andrographolide, and maslinic acid against *E.coli* where the inhibition occurred in lower concentrations while the higher concentrations were unable to inhibit the bacterial growth. These observations resemble the "Eagle effect " that has been referred to the paradoxically reduced antibacterial effect of some antimicrobial agents at high doses. The reported MIC of stigmasterol, bixin, maslinic acid was 0.002 mg/mL while the MIC of andrographolide was found as 0.01 mg/mL against. *E. coli*. However, *E.coli* exhibited resistance to lupeol. These preliminary observations revealed the ethnopharmaceutical significance of the selected phytochemicals and their potential to be developed as antimicrobial substances.

Keywords: Antimicrobial, Eagle effect, Phytochemicals, Natural products

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Optimization of Preparation of Alginate Nanoparticles for Encapsulation of Ivy Gourd Extract

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Nanoencapsulation is an innovative approach to overcome the limitations of conventional herbal extracts that are used as therapeutic agents. The optimization of conditions in the preparation of nanoparticles is critical in the development of nanonutraceutical formulations from edible plant extracts. The objective of the present study was to optimize the conditions such as temperature, amount of surfactant and the process (speed of stirring and homogenization) in order to develop Ivy gourd *Coccinia grandis* L. (Cucurbitaceae) leaf extract encapsulated alginate nanoparticles with an appropriate particle size and encapsulation efficiency. Alginate nanoparticles were synthesized using ionic gelation method varying the conditions as temperature, amount of surfactant and the process using magnetic stirrer and homogenizer. Span 80 was used as the surfactant. The particle size analysis (PSA) measurements were obtained at each step of the optimization process. The aqueous leaf extract of *C. grandis* (1 mg/mL) was encapsulated using the ionic gelation method under the optimum conditions. The resultant pellet was subjected to the PSA. The encapsulation efficiency of nanoencapsulated aqueous leaf extract was calculated with respect to the total phenol content in the supernatant. The optimized conditions in the nanoparticle formation were temperature at 30 ^{o}C, 5 drops of span 80 and stirring at a speed of 1100 and 1400 rpm (after addition of cross linker - $CaCl_2$). The particle size obtained for the blank nanoparticles under optimum conditions was 433.70 ± 54.32 nm. The particle size and encapsulation efficiency of nanoencapsulated aqueous leaf extract of *C. grandis* were 520.30 ± 38.79 nm and 54.56% respectively. The temperature, amount of surfactant and the process (speed of stirring and homogenization) affects the particle size of alginate nanoparticles. The optimized conditions were adequate to obtain a satisfactory encapsulation efficacy of *C. grandis* leaf extract and the optimized conditions will be used in the further development of herbal nanonutraceutical formulation/s using ivy gourd.

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Keywords: Alginate nanoparticles, Coccinia grandis, Nanonutraceuticals

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High Prevalence of Community-Associated Methicillin-resistant *Staphylococcus aureus* Infections in patients admitted to District General Hospital-Matara

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Methicillin-resistant *Staphylococcus aureus* (MRSA) shows resistance to most commonly used antibiotics. MRSA can be classified as community-associated (CA) or healthcare-associated (HA) based on epidemiological, genotypic, and antibiotic susceptibility patterns. This study aimed to investigate the prevalence and predominant MRSA types isolated among patients admitted to District General Hospital, Matara (DGHM). Consecutive *S. aureus* isolates were collected from August to November 2020 from the clinical microbiology laboratory of DGHM. All *S. aureus* and MRSA isolates were confirmed using standard microbiological methods. Sociodemographic and clinical data were collected from medical records. Based on the antibiotic profile, isolates were identified as HA-MRSA (often resistant to β-lactam antibiotics as well as erythromycin, clindamycin and fluoroquinolones) and CA-MRSA (often resistant only to ß-lactam agents, erythromycin and occasionally to fluoroquinolones), as described by the Centers for Disease Control and Prevention, USA. A total of 103 *S. aureus* isolates were collected from the laboratory during the study period. The isolates were from 52 (50.5%) males and 80 (77.7%) adults (≥18years). Isolates were obtained from pus (75, 72.8%), blood (17, 16.5%), respiratory (6, 5.8%), sterile fluid (3, 2.9%) and urine (2, 1.9%) cultures. Of all *S. aureus*, 57 (55.34%) isolates were identified as MRSA mainly from pus (42, 73.68%) and blood (8, 14.04%). In all MRSA isolates, resistance to non-β-lactam antibiotics were seen as 88% to erythromycin, 35% to clindamycin and 47% to ciprofloxacin. A total of 17 isolates showed resistance to all 3 antibiotics indicating, 29.8% of the MRSA as HA-MRSA and the rest as CA-MRSA (70.2%). The majority of *S. aureus* isolated from clinical cultures at DGHM during the study period were MRSA. CA-MRSA can be recognized as the predominant MRSA type. More robust analyses including epidemiological and molecular data are needed to confirm the leading MRSA types.

Keywords: Antibiotic resistance, CA-MRSA, HA-MRSA, MRSA infection, Prevalence

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Association of Serum Vitamin D with Bone Turnover Markers, Trabecular Bone Score and Bone Mineral Density in A Group of Community Living Adult Women in Bope-Poddala MOH Area

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Although hypovitaminosis D is prevalent in the community, its associations have not been studied in our country. This study investigated the association of serum 25-hydroxyvitamin D [25(OH)D] with bone turnover markers, trabecular bone score (TBS) and bone mineral density (BMD) in a group of adult women. A total of 333 adult women >20 years of age, living in Bope-Poddala MOH area were recruited by age stratified random sampling method. Serum 25(OH)D (total), bone formation marker; procollagen type I N-propeptide (PINP) and bone resorption marker; cross linked C-telopeptide of type I collagen (CTX) were measured using ELISA. Vitamin D cut-off levels were defined as deficient (<20 ng/mL), insufficient (20-29 ng/mL) and sufficient (≥30 ng/mL). TBS, BMDs of hip (THBMD), femoral neck (FNBMD), spine (LSBMD) and whole-body (TBBMD) were measured by DXA. Multivariate analysis (adjusted for possible confounders) was used to compare the means between those with normal (n=194) and low 25(OH)D levels (insufficient or deficient, n=139). Partial correlation (adjusted for possible confounders) was used to elicit correlations between variables. Mean CTX and PINP levels were significantly high in vitamin D deficiency/insufficiency vs normal group (CTX; 0.60 ng/mL vs 0.50 ng/mL, p=0.004), (PINP; 325 pg/mL vs 287 pg/mL, p=0.046). Mean TBS, THBMD, FNBMD and TBBMD were significantly lower in vitamin D deficiency/insufficiency vs normal group (TBS; 1.283 vs 1.307, p=0.011), (THBMD; 0.867 g/cm^2 vs 0.904 g/cm^2, p=0.001), (FNBMD; 0.718 g/cm^2 vs 0.750 g/cm^2, p=0.003), (TBBMD; 0.970 g/cm^2 vs 0.996 g/cm^2, p= 0.005). Further, serum 25(OH)D had negative correlation with CTX (r=-0.20, p<0.001) and PINP (r=-0.124, p=0.023) and positive correlation with TBS (r=0.14, p=0.010) and BMD (r=0.11-0.19, p<0.04). In conclusion, Vitamin D deficiency/insufficiency is associated with increased bone turnover, lower BMD and poor bone microarchitecture.

Keywords: Bone turnover markers, Serum vitamin D, Bone mineral density

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Use of Traditional, Complementary and Alternative Medicine in Sri Lanka; A Systematic Review

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Traditional, complementary and alternative medicine (TCAM) practices are well-known in Sri Lanka. We performed a systematic review on the usage of TCAM among Sri Lankans since this has not been adequately evaluated. A literature search was done in Pubmed, Google Scholar and Ovid using keywords "Ayurveda"or "Siddha" or "Uniani" or "Desheeya Chikithsa" or "complimentary medicine" or "alternative medicine" and "Sri Lanka". Primary studies describing the usage of TCAM among Sri Lankans were included in the analysis. Reviews, case reports and studies conducted among non-Sri Lankans were not included. Of the final 385 studies retrieved after the search only five studies were directly relevant. A study including 254 adults with diabetes attending a tertiary care hospital in the Central province found TCAM use among 76% patients. While 19% were on one type of CAM, 34%, 21% and 2.4% were on two, three or more than three preparations, respectively. Another group of researchers in 2010, found TCAM use in 67.4% cancer patients among 500 patients studied. 95% of those who used TCAM thought "it would cure their cancer" while others did not take mostly on doctors' advice. According to another study 18% of the study participants used TCAM for oral conditions. Of them, 72%, 3% and 25% had used Ayurvedic, Unani and folk medicines respectively. In 2019, reported use of medicinal plants among 53.7% of subjects selected randomly from Pollonaruwa. A similar study by same researcher in 2018 found use of medicinal plants for inflammatory conditions among 50.7% of subjects in the Western province. Studies examining the use of TCAM among Sri Lankan are sparse. The available studies, however, indicate that a high proportion of patients/people use TCAM for their illnesses. More studies are needed to uncover the reasons for using TCAM among Sri Lankans.

Keywords: Complementary therapies, Medicine-traditional, Systematic review

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Optimization of Encapsulation Efficiency of *Coccinia grandis* (L.) Voigt Extract Encapsulated Nanoliposomes

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Nanoliposomes are commonly used in the encapsulation and delivery of plant polyphenols. This technology offers an attractive strategy to address the limitations in bioavailability and stability of polyphenols. Leaves of *Coccinia grandis* (L.) Voigt is a rich source of polyphenols which exhibit antidiabetic effects. Encapsulation of *C. grandis* extract into nanoliposomes may lead to the development of a novel therapeutic agent against diabetes mellitus. This study attempted at optimizing encapsulation efficiency (EE) of *C. grandis* leaf extract encapsulated nanoliposomes at varying loading concentrations of the plant extract. Nanoliposomes were formulated by modified emulsification and ultrasonic method using ethanolic solution of phosphatidylcholine and cholesterol (20:1) as the lipid phase and phosphate buffered saline mixed with Tween® 80 (0.1% v/v) as the aqueous phase. Particle size and poly dispersity index (PDI) of the nanoparticles were determined by dynamic light scattering. Formulation of *C. grandis* leaf extract encapsulated nanoliposomes were initiated by dissolving different solvent extracts [distilled H_2O, EtOH (70% v/v) and EtOH (100% v/v)] in the lipid phase at different concentrations (1.5, 3, 6 and 9% w/v). The EE was determined by quantifying the polyphenols of the extract and the unloaded polyphenols after encapsulation. The encapsulated nanoliposomes were freeze dried for determination of loading capacity (LC). Creaming Index of nanoliposomes were determined. The Z-average particle diameter of blank liposome nanoparticles was 132.56 ± 5.48 nm with a polydispersity index (PI) of 0.499. The maximum EEs and LCs for aqueous (44.10 ± 2.77%, 2.5 ± 0.25%) and EtOH (70% v/v) (35.76 ± 3.51%, 1.6 ± 0.17%) were obtained when extracts were loaded at 6% w/v. The EtOH (100% v/v) extract showed the highest EE and LC (50.12 ± 2.58%, 1.1 ± 0.07%) when loaded at 3% w/v. Creaming index of all formulations was in a range of 90.2-94.8% indicating favourable stability. Obtained data could be used in future investigations on *C. grandis* leaf extract encapsulated nanoliposomes for the development of nano-nutraceuticals with improved therapeutic outcomes.

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Keywords: Coccinia grandis, Encapsulation efficiency, Nanoliposome

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Gmelina arborea Roxb. Aqueous Extract Loaded Chitosan Nanoparticles: Formulation and Characterization

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Decoctions prepared from the bark of *Gmelina arborea* have been employed in Sri Lankan traditional medicine as a remedy against diabetes mellitus. Encapsulation of bioactive secondary metabolites of *G. arborea* could enhance their therapeutic potential and provide controlled release. Amongst the different matrices available as options to encapsulate bioactive compounds, chitosan-based nanoformulations have received favourable attention due to their advantageous biological properties such as biodegradability, biocompatibility and nontoxicity. Dried powdered stem-bark *G. arborea* (30 g) was separately extracted using deionized water, acetone, ethyl acetate, dichloromethane (400 mL each) under ultrasonication (40 kHz, 37 ºC, 30 min). The α-amylase inhibitory assay was conducted on each dried extract dissolved in buffer or DMSO, in triplicate. The total phenol content (TPC) and flavonoid content (TFC) were determined according to Folin-Ciocalteu and aluminium chloride methods, respectively. The aqueous extract which showed the highest α-amylase inhibitory activity (IC_{50} 0.19±0.04 mg/mL), TPC (12.97±0.12 mgGAE/g) and TFC (1.58±0.02 mgGAE/g) was subjected to nanoencapsulation. The aqueous extract of *G. arborea* was encapsulated in chitosan-tripolyphosphate (CS-TPP) by ionotropic gelation method under magnetic stirring and homogenizing. Dynamic light scattering analysis of Z-average and polydispersity index (PDI) indicated that magnetic stirring method (104.92±1.22 nm, PDI 0.418) was more suitable for nanoformulations than homogenizing (140.28±5.34 nm, PDI = 0.403). Aqueous extracts at varying (i.e. 0.125% w/v, 0.250% w/v, 0.375% w/v) were encapsulated to CS-TPP nanoformulations. Unloaded polyphenols were separated by centrifugation (10,000 rpm, 4 ºC, 30 min) and free polyphenol contents were determined by Folin Ciocalteu assay in triplicates. The highest encapsulation efficiency (EE) (57.64±2.38%) and loading capacity (LC) (0.25±0.07%) were observed for 0.375% w/v aqueous extract. Further studies on α-amylase inhibitory activity of loaded CS-TPP nanoformulations are in progress to investigate the antidiabetic activity towards the development of commercial nano-nutraceuticals with enhanced therapeutic potential.

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Keywords: Gmelina arborea, Nanoencapsulation, Chitosan, Tripolyphosphate

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Effect of Water: Ethanol Ratio on Extraction Yield, Total Polyphenol Content and Total Flavonoid Content of Selected Sri Lankan Medicinal Plants

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Plant polyphenols and flavonoids are of great interest for the development of nutraceuticals targeting the management of chronic disease. Composition of the extraction solvent is an important determinant for the preparation of polyphenol rich plant extracts. Pure organic solvents, aqueous-organic solvents and distilled H_2O are commonly used for the extraction of plant polyphenols and flavonoids. H_2O and ethanol are considered as solvents suitable for human consumption hence commonly used in extraction of bioactive compounds. This study aims to investigate the effect of water: ethanol ratio on extraction yield, total polyphenol content (TPC) and total flavonoid content (TFC) of selected medicinal plants using *in vitro* colorimetric assays. Leaves of *Coccinia grandis* (L.) Voigt (Kovakka), *Gymnema sylvestre* (Retz.) Schult (Masbedda), *Murraya koegnii* (L.) Spreng. (Karapincha), *Costus speciosus* (Koenig) Smith. (Thebu), flowers of *Cassia auriculata* L. (Ranawara) and aerial parts of *Scoparia dulcis* L. (Wal koththamalli) were collected and oven dried (40 °C). Dried plant materials (6 g each) were extracted using ethanol (EtOH) (100% v/v, 60 mL), EtOH (70% v/v, 60 mL) and distilled H_2O (60 mL) under ultrasonication (40 kHz, 40 ^{0}C for 30 min). Resulting organic phases were concentrated *in vacuo* and aqueous extracts were freeze dried. TPC and TFC were analyzed by Folin Ciocalteu and aluminium chloride assays respectively, in triplicates. The highest extraction yield was obtained for the aqueous extracts except for the *C. auriculata* and *G. sylvestre* extracts where the highest yield was given by EtOH (70% v/v). The TPC and TFC of the plant extracts were in the range of $22.79 \pm 1.06 - 196.06 \pm 14.83$ mg gallic acid equivalent (GAE)/g and $4.26 \pm 0.10 - 128.13 \pm 9.34$ mg quercetin equivalent (QE)/g respectively. TPCs were high in EtOH (100% and 70% v/v) extracts. The EtOH (100% v/v) extracts exhibited the highest TFC. The results revealed that EtOH (100% and 70% v/v) is suitable for the extraction of polyphenols and flavonoids from the selected medicinal plant extracts.

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Keywords: Extraction solvents, Flavonoids, Medicinal plants, Polyphenols

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Effects of Phyllodes Extracts of *Acacia auriculiformis* A. Cunn. ex Benth. on Selected Weeds and Crop Species; Insight Towards a Bioherbicide Development

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Acacia auriculiformis is an introduced/non-native plant species has caused deleterious effects on biodiversity; become one of the most noxious plant species in Sri Lanka. The study was aimed to investigate the phytotoxic effects of phyllodes of *A. auriculiformis* on two weed species; *Tridax procumbens* (dicot) and *Echinochloa glabrescens* (monocot) and two crop species; *Oryza sativa* (AT–56) and *Vigna radiata*. Pot experiments were carried-out in triplicates, utilizing ambient water (experiment-1) and boiled water (experiment-2) extracts of phyllodes of *A. auriculiformis* to determine its effects; both concentration (0-control,0.5%,1% and 5% w/v) and the age (extracts were kept for 1,7,14,21 and 28-days, in experiment-1) on germination (12-healthy seeds per replicate) and growth (5-seedlings per replicate) of selected weeds and crop species over two weeks. Generalized Linear Model (GLZ) and two-way ANOVA tests were used to analyze germination and growth data, respectively. In experiment-1; significant reduction in germination percentage ($p<0.05$) was observed in *E. glabrescens* (concentration-0.5%,1%,5%w/v for all ages) and *T. procumbens* (concentration-1%,5%w/v, except at 1-day old extracts). Shoot and root dry-weights of *E. glabrescens* were significantly reduced ($p<0.05$) at 5% concentration of 1-day and 7-days old extracts. However, no significant effect of age of extract was observed. In experiment-2; significantly lower germination percentages of *T. procumbens* and *E. glabrescens* were observed, compared to the control ($p<0.05$) at all concentrations. Shoot and root length of *E. glabrescens* and *V. radiata* (at 5%w/v) and dry-weights of all species (at all concentrations) were significantly reduced ($p<0.05$) compared to controls. It was concluded that 5%w/v water extract is the effective concentration in reducing germination and growth of selected weed and crop species. Further, this concentration is more effective on dicots than monocots. Current study revealed that the phytotoxicity of phyllodes of *A. auriculiformis* could be used to produce bioherbicide which could pave the way for an ethnobotanical management of *A. auriculiformis*.

Keywords: Acacia auriculiformis, Bioherbicide, Germination, Growth, Ethnobotanical management

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RNA silencing suppressor protein of CaCV Triggers Hypersensitive Resistance Response in Capsicum; Candidate Avr Determinant

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Capsicum chlorosis orthotospovirus (CaCV) is an emerging pathogen of capsicum and chili crops in Australia and South-east Asia due to lack of resistant cultivars. In Australia, breeders are trying to incorporate CaCV resistance into commercial cultivars. However, a corresponding avirulence (*Avr*) determinant has not been identified. Therfore, the present study was aimed to identify a candidate CaCV protein functioning as an Avr determinant. The R-Avr interaction initiates a cascade of hypersnsitive responses (HR) leading to the accumulation of reactive oxygen species (ROS). Therefore, detection of ROS is an indication of HR. All CaCV proteins except RNA polymerase were transiently expressed in CaCV resistant and susceptible cultivars. Briefly, CaCV open reading frames (ORFs) for the proteins of NSm, Gc and Gn glycoproteins, NSs, and N were cloned into plant expression vector (pSITE II) as fusion to flag peptide using Gateway® cloning system and transformed into plant using *Agrobacterium*. Three strains of *Agrobacterium* and various optical densities were tested to determine a suitable *Agrobacterium* strain and concentration that minimally influence leaves. Recombinants and empty pSITE II vector were transformed into *A. tumefacience* strain EHA105 and infiltrated into 4-5th leaves of 5-6 weeks old resistance and susceptible capsicum. NSs expression led to severe necrosis in the infiltrated zone of resistance plants while all other treatments including empty vector showed chlorosis. Buffer-infiltrated leaves did not show any visible response. Therefore, chlorotic phenotype was considered as a plant's general response to agroinfiltration. Further, 3,3'-diaminobenzidine (DAB) histochemical assay provided evidence for accumulation of hydrogen peroxide only in the leaves of resistant capsicum expressing NSs. These data confirmed that CaCV NSs uniquely triggers a necrotic HR-like phenotype in CaCV resistant capsicum and NSs is the most likely viral *Avr* gene candidate. This is the first report of identifying NSs functioning as the *Avr* gene in capsicum.

Keywords: Avr gene, CaCV, Hypersensitive response, Resistance

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Comparison of the Quantities of Selected Phytochemicals of the Leaves of Seven Guava Varieties in Sri Lanka

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Guava leaves contain various chemical constituents with significant pharmacological activities such as anticancer, antidiabetic, antimalerial, etc in humans. Eventhough, Sri Lanka is rich with many guava varieties including wild and introduced, no adequate scientific studies have been documented yet based on the guava variety for their phytochemical quantities. Therefore, this study was aimed to determine the quantity of total polyphenolic, flavonoid, tannin and terpenoid content in seven guava varieties namely, *Psidium pomiferum* (Apple-pera), *Psidium guineense* (Embul-pera), *Psidium guajava* (Getta-pera and Common guava) and improved varieties of *Psidium guajava* (Kanthi and Pubudu) and *Psidium guineense* (Costorican) for the purpose of producing a repository to be used for the scientific community and general public. The leaves were collected and authenticated prior to use. The chemical constituents of cleaned and air-dried guava leaves were extracted by maceration with methanol and phytochemical quantifications were carried out spectrophotometrically using standard protocols. Mainly, total polyphenolic and tannin contents were determined by Folin-Ciocalteu method and flavonoid content was determined by $AlCl_3$ method. Highest polyphenolic and tannin contents were observed in common guava (479.29 ± 2.16 mg GAE/g and 437.54 ± 0.57 mg TAE/g respectively) with respect to other varieties and lowest value was observed for one of the improved varieties, Costorican (352.21 ± 2.72 GAE/g and 323.27 ± 1.71 mg TAE/g respectively). The highest value of flavonoid content was observed in Kanthi (34.23 ± 0.05mg QE/g). Terpenoid is abundant in apple guava (29.29 ± 0.09 mM LE/g) compared to other varieties. All the varities used in this study contain large quantities of pharmacologically important phytochemicals such as phenolics, flavanolids , teprnoids and tannins. A slight variation of these phytochemicals is noted among the varities, however the common guava is rich with all the analyzed phytochmeicals in the study. Therefore, further investigations are required to isolate bioactive phytochemicals and respective antioxidant analysis in order to be used them in the nutraceuticals and other pharmacological applications.

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Keywords: Guawa varities in Sri Lanka, P. guajava, P. guineense, P. pomiferum, Phytochemicals quantitifcations

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Preliminary Study on Phytochemical, Proximate and Physicochemical Parameters of the Yellow Variety of Cashew Apple (*Anacardium occidentale*) Grown in Giradurukotte Region, Sri Lanka

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Cashew apple is the seasonal, accessory fruit of *Anacardium occidentale*. Although kernel has a tremendous local and international market value, cashew apples get wasted in bulk due to high perishability, astringency, limited shelf life and lack of post-harvest management techniques. Availability of such naturally ripen, nutritious fruits are scarce in the market and introducing value added products from cashew apple is important to manage consumer requirements in a healthy manner. Aim of this study is to conduct phytochemical, proximate and physicochemical analyses of cashew apple in order to explore the possibility for value addition. Phytochemical analysis was carried out using standard protocols and it showed the presence of main phytochemicals such as alkaloids, saponins, terpenoids, quinones and glycosides. Total flavonoid, phenolic and tannin were quantified based on colorimetric method using quercetin, gallic acid and tannic acid as the standards respectively and the results were recorded as 88.1 ± 0.6 mg QE/g of total flavonoids, 161.4 ± 1.3 mg GAE/g of phenolic and 143.1 ± 1.2 mg TAE/g of tannin. Proximate analysis was carried out by following AOAC protocols and it showed the moisture (78.75), ash (4.14), crude fat (8.11), fiber (5.64), carbohydrate (2.03) and crude protein (1.33) content in w/w 100% respectively. Fresh juice prepared from fruit pulp showed pH as 4.13 ± 0.01, titratable acidity as 0.31 ± 0.01%, TSS as 40.0 ± 0.5˚ Brix, density as 1.0133 g/mL, viscosity as 4.27 mPa, total sugars as 2.32 ± 0.31 g / 100 mL and ascorbic acid as 181.4 ± 0.7 mg / 100 mL. As a conclusion, cashew apple is rich in important phytochemicals, acceptable proximate compositions and favorable physiochemical properties that are responsible for its nutritional profile showing great potential for value addition in order to make it available throughout the year.

Key words: Cashew apple, Phytochemicals, Proximate, Physicochemical composition

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Heavy Metal Contents in Surface Sediments of Kalametiya Lagoon, Sri Lanka and Heavy Metal Uptake by *Typha angustifolia* L., A Wetland Sedge

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Heavy metal pollution in aquatic ecosystem causes severe threats to all types of entities. Sediments act as a sink and a carrier of heavy metals in aquatic environment. Available data on heavy metal concentrations of Kalametiya lagoon sediments and associated vegetation are limited. Therefore, this study was aimed at studying heavy metal contents in surface sediments of Kalametiya lagoon and to assess the phytoremediation capacity of wetland sedge *Typha angustifolia* L. Surface sediment (0–15 cm) and *Typha* plant samples were collected from 36 different grid points across Kalametiya lagoon in March 2019. Both samples were subjected to a total digestion (i.e. microwave digestion with conc. HNO_3 and HCl) and analyzed by using ICP-MS to examine the heavy metal contents of arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), and mercury (Hg). In addition, a questionnaire survey was conducted to investigate the possible sources of the heavy metals studied. The results showed that mean value of heavy metals concentrations except Hg were lower than threshold effect levels (TEL) and Hg may reach to potential effect level (PEL) in near future. Higher accumulation of heavy metals Cr, Pb and As was observed in the lagoon outlet while lower concentrations in the inlet of Kalametiya Lagoon. The mean heavy metal contents in the sediments of Kalametiya lagoon decreased in the following order Cr (1.849-3.252 ppm) > Pb (0.137-0.347 ppm)> As (0.075-0.104 ppm) > Hg (0.002-0.425 ppm)> Cd (0.004-0.009 ppm). The sedge, *Typha* took up heavy metals in the following order: Cr > Pb > As > Cd > Hg. Industrial sewage, river suspended sediments and agrochemicals such as fertilizers, pesticides are identified as the possible sources for the heavy metal loads. Presently, it is highly recommended to detour the water inflow channel to avoid the accumulation of toxic heavy metals.

Keywords: Aquatic environment, Kalametiya lagoon, Phytoremediation, Spatial distribution, Typha angustifolia

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Forecasting Gold Prices in Sri Lanka Using ANN and KNN approaches

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Forecasting is the process of estimating the relevant events of the future, based on the analysis of their past and present behavior. There are various methods of forecasting such as Statistical methods, time series methods, Machine learning methods, etc. Each method has its properties, accuracies, and costs that must be considered when choosing a specific method. However, no method can be suggested as universally applicable. Although several studies developed models to predict gold price in Sri Lanka based on traditional time series modeling such Auto Regressive Integrated Moving Average (ARIMA), Vector Auto-Regressive (VAR), etc. and Feed Forward Neural Network (FFNN), no studies has been used K-Nearest Neighbors (KNN) algorithm to predict the gold prices in Sri Lanka. So, the objective of this study is forecasting gold prices in Sri Lanka using the K-Nearest Neighbors (KNN) algorithm and Artificial Neural Network (ANN) model. This study is based on the data set of daily gold prices in Sri Lanka from June 10,2014 to June 02, 2017. First 600 data points were selected for training the models and the rest were used to test the accuracy of the models, while there were 719 data points in the set. In this study, input and output for KNN and ANN approaches have been selected as consecutive past 7dyas values and next-day value of the gold price respectively. The min-max normalization process has been used to transform the data into the range [0,1] for both approaches. The Euclidean distance has been used to find the parameter "*k"* in KNN that refers to the nearest data points to the unknown and the "trial and error" technique is used to choose the best ANN architecture with back-propagation learning. While parameter k in KNN was selected as 3, the optimal ANN model was 7- 4 -1 architecture, i.e. the number of nodes in the input layer, hidden layer, and output layer were 7,4 and 1 respectively. The initial weight sets between (-1,1), for input and output layers were generated randomly, the learning rate of the back-propagation learning algorithm was 0.8 and the number of iterations in the training process was 6000.

Keywords: ANN mode, Forecasting, Gold price, KNN model

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Invasive Alien Plants and the Associated Insect Assemblages in Some Selected Habitats in Matara District, Sri Lanka

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İnvasive alian plants cause major threats to the biodiversity of Sri Lanka. Abundance and distribution of these plants within the country has increased significantly within past two decades. Present study aims to identify invasive alien plant species in five selected natural habitats in Matara District. Further, insect fauna associated with two species of invasive plsnts were studied. Selected five natural habitats were Kiralakele wetland, Kekandura forest, University of Ruhuna premises(UOR), Godagama and Akuressa. Within each habitat, sampling sites were selected randomly and using a line transect (100 m), invasive plants found in the site were counted. Observations were made on insect fauna associated with *Anona glabra* and *Lantana camara* plants in Kiralakele. Data was collected by visiting each habitat once a monthfrom June 2016 to February in 2017. All studied habitats are affected by alien invasive plants and ferns. Among the identified 20 invasive plants during the study, the most common invasive plants found in all sites were *Acasia sp, Typha sp, L. camara, pennisteum sp, Panicum maxicum* and *Alstonia macrophylla*. *Anona glabra* is the most dominant plant associated with waterbodies of study habitats. *Acasia* plants were also associated with water bodies in the kiralakele wetland. Other plants such as *A. glabra* and *Hydrilla* species are associated with aquatic habitats and, in Kiralakele wetland. *A. glabra* plants have high distribution in all sites indicating that one of the important natural environments in Matara District is seriously affected by invasive plant species. İn UOR premises, all species of invasive plants were recorded but their abundance is not high due to the continuous maintenance of landscape. Faunal association in two invasive plant species namely *A. glabra* and *L. camara,* in Kiralakele indicated insects belong to 25 families and to 23 families were associated with *A. Glabra* and *L. Camara* plants respectively. Further, most of the fauna associated with both plant species were insects and large vertebrates such as birds or reptiles are not associated and they were only occasional visitors of the plants. Finding of the study indicates most of the natural as well as human modified landscapes in Matara district are affected by invasive plants, but they are not important sources of food or nesting sites for larger animals such as birds.

Keywords: Invasive alien plants, Insect fauna, Matara District

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Habitat Diversity and Coexistence of Mosquito Larvae in Kalutara District, Sri Lanka

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Mosquitoes can breed in variety of aquatic environments. Different types of breeding habitats and their properties influence the coexistence and the occurrence of different mosquito species. However, knowledge on mosquito breeding site preference is important for planning effective mosquito control strategies. The purpose of the present study was to identify coexisting mosquito species in different aquatic habitats available in Kalutara district. The study was conducted in 13 Medical Officer of Health areas in Kalutara District. Larval survey was carried out in every two months of the study period from January 2019 to August 2020. Dipping and pipetting methods and well net was used to collect mosquito larvae. All collected larvae were observed under the compound microscope and identify up to the species level using available taxonomic keys. According to the results in different aquatic habitats 67 forms of coexistence could be observed among mosquito larvae. The coexistence of five species (*Anopheles tessellatus, A. elegans, Culex tritaeniorhynchus, C. brevipalpis* and *Heizmania* sp.) were observed in a stone pond in Gokarawala in Walallawita area. Two species, *Aedes albopictus* and *Armigeres subalbatus* were the frequently observed coexisting species throughout the study period All of them were found in ephemeral collections of water. Normally *Aedes aegypti* breeds in artificial container habitats and *Ae. albopictus* breeds in natural container habitats. But *Ae. aegypti* and *Ae. albopictu*s were observed as the coexisting species seven times. Similarly, *C. quinquefasciatus* breeds in polluted water and dengue vector mosquitoes breed in clean water. But *C. quinquefasciatus* coexisted with both *Ae. aegypti* and *Ae. albopictus*. *C. tritaeniorhynchus* and *C. gelidus* also coexisted in ground pools and channels in Panadura area. Mosquito larvae coexistence also could be observed with predatory mosquito larvae. To get more information on habitat diversity of mosquito larvae further study should be done to identify the parameters that determine the selection of breeding sites by female mosquitoes.

Keywords: Breeding places, Coexistancting Mosquito species, Kalutara district, Predatory mosquito larvae, Vector mosquitoes,

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Drug Repositioning Using Sparse Graphs and Subnetwork Identification

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New drug discovery is a long process that requires a large investment of money and time. Drug repositioning focuses on identifying new therapeutic effects for existing drugs. Computational drug repositioning plays an essential role in pharmacology as it can be used to reduce the number of in-vivo and in-vitro experiments. In computational drug repositioning, it is believed that drugs having similar characteristics are more likely to demonstrate similar therapeutic effects. Hence, analysing pairwise drug similarity is crucial. Subnetwork identification (SI) is a network-based approach that identifies a small subnetwork from a large drug similarity network (DSN) focusing on a single disease. Unlike other popular network-based and machine learning approaches, SI can be used to infer repositioning candidates for a single disease at a time. The drugs in the identified subnetwork should share similar characteristics. For the first time, the drugs associated with the nervous system are chosen from Class "N" of Anatomical Therapeutic Chemical (ATC) classification to construct the DSNs. This study aims to demonstrate the generalization of subnetwork identification method for drug repositioning. In the DSNs, drugs are represented by the vertices, and terminals are a predefined set of vertices chosen according to ATC class-N. SI algorithm focuses on identifying subnetworks from the DSN, minimizing the edge-cost of the subnetwork. SI algorithms perform well on sparse graphs. Moreover, employing different DSNs by varying the terminals and varying the sparse graph generation methods (SGGMs) provides an opportunity to assess the drug repositioning candidates based on a consensus solution. This study employs two new SGGMs for identifying subnetworks from large-scaled DSNs. In addition, two existing SGGMs were employed to create four different types of sparse DSNs. The repositioning candidates identified in multiple subnetworks are more likely to reposition for the disease represented by the DSN. Nimodipine, Alclometasone, Lisinopril, Theophylline, Vinblastine, and Naftifine appeared in at least five subnetworks. Hence, they can be inferred as reliable drug repositioning candidates for diseases associated with the nervous system.

Keywords: ATC classification, Drug similarity network, Drug repurposing, Nervous system, Sparse graph

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Nonlinear Time Series Modelling using Alternating Conditional Expectation: A Case Study on Colombo Stock Exchange

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Time series modeling is a dynamic research area and is commonly applied in real life. While a lot of research is focused on linear analysis of time series, the actual data is often nonlinear. Recently nonlinear time series models have gained much attention due to the fact that linear time series models faced various limitations in many empirical applications. There are many kinds of nonparametric methods such as the kernal smoothing, local linear regression, peanalized regression, alternating conditional expectation (ACE) algorithm and so on to model nonlinear behaviors. The accuracy of the forecast might be enhanced by modeling the nonlinear behaviors of the series. As the Colombo Stock Exchange is the major financial trading agency in Sri Lanka, attention was paid to model and forecast the Standard & Poor's Sri Lanka 20 (S&P SL 20) index. Although many researchers have modeled stock market indices using Box-Jenkins methodology, published researches on modeling S&P SL 20 index using nonparametric techniques are relatively less. Generally, stock prices are chaotic and show nonlinear behaviors. BDS test is a powerful tool for detecting serial dependence in time series. The BDS test applied, reject linearity of the S&P SL 20 series . Among different types of nonparametric techniques, this study focuses on ACE algorithm to model and forecast the S&P SL 20 index. When applying the ACE algorithm on real data, the expected values are replaced by the corresponding sample values. To estimate conditional expectations, the Super-smoother method is used in this study. The error measure criteria used here is Root Mean Square Error (RMSE) and its value is 1.59. The RMSE of the best linear model ARIMA (1,1,0) is 21.14. The results show that the ACE method can successfully be applied as a better approach to model the S&P SL 20 index.

Keywords: Alternating conditional expectation algorithm, Nonlinear time Series, Nonparametric methods

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On Some Statistics of Poisson Distribution with Applications to a Particular Family of Biochemical Reaction Networks

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Biochemical reaction networks (BCRNs), which describe the chemical reactions occurring between molecules inside a living cell, play a central role in systems biology and related areas. Mathematical and stochastic modelling together with computer simulations has long been recognized as important approaches in studying many aspects of such complex networks. In particular, we consider an elementary stochastic model for protein production and degradation. This simple model is also a component of more complex models for gene regulatory networks which is a particular family of BCRNs. It is known that this stochastic model is a poisson process that falls into the category of Markov processes which is a very important class of stochastic processes. In the present simplified model, the protein is produced at a constant rate k_1, while it is degraded with rate k_2. The equilibrium distribution of this simple network is a Poisson distribution with the parameter determined by k_1 and k_2. For different values of k_1 and k_2, we have a family of such networks each having a Poisson distribution, that is, we identify each network by its distribution. Thus, we construct a differentiable manifold having such simple protein networks (Poisson distributions) as elements and study their properties from information theoretical and geometrical points of view. We first derive some information functionals of the Poisson distribution namely, entropy, relative entropy (a.k.a. Kullback-Leibler divergence), and Fisher information matrix. We elaborate on the relationship between relative entropy and Fisher information matrix by expanding the relative entropy functional in Taylor's series. The exponential family structure of the Poisson distributions is discussed demonstrating the importance of this concept for many good intrinsic properties such as parameter estimation of those distributions. In this new setting, we elucidate that entropy as a measure of the complexity of the network under consideration. Geometrically, the relationship between Fisher information and relative entropy reveals that it is appropriately used for measuring the sensitivity of the parameters. This should be clear from the facts that the relative entropy can be used as a measure of the distance between two distributions and Fisher information can be used to measure the efficiency of an estimated parameter.

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Keywords: Biochemical reaction networks, Information functionals, Information theory, Information geometry, Poisson process and distribution

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Floral and Leaf Epidermal Morphology of Two Selected Species in Genus *Plumeria* and Their Taxonomic Significance

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Two species of *Plumeria* (*P. rubra* L. and *P. obtusa* L.) found in Sri Lanka are quite similar in their morphology. There is no total descriptive research work carried out about floral and leaf epidermal morphology in genus *Plumeria* in Sri Lanka. Therefore, the main aim of this research was to compare and contrast variation in floral and leaf epidermal morphology to assess their value in species level identification and classification. Another objective is to establish the taxonomic relationships between these two species. Leaves and flowers of *Plumeria obtusa*, and *Plumeria rubra* (*P.rubra* var. *acutifolia*, *P.rubra* var. *tricolor*) were collected from three locations in Matale and Matara districts. Floral morphological characters such as petal length and width, etc. and leaf epidermal morphological characters such as stomatal density and index, trichome density, etc. of the species were observed, measured and compared. The results of this investigation manifested some similarities and interspecific variation of the species. Relatively significant highest adaxial stomatal index and stomatal density are in *P.rubra* var. *acutifolia* and lowest in *P.obtusa.* Trichome density, trichome length and width are highest in *P.obtusa* and lowest in *P.rubra* var. *acutifolia*. Longest, widest epidermal cells and longest narrowest guard cells are in *P.obtusa.* Shortest, narrowest epidermal cells and shortest, widest guard cells are in *P.rubra* var. *tricolor*. Shape of epidermal cell on adaxial leaf surface in *P.obtusa*, *P.rubra* var. *acutifolia* and *P.rubra* var. *tricolor* are irregular, pentagonal and hexagonal respectively. Moreover longest and widest petal length are in *P.obtusa*. and corolla colour of the two species are characteristics to them. Therefore, those differences could be used as taxonomically valuable characters to identify the two species. However both species showed inter species similarities in paracytic stomata and non-glandular, unicellular, filiform trichome, presence of epicalyx, twisted petal aestivation and lobed stigma.

Keywords: Epidermal morphology, Floral morphology, Plumeria obtusa, Plumeria rubra, Taxonomy

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A Preliminary Study to Identify Possible Mammalian Reservoirs of Cutaneous Leishmaniasis Parasites in Selected Sites of Hambantota District, Sri Lanka

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Cutaneous leishmaniasis (CL) is an established disease in Sri Lanka transmitted by sand flies Hambantota is one of the endemic areas for the disease. *Leishmania donovani* the causative ager of CL needs a mammalian host and an arthropod vector, sand fly in its life cycle. Present study wa conducted to investigate on whether domestic or peri-domestic animals of CL infected patients a reservoir hosts in Hambantota district. CL positive patients were identified by examining th Giemsa–stained thin smears of lesions which were collected from patients who presente themselves to either Tangalle or Hambantota hospital from March, 2014 to February, 2017. Bloo samples were collected from dogs (n= 56), a cat and rats (n=8) found from households of selecte CL positive patients of the same profile. Buffy coat was separated from blood sample wit Histopaque by centrifugation and PCR was performed with two primers kDNA and ITS1, LITSI separately. Secondly, two smears were prepared from each buffy coat sample and tissues of splee and liver of each rat. These smears were stained with Giemsa and prepared smears were examine under the oil emersion lens of light microscope to detect amastigote form of *Leishmania donovan* Ethical approval for the study was obtained from the Ethics review Committee of Faculty o Medicine, University of Ruhuna All caught rats were identified as *Mus mayori* species. PCI samples prepared from buffy coat of dog blood were negative for the parasite. It was unable to fin amastigote form of *L.donovani* from each smear. Findings of the present study may indicate tha examined animals do not participate in transmitting of *L.donovani* parasite. Anthroponoti transmission cycle of *Leishmania* parasites may be persisting in study sites of Hambantota district

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Keywords: Cutaneous leishmaniasis, Hambantota, Leishmania sp.,Mus mayori, Reservoir hosts

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Effect of Different Data Structures When Applying CLLA to Accelerate Computational Processing of the State-of-the-art Meshfree Based Plant Cellular Models

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Compared to numerous theoretical and empirical models, in order to simulate a wide range of plant cellular models to predict complex microcellular behaviour, numerical models are increasingly being used by the researchers in recent times. In this regard, meshfree methods such as Smoothed Particle Hydrodynamics (SPH) which is a popular method to model fluid flows, are found to be more adaptable and capable, particularly when handling excessive deformation. This is mainly due to the method of interaction calculation where meshfree methods update the neighbour particles in real-time and do not rely on fixed grids like in grid-based methods. However, the neighbourhood finding and interaction calculation become extremely costly in meshfree methods and hence the simulation time extends more than grid-based numerical methods. As a solution, the study applied Cell Linked List Algorithm (CLLA) which is one of the Nearest Neighbour Particle Searching (NNPS) technique over conventional All Pair Searching (APS) using the state-of-the-art meshfree based plant cell numerical model. The novelty of this paper is to determine the effectiveness of different data structure usage towards computational efficiency of meshfree based plant cellular models. The study used same algorithm with different data structures to analyse the efficiency. Accordingly, the study compared the performance of two data structures: map and vector. Both qualitative and quantitative simulation outcomes of a fresh single cell and tissues composed four and seven cells, were simulated with APS and CLLA, incorporating both maps and vectors. CLLA with maps resulted in 10-17% computational time saving while CLLA with vectors gave 30-24% time saving compared to the original model using APS and vectors. Therefore, the study found that the vector data structure can be recommended for meshfree based plant cell models in order to minimise computational cost.

Keywords: Cell linked list algorithm (CLLA), Maps and vectors, Meshfree based plant cell model, Nearest neighbour particle searching (NNPS), Smoothed particle hydrodynamics (SPH)

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Optimal Quarantine and Isolation Strategies for COVID-19 Based on a Mathematical Model

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Most of the countries in the world are currently suffering from the COVID-19 pandemic. Until researchers find medicines or vaccinations to suppress this disease, the most appropriate control techniques are wearing facial masks, frequently cleaning hands, social distancing, quarantining suspected close-contacts, and isolating infected people. A properly managed disease control process is very useful as it helps to minimize the economic and social issues that occur due to the spread of the disease. This paper aims to find optimal quarantine and isolation control strategies for COVID-19 based on a modified six compartments (susceptible(S), exposures (E), infectious (I), quarantined (Q), isolated (J), recovered (R)) mathematical model (SEQIJR-type). Modification to the model is done by considering quarantine and isolation rates as time-dependent parameters, in order to define optimal control problem which brings a novelty to the current study. The optimal control problem is designed to minimize the number of infections, quarantine, and isolated population sizes by proposing a suitable cost functional. Pontryagins Maximum Principle was applied to minimize cost functional. When there is no control, the infected population size was highly increased over time whereas it was reduced by a considerable amount with the presence of control strategies. Possible maximum strengths of the control strategies depend on the capacities of hospitals and quarantine centers as well as the economic strength of a disease spreading country or region. Therefore, controlling infectious population size in such a way that not exceeding the maximum hospital capacity is very important in the disease management process. Considering this fact, we subsequently insert an inequality state constraint to the problem to find optimal isolation and quarantine strategies that required controlling the disease. The observations indicated that the limited capacity of the isolation centers causes to increase in the size of the infected population which makes sense for real scenarios.

Keywords: COVID-19, Disease control strategies, Disease modelling, Optimal control, Pontryagin's maximum principle

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Characterization and Treatment of Paint Industry Effluents Using Coagulation and Fenton Oxidation

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The wastewater released from the paint industry contains a large number of toxic chemicals including dyes and organic matter. These toxic effluents have been reported to have adverse effects on the environment and human health. Therefore effective treatment procedures need to be followed before discharging them into the environment. The research work reporting here aimed to characterize the effluents released by a local paint industry and then apply the coagulation and Fenton oxidation technique to treat the effluents. The initial characterization of the effluents revealed that the wastewater is high in COD (5870 ppm), Oil & grease (3000 ppm), Turbidity (>800 NTU), BOD (35 ppm), TDS (1023 ppm) and TSS (1121ppm). All these parameters exceeded the tolerance limits imposed by CEA. The coagulation studies were carried out by using $Al_2(SO_4)_3.16H_2O$ (Alum), polyaluminum chloride (PAC), polyaluminum chloride with polyacrylamide polymer. The reduction of COD was evaluated as an indicator of treatment efficiency. The maximum COD reduction 78% was observed at Al^{3+} dosage of 1000 ppm when the Alum and PAC were used as the coagulants at pH=8. A very low Al^{3+} concentration (100 ppm), an 83% reduction of COD was observed when the 50 ppm polyacrylamide was mixed with PAC. Fenton oxidation of the waste resulted in a 90% COD reduction when 6 $mmoldm^{-3}$ of Fe (II) and 60 $mmoldm^{-3}$ of H_2O_2 (1:10 ratio) were used at pH=4 with 600 rpm stirring rate at temperature 30 ^{0}C. The results of the current study will be useful when waste treatment plants are designed to treat the paint industry effluents.

Keywords: Coagulation, COD, Fenton Oxidation, Wastewater, Polyaluminum chloride

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Assessment of Genotoxic Effects of Pollutants in Moragoda Ela Cross drains, Galle Using Erythrocytes Nuclear Abnormality (ENA) Biomarker of Tilapia (*Oreochromis niloticus*)

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Biomarkers measured in fish have been proposed as sensitive or "early warning" tools for assessing the quality of aquatic environments. Moragoda Ela is an open canal connected with three cross drains serves as a major canal of Galle municipal Area Drainage System. The canal plays an important role in conveying surface drainage and flood waters. However, there are numerous illegal discharge points of wasted water from residences, commercial establishments (vehicle service stations, fuel filling stations) and warehouses located adjoining the canal subjected to contaminate water with polycyclic aromatic hydrocarbons (PAHs). In this study, Erythrocytes nuclear abnormality (ENA) biomarker, one of the promising tests of environmental genotoxicity, was used to assess genotoxic damage of fish due to contamination of aquatic water bodies with PAHs. The central aim was to observe the presence of any ENA type to undergo an advance biomarker assessment in future. Sample collection of resident fish Tilapia (*Oreochromis niloticus*) was carried out in 3 selected sites (site 1; Beligaha bridge (n=13), site 2 Kanampitiya bridge (n=14), site 3 Kahaduwattha bridge (n=11)) that receive the discharge from commercial establishments and warehouses along the canal over one month of period. Several water samples were checked each day in all sites for presence of oil droplets. Length and weight of the fish were measured. Peripheral blood smears of fish stained with Methylene blue (4 smears per fish) were preapared and different ENA's type (micronuclei (MN) , nuclear buds (NB), bi-nucleated (BN), fragmented-apoptotic cells (FA) and altered nuclei (AN)) were enumerated while counting up to a total of 10000 RBCs (per fish). Site 1 was observed as the most polluted water column of the Moragoda canal with PAHs. AN was the prominent observed ENA type in all sites with significant amount in site 1 (Kruskal Wallis test, p= 0.001). There were no correlations of ENA types with length or weight of fish ($P > 0.05$). NB and FA were only observed in site 1. Percentage occurrence of abnormalities in all sites was 57.89%. Hence, the tested biomarker can be used in genotoxicity

Keywords: ENA, Genotoxicity, Moragoda ela, PAHs, Tilapia

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Carbon Footprint of an Individual as a Key Identification Toward Maintaining a Sustainable Lifestyle: A Case Study in Faculty of Technology, University of Ruhuna

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Greenhouse gas emissions (GHGs) due to the human demand for the utilization of earth ecosystems' resources drive towards rising global warming and climate change. Therefore, identification and implementation of emission reduction strategies on anthropogenic activities is required to address the climate change. Calculating carbon footprint (CFP) is the valuable first step to quantify these emission reductions and it is one of the tools to assess emission of GHGs by individual, organizational, product or activities or events. Assessment of primary and secondary CFP of a person is important to identify GHGs emissions and reduction opportunities to promote the sustainable lifestyle by individuals. The study was carried out at the Faculty of Technology, University of Ruhuna, Sri Lanka to assess the primary and secondary CFP of a person and to identify the strategies in sustainable consumption and lifestyle of the individuals. Activity data was collected at both household and university on energy/electricity and water consumption, transportations, commuting and other activities relevant to GHG emissions through questionnaire and structured interviews of academic staff, non-academic staff, and students (total 123 people) of the faculty using stratified random sampling method. Emission Factors were obtained from data published by Sustainable Energy Authority, Sri Lanka, and DEFRA emission factor conversion data base for GHG reporting and applied standard equation for CFP to access the persons' CFP. The calculator developed by Carbon Footprint Ltd (registered in England and Wales) based on previous researches, was used to calculate the secondary footprint. The result illustrates that average primary CFP of the individual in the faculty is 5.443 tons of CO_2 equivalent (tCO_2-e)/ year and secondary CFP is 2.28 tCO_2-e)/year. The results show that awareness raising is required on energy conservation, food and beverage consumption, electronic equipment usage and pharmaceutical and recreational, cultural, and sporting activities to reduce the GHG emission and promoting sustainable lifestyle with low carbon activities.

Keywords: Carbon footprint, Climate change, GHG emissions, Global warming, Sustainable consumption

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The Economic Impact of 2017 Floods in Baddegama Divisional Secretariat Division in Galle District

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Fifteen districts were affected by floods and landslides in Sri Lanka due to the heavy rains in southwest monsoon during May 2017. The floods in Baddegama DSD were severe than the previous years and affected the livelihood of the people. The objectives of this study were to evaluate the economic impact of 2017 floods in Baddegama divisional secretariat division (DSD) in Galle district and to analyze the damage occurred due to floods in 2017 and corresponded satisfaction level on damage compensation payments received by the respondents. A sample of one hundred fifty-two flood affected households from twenty-five affected Grama Niladari Divisions (GNDs) were selected (15% of the affected population) according to the stratified sampling technique. The data was analyzed by using descriptive statistical methods, non-parametric statistical methods of Kruskal-Wallis H test one-way ANOVA and the regression analysis. Twenty one percent of the household heads were laborers followed by 17% were unemployed, 14.5% were self-employed and 12.5% were private sector employed. Significantly highest numbers of households were limitedly damaged (55.3%) while 19.1% of households were partially collapsed. Significantly higher percentage of Small and Medium Enterprises (SMEs) (64.7%) were severely damaged due to floods which implies the SMEs were highly affected than the houses. Further, the 89% crop cultivation and the 80% of respondent's occupations were affected by 2017 floods. Significantly higher percentage of people 57.9 % were unsatisfied about their damaged compensation while significantly lower percentage of 31.7 % people were satisfied. However, the regression analysis conducted on the relationship between the expected and received damage compensation payments for total damages due to the floods in 2017 were significantly positive by resulted P value of 0.000 ($P \leq 0.05$). Corresponded facts highlighted the significance of damage compensation payments are consensus hence inadequate in filling the gap occurred due to the SME damage and the circumstance directly and adversely impacted the economic status of the people of Baddegama DSD.

Keywords: Disaster management, Economic impact, Floods, Social impact

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Anthocyanins Isolated from *Hibiscus syriacus* L. Protect the Ultraviolet B-induced Damage to HaCaT Keratinocytes and Zebrafish Larvae Through Mitochondrial Reactive Oxygen Species Inhibition

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Hibiscus syriacus L. is the national flower of South Korea and is generally used as a traditional Asian medicine. In particular, Ethanol extraction of anthocyanins from the flower petals of *H. syriacus* L. variety Pulsae (PS) possess anti-septic shock, anti-oxidant, and anti-melanogenic properties. Several studies reported that ultraviolet B (UVB) radiation induced the overproduction of reactive oxygen species (ROS), which caused the degradation of extracellular matrix components of the skin by activating matrix metalloproteinases and keratinocyte apoptosis. Nevertheless, whether PS positively or negatively regulates UVB-mediated photoaging and photodamage is unknown. The HaCaT keratinocytes were treated with PS (0–400 μg/mL) and cultured for 2 h before (pre-PS treatment) or after (post-PS treatment) 30 mJ/cm^2 UVB irradiation. The zebrafish larvae were treated with PS for 2 h and then irradiated by UVB (150 mJ/cm^2). UVB irradiation gradually reduced the survival rate of zebrafish larvae to approximately 60%-70%, and the survivors suffered from morphological abnormalities. However, PS restored the survival rate in a concentration-dependent manner without any abnormalities and the highest concentration of PS (200 μg/mL) resulted in a 100% survival rate of UVB-irradiated zebrafish larvae. PS also decreased UVB-induced excessive total intracellular ROS and mitochondrial ROS (mitoROS) production along with a decrease in the depolarization of the mitochondrial membrane potential. PS inhibited the expression of endoplasmic reticulum (ER) stress marker proteins, such as GRP78, p-eIF2α, ATF4, and CHOP in UVB-irradiated HaCaT keratinocytes and suppressed ER stress-induced apoptosis, resulting in a decrease in mtROS production via the stabilization of the mitochondrial membrane potential. The results indicate that PS inhibits UVB-induced apoptosis by down-regulating total cytosolic ROS and ER-mediated mitoROS production in both HaCaT keratinocytes and zebrafish. The PS has potential to protect skin from UVB-induced photoaging and photodamage. The effect of PS against UVB-induced skin damage is clinically need to be evaluated.

Keywords: Endoplasmic reticulum, Hibiscus syriacus, Reactive oxygen species, Ultraviolet B

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Automated Cleaning Robot for a Domestic Environment

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In the modern world, most of the day to day tasks are replaced by robot applications. Floor cleaning is one of the significant functions which need much more time to fulfill correctly. This is an essential part of the household cleaning process, which requires a cleaner and tidy environment. A conventional floor cleaning method involves a broom to wipe out the dirt and waste clothes to wipe out the mud. Multifunctional robots capable of performing these two tasks are perfect solutions to this heavy time-consuming works. Mostly available autonomous solutions have several drawbacks when it comes to flawlessly executing these tasks. Identifying the mud and dirt correctly and performing the appropriate cleaning method to clean the dirt or mud surface is challenging for commercially available products. This study provides a solution to overcome those problems, and the proposed method can identify the mud and dirt correctly in the domestic environment. Also, selecting the cleaning method appropriate to clean the surface among sweeping and mopping is a product feature. A vision-based algorithm is used to separate mud and dirt elements on the surface. The product shows around a 70% success rate when identifying segments. A sensor-based embedded system is used to avoid obstacles, sharp edges, and stairs. Based on the findings, this product will save an average of more than two hours per week on a household chore.

Keywords: Cleaning robot, Dirt detection, Floor cleaning, Multi-functional cleaning, Mud identification

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Conceptual Model to Identify Pest and Disease of Brinjal in Home Gardens: A Case study

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Home gardening has become an essential part of Sri Lankans after launching the "Saubhagya" program which aims to develop one million home gardens. But with the busy lifestyles of the people, it revealed that it is very difficult to manage their home gardens. Hence the gardens are not as effective and efficient as it should be, most of the gardens are left behind even before getting a single crop yield. Lack of context-specific, complete, and actionable information to make timely-correct decisions was identified as the major factor for that. Since mobile phones play an important role in modern lifestyles, the team "Govi-Nena" introduced a mobile App called Govi-Nena Home Gardening specially designed and developed for Sri Lankan home gardeners. After launching the game-changing mobile application we had several feedback sessions with the agricultural domain experts. More than 90% of the participants urged the requirement of having a customized pest and disease calendar for the home gardeners which will enhance the efficiency and effectiveness of home gardens by maximizing the yield. A case study was conducted in selected fields in the "Kirimatimulla" area in the "Matara" district by selecting the Brinjal to check the feasibility of addressing the above critical improvement. A novel model has been developed by syncing crop life cycle stages with pest and disease life cycles. The model will allow users to visually map the symptoms of pests and diseases with their home gardens which lead to the identification of pests and diseases accurately. When the user inputs are ambiguous, it will take additional user inputs as images and predict the pest and disease attacks using a convolutional neural network-based algorithm. The model is currently under construction while having continuous improvements by getting the feedbacks of the domain experts which shows promising results to the end users.

Keywords: Crop calendar, Home garden, Govi-Nena mobile application, Pest and diseases Prediction system

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Identify the Supra Harmonics in Low Voltage Distribution System Due to Photovoltaic Inverters

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A significant amount of voltage and current distortion were detected in the power distribution system due to the problem of power system harmonics; it is the impact of the poor power quality. Over the past few decades, different types of power electronic devices are introduced to the power distribution system and electricity grid has undergone dramatic changes due to them. High-frequency switching power electronic device usage is becoming more popular for residential and commercial loads. Underlying all those power electronic equipment are popular with high energy efficiency, controllability, ecologically friendly, durable quality, cost-efficient, low maintenance, lesser weight, and smaller size. These techniques are supported to reduce harmonic contents generated by loads, using active power factor correction (PFC) circuits. The smart grid concept is very often used in the world; it intends to increase energy efficiency, reduce the energy cost, and simultaneously to achieve a sustainable balance between production and consumption, increasing the reliability of the power grid and the power quality of the electrical energy delivered to the loads. The electrical power grid has to be developed to support reference technologies, as integrated communications, power electronic devices, Energy Storage Systems and Advance metering infrastructure with more environmentally friendly and energy efficient systems. The devices introduce additional distortion for high frequencies, which is above 2 kHz due to their internal switching frequency. Between 2 kHz to 150 kHz, frequency range harmonics are named as High frequency harmonics (HF) or supra-harmonics. This research is focused to identify the supra-harmonic emission in the low voltage distribution system due to photovoltaic inverters. For that, MATLAB/Simulink software is used to model and simulate single-phase, three-phase inverters.

Keywords: Distribution system, High frequency, Inverter, Photovoltaic, Supra-harmonics

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වර්තමාන වැඩ ලෝකයේ පවතින රැකියා අවස්ථා සමග රැකියා අපේක්ෂිත තරුණ ප්‍රජාවගේ හැකියාවන්, ලැදියාවන් හා සුදුසුකම් අතර පවතින නොගැලපීම හේතුකොට ගෙන උද්ගත වන රැකියා වියුක්තිය සමාජය තුල බොහෝ කාලයක පටන් පවතින අර්බුධයකි. තරඟකාරී වැඩ ලෝකයට ගැලපෙන ආකාරයට තරුණ ප්‍රජාව ශක්තිමත් කිරීම සමාජීය වගකීමකි. තරුණ ප්‍රජාව තම හැකියාවන්, ලැදියාවන් හා පෞරුෂ ගතිලක්ෂණ හඳුනා ගනිමින් සිය අනාගත ගමන් මග සැලසුම් කිරීම, සංකීර්ණ වැඩලෝකය තුල තනිවම කල හැක්කක් නොවේ. එහි දී දක්ෂ, සුදුසුකම් ලත් වෘත්තීය උපදේශකවරුන්ගේ සහාය අත්‍යවශ්‍ය වේ. එසේ නොවන කල තරඟකාරීව බිහි වන වෘත්තීය පුහුණු කඩවලට හසු වී ඔවුන් කාලය, ධනය වැය කරමින් වැඩ ලෝකය තුල අතරමං වේ. ඒ තුල අපේක්ෂා භංගත්වයෙන් පිරි අසහණකාරී තරුණ පිරිසක් සමාජය තුළ බිහි වේ. එය රටකට හිතකර තත්වයක් නොවේ. මෙකී තත්ත්වය තවදුරටත් අධ්‍යනය කරනු වස් මාතර දිස්ත්‍රික්කයේ පාසැල් හැර යන තරුණ තරුණියන්ගේ ජීවන ඉලක්ක හා වැඩ අකල්ප හඳුණා ගනිමින් ඔවුන්ට විධිමත් මාර්ගෝපදේශණ සේවාවක අවශ්‍යතාව පෙන්වා දීම සහ ඒ වෙනුවෙන් ගත හැකි ක්‍රියාමාර්ග යෝජනා කිරීම මෙම අධ්‍යයනයේ අරමුණයි. නියැදි ඒකක 80 ක නියැදියක් යොදාගනිමින් ප්‍රශ්නාවලියක් මගින් ප්‍රාථමික දත්ත රැස්කර මාතර දිස්ත්‍රික්කය තුළ මෙම අධ්‍යනය සිදු කර ඇත. ගුණාත්මක විශ්ලේෂණයක් ද විස්තරාත්මක සංඛ්‍යාන ක්‍රම භාවිතයෙන් ප්‍රමාණාත්මක විශ්ලේෂණයක් ද සිදුකර ඇත. බහුතර සේවා වියුක්තියක් පවතින්නේ උසස් පෙළ සමතුන් අතර වේ. නියැදියේ බහුතරය පාසැල් අධ්‍යාපනය අවසන් කර අවම වසර 03ක් ගත වී ඇත. යටත් පිරිසෙයින් 51%ක් වෘත්තීය සුදුසුකම් සපුරා නැත. නියැදිය තුල 62%ක් රජයේ රැකියා අපේක්ෂා කරයි. මෙම නියැදියෙන් 59%ක් තම අධ්‍යාපනික අරමුණු සාක්ෂාත් කර ගැනීමට නොහැකි වූ බව පවසන අතර නියැදියෙන් 68% ක් ජීවිතය දිහා බලන්නේ අභියෝග වලින් පිරි දුෂ්කර එකක් ලෙසයි. එය ඔවුන්ගේ අපේක්ෂාභංගත්වය පෙන්නුම් කරයි. අනාගත ඉලක්ක ලගා කර ගනීමට යායුතු නිවැරදි හා ප්‍රයෝගික ක්‍රමවේද පිලිබඳ අවබෝධය මෙන්ම වැඩ ලෝකයට අවශ්‍ය කරන දැණුම ,ආකල්ප,කුසලතා සංවර්ධනය පදනම් කර ගනිමින් පාසැල් අධ්‍යාපනයේ සිට සාර්ථක වෘත්තීය අනුගත වීම දක්වා විධිමත් වෘත්තීය මාර්ගෝපදේශණ සේවාව සෑම දරුවකුටම ලබා ගත හැකි පරිදි ප්‍රාදේශීය මට්ටමේ සිට ජාතික මට්ටම දක්වා විධිමත් වෘත්තීය මාර්ගෝපදේශන සේවාවක් ලබා දීමේ ප්‍රයෝගික වැඩපිළිවෙලක් සැකසීමට අවශ්‍ය ඉදිරි පියවරයන්ට මෙම අධ්‍යයනය තුලින් මගපෙන්වීමක් සිදුකර ඇත.

ප්‍රමුඛ වචන: රැකියා ආකල්ප, ජීවන ඉලක්ක, වෘත්තීය මාර්ගෝපදේශනය , අධ්‍යාපන හා වෘත්තීය සුදුසුකම්

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Content Analysis of Sri Lankan University Library Websites: An Analytical Study

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The Sri Lankan state university libraries are functioning with numerous library services for the students and the staff. Currently, few academic libraries offer online services through their library websites. This study was designed to analyse the contents in the library websites and to identify the special services offered by them. Fifteen government university libraries functioning under the University Grants Commission were selected for the study using the purposive sampling method. Data were collected using a checklist used in previous studies which contained 57 items. It was conducted during the month of September 2020. Information was collected under six major areas as general, library collection, library services, e- resources, links, search and retrieval–ınterface and Web 2.0 applications. According to the results, the library of the University of Moratuwa had the highest number of information category, which is 40 items (70.17%) in the checklist. Library of the University of Colombo had 39 items (68.42%) and both University of Sri Jayawardenepura and University of Kelaniya libraries had 38 items (68.42%). This study revealed that there was a substantial development of new services in the library websites as compared to previous studies in Sri Lanka. It was observed that new services such as laptop lending service, federated search service, Remote access (through VPN/ Shibboleth) and research support were amalgamated to several library websites. All the library websites offered electronic resources such as journal databases, eBooks and theses by online and more than 50.00% libraries provided remote access to users as a solution with the COVID-19 pandemic.

Keywords: Academic libraries, Content analysis, Library websites

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Impact of Predatory Journals on Sustaining of Publishing Quality: A Literature Review

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Predatory/deceptive journals are exploiting the scholarly publication models and indexing systems, and have been reported to be affecting the publication quality in scholarly information dissemination. Hence, the importance of being alert about the existence of deceptive literature/predatory journals, and the approaches to avoiding them is widely discussed in the recent literature. The objective of this article is to review the recent scholarly literature on sustaining the publication quality in the context of academic information dissemination. Literature over the last five years (January 2016- November 2020) were searched through seven databases to locate research on quality issues due to predatory journals. They were individually assessed for relevance and quality; 15 most relevant papers were selected for this review. This review identified the issues linked with the creation of blacklists/whitelists, the peer review process, citation patterns, indexing them in citation databases, and related experience of authors as well as of authorities, that provide fundamental approaches for avoiding questionable/predatory journals. Discussions on blacklists/whitelists concern about their binary classification and highlight the need for unbiased quality criteria for inclusion. The importance of transparency in the peer-review process has been highlighted as an approach to sustain true quality. Concerns on citation patterns have brought out the evaluation criterion denoting the unethical publishing practices, in selecting quality sources to be referenced in ongoing research. The Predatory publications are inadvertently indexed in well-known and high-quality databases posing further weight on the "Think. Check. Submit" strategy. Furthermore, the review revealed that the problem of fake/predatory publishing is not limited to vulnerable researchers. Hence, these insights into quality publishing will contribute to the authors' decision making, as well as authorities' concerns in promoting ethical scholarly publishing practices.

Keywords: Predatory publishing, Publication-quality, Scholarly communication

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