2nd Applied Sciences Undergraduate Research Symposium 2023

ABSTRACTS

Empowering the Next Generation Leaders of Innovation

APSURS

SABARAGAMUWA UNIVERSITY OF SRI LANKA

"Empowering the Next Generation Leaders of Innovation"

31st May 2023

Faculty of Applied Sciences

Sabaragamuwa University of Sri Lanka

APSURS 2023

Applied Sciences Undergraduate Research Symposium

Empowering Next Generation Leaders of Innovation

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SABARAGAMUWA UNIVERSITY OF SRI LANKA

31ST May 2023

Faculty of Applied Sciences

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APSURS 2023

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APSURS 2023 provides a platform for undergraduates to share findings of their research, and potential as researchers with an extensive research, and scholarly community thereby exposing them to broad academic, and industrial opportunities, and research collaborations with the leading industries. It encourages undergraduates to examine local, and global trends in their fields of research, and to share the developments, technology, skills, knowledge, and investments.

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Message from the Vice Chancellor

It is with great pleasure that I pen this message to the Second Applied Sciences Undergraduate Research Symposium (APSURS 2023) of the Faculty of Applied Sciences. It is indeed a great pleasure to see this academic initiative continuously developing, since its inception last year.

The conference theme "Empowering the next generation leaders of innovation" encapsulates a major role of a higher education establishment in applied sciences, that is also necessitated by the constantly growing challenges facing the present day society. Only innovation and novel initiatives can address the current issues in the social, economic, and environmental realms. The Faculty of Applied Sciences inherently has the opportunity to promote interdisciplinary research by empowering undergraduates in a variety of fields, including computer science and information systems, natural and applied sciences, chemistry, physics, food science and technology, natural resources and environmental science, and sports sciences and physical education. I believe the annual APSURS will continue to harness the above opportunity, yielding significant outcomes to the world. Further, the exposure to renowned researchers and industry professionals gained by the students will certainly empower them to become successful innovators.

I thank the Organizing Committee for their commitment towards making the Faculty's vision a reality, and I wish that all young innovators will gain strength and capacity to serve the nation and the world, with the knowledge and the skills they acquired during their studentship at the Sabaragamuwa University of Sri Lanka.

Senior Professor R.M.U.S.K. Rathnayaka
Vice Chancellorr
Sabaragamuwa University of Sri Lanka

Message from the Dean

It is my great pleasure to compose this message to the Proceedings of the 2nd Applied Sciences Undergraduate Research Symposium 2023 (APSURS-2023), organized by the Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka. This symposium is a unique event in the Faculty's annual calendar, which creates a great opportunity for undergraduates around the country to showcase their knowledge and competencies gained from their final year independent research projects. This year, in parallel with the Symposium, the organizing committee has introduced a novel concept i.e., "Startup Pitch Competition", where undergraduates have an immense chance to expose their innovative products, technologies, services, prototypes, or business ideas to an expert panel of investors, venture capitalists and academics. Thus, this symposium will be a great avenue for undergraduates to keep abreast of sharing and publishing their latest research findings mainly under three domains viz. Computer Science and Information Systems, Natural and Applied Sciences: Chemistry, Physics, Food Science & Technology and Natural Resources and Sports Sciences and Physical Education. Thus, I believe that APSURS-2023 will undeniably promote high-quality research culture and the intellectual curiosity of young researchers.

Conducting a research symposium is a massive responsibility and to succeed in this event all the members in the Faculty and the University have given enormous support to the organizing committee. Therefore, as the Dean of the Faculty of Applied Science, Sabaragamuwa University of Sri Lanka, I wish to express my sincere gratitude to the Vice-Chancellor, Sabaragamuwa University of Sri Lanka, Keynote Speaker, Plenary Session Speakers, Heads of the Departments, Organizing Committee of the APSURS-2023 for their great effort towards making this event a success. All the research supervisors of the final year undergraduates, and all the other Academic, Administrative, Non-academic staff members and Sponsors for their support and commitment in making this event a success.

Finally, I convey my wishes to all the presenters of the APSURS-2023.

Professor E.P.N. Udayakumara
Dean - Faculty of Applied Sciences
Sabaragamuwa University of Sri Lanka

Message from the Symposium Chair

It is with great pleasure that I convey this message on behalf of the organizing committee of the 2nd Applied Sciences Undergraduate Research Symposium (APSURS 2023). This is a preeminent venue for presenting, discussing and exchanging contemporary knowledge from research findings on various fields of Natural and Applied Sciences, Computer Science and Information Systems and Sport Science and Physical Education. This provides a great platform to build collaborations and strengthen the partnerships among the professionals in academia and the industry. The symposium showcases findings from sixty-eight undergraduates to a multidisciplinary audience. The symposium is shaped by a number of renowned scientists, innovators and corporate leaders including Dr. Harsha Subasinghe, President and CEO, Codegen International., Dr. Adha Fatmah Siregar from the Ministry of Agriculture of Republic of Indonesia, and Mr. Hiran Punchihewa from Virtusa (Pvt) Ltd. Further, this year's symposium uniquely features a "Startup Pitch Competition" where undergraduates have a unique opportunity to showcase their innovative ideas, empowering them to build businesses and grow as entrepreneurs.

I would like to extend my sincere gratitude to the Vice Chancellor of the Sabaragamuwa University of Sri Lanka and, the Dean of the Faculty of Applied Science for their excellent guidance to make APSURS 2023 a success. I express my sincere gratitude to the keynote speaker and plenary speakers for their outstanding contribution. I specially thank the panel of judges of the Startup Pitch Competition, and the Director, University Business Linkage Cell and organizing team for facilitating the event. The support extended by the Heads of the Departments, the editorial board and reviewers and all members of the sub-committees are also duly acknowledged for their hard work and excellent commitment. This symposium is indeed a great outcome from an excellent teamwork comprising the involvement of academic, administrative, non-academic staff members, and students.

This symposium was organized in parallel to the International Conference in Applied Sciences (ICAPS - SUSL 2023) and I gratefully acknowledge the guidance provided by its Chair and his team. The outstanding commitment provided by the Secretary of APSURS 2023 toward its success deserves my sincere thanks. I greatly appreciate the support we received from our sponsors in overcoming the financial challenges. Finally, I extend my sincere wishes to all the authors and presenters for their enthusiasm in presenting their research findings at APSURS 2023.

Dr. Hasintha Wijesekara
Symposium Chair - APSURS 2023
Sabaragamuwa University of Sri Lanka

Keynote Address by Dr. Harsha Subasinghe

Shaping the World through Innovation

There are clearly identifiable qualitative leaps in incorporating modern technological developments into different functions in our day-to-day life. By enhancing the quality, comfort, and safety of such functions, this trend has been able to take shape and demonstrate their importance in modern day smart cities. The use of information and communication technology to make the facilities and services more effective is one such example that provides an avenue for people to fulfill their requirements and achieve maximum benefits.

The integration of artificial intelligence-based technologies into smart cities offers exceptional prospects to guarantee a high standard of living for the wellbeing of its residents. Not only individual benefits, but modern technological development also helps to achieve positive impacts to social, economic, and environmental sectors. For example, a substantial impact on the national economy and thereby the development could be achieved if we switch from imported petroleum-based fuel vehicles to renewable energy sourced electric vehicles.

At Vega Innovations, we innovate ways that support the development of high-performing electric vehicles while fostering science, technology and engineering excellence in the nation. As one of the largest private sector investors in Artificial Intelligence and multidisciplinary development in Sri Lanka, at Codegen International, we design, engineer and innovate high value IP products that support solving real world challenges, shaping tomorrow's world. The goal of technological innovations should not be confined to developing economic benefit to individuals, industries, or societies, it should also support the spiritual development of mankind to enjoy the best quality of their lives.

Dr. Harsha Subasinghe
President and CEO
Codegen International

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Computer Science and Information Systems

Plenary Speech by Mr. Hiran Punchihewa

I consider this as an immense privilege to contribute this message at the occasion of the inauguration of "APSURS 2023". It is a known fact that the standards of technical and technological education provided at local universities have been maintained at high and precise paradigms at the moment. Yet at the speed of the development and progress that the technological and technical spheres undergo globally, it has been realistically felt that we have to be extra vigilant in keeping with the momentum of those progressions. In that context, undergraduates of local universities are bound with the responsibilities of upgrading their knowledge and feasibilities of the relevant spheres in par with the parameters of rapidly changing international standards. This is an utmost important substance that our undergraduates should have if they are to provide futuristic innovations to build a sustainable and resilient society.

Prioritizing and identifying the right research themes play a major role in improving the relevance and practicality in implementation of the same. Students must have proper and practical understanding of the agile nature of the current global context and focus should be to find practically sustainable approaches rather than mere theoretical concepts.

A significant revelation in that context has however been identified in the way of the lapses of competency levels in practicalities in communication and in executing other soft skills, which hold a paramount importance in fostering innovations in the current global context. Though most of the undergraduates possess theoretical and academic knowhow, when it comes to utilize that knowledge in research and development undertakings, they face a lot of difficulties, with vacuums hindering their progress in practical spheres. Consequently, more attention and emphasis should be focused on improving the soft skills and communicative frequencies in parallel with the technological and technical curriculum as undergraduates.

In essence, these types of proper identification of right research themes and proper adaptations of communicative and soft skills may pave the way to do the right innovations with practical aspirations to face the fluctuating Technological and Technical spheres in the present global textures.

Mr. Hiran Punchihewa
Associate Director - Delivery
Virtusa (Pvt) Ltd

- Session -

Computer Science and Information Systems

Comparison of Animal-Vehicle Collision Avoidance Systems Using Image Processing Technique

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Animal-vehicle collision (AVC) is a significant global issue that causes considerable loss of life and property damage. Real-time animal detection using computer vision techniques and machine learning algorithms is considered to be the most effective way to prevent AVC. This study presents a review of the state of art methods used for animal detection and prevention of AVC using image processing techniques. Histogram of Oriented Gradients (HOG), Local Binary Patterns (LBP), and Haar features are the commonly used methods for object and animal detection. However, challenges such as image scale and viewpoint variability, background clutter, lighting conditions, image quality, and occlusion lower the accuracy and effectiveness of these methods. Various classifiers such as K-way logistic regression, support vector machine (SVM), and K-nearest neighbors (KNN) are used to overcome these problems and evaluate features. LBP-AdaBoost and HOG features showed better results than others, with a detection rate of 91%, when extracted from regions of interest (ROIs). The performance of the system is further improved when combined with HOG-SVM. Thus, HOG and LBP features can be useful for detecting animals despite the defects in images. The best method for AVC detection is HOG-SVM with a detection accuracy rate of 92%. DCNN, HOG-AdaBoost, and LBP-AdaBoost showed an accuracy rate of 91%, 84%, and 82% respectively. The worst performance was seen when the Haar-AdaBoost method was used (79%). However, the effectiveness of each technique depends mainly on the accuracy of real-time animal detection, the signal transmission speed from the system to the driver, and the vehicle speed. Comparative analysis can be carried out considering animal detection for methods used in foggy weather conditions and the effect of speed variations of the vehicle on the results. Expanding the scope of detection to cover a broader range of animal species is proposed as a future direction of AVC systems.

Key words: Accident Prevention, Animal Detection, Animal-vehicle collision, Collision Avoidance, Image Processing

Augmentation Techniques for Personality Type Classification Using Social Media Text

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Social media platforms have evolved into a ubiquitous hub for individuals to convey their thoughts, emotions, and behaviours, allowing to generate insights into their personalities. However, the available social media datasets are not diverse enough as they often tend to over-represent certain groups of individuals such as young people. Further class distribution is disproportionate, potentially restricting the generalizability and accuracy of personality analysis. To address these challenges, this study suggests a method using text augmentation techniques and machine learning to expand the dataset and improve the effectiveness of the analysis using the Myers-Briggs Type Indicator (MBTI) dataset of 430000 posts belonging to 8600 individuals from personalitycafe forum. The dataset was split into 80% training and 20% testing sets and the training dataset was later augmented and fed into the models. All the models were evaluated using standard metrics such as accuracy, precision, and recall. Among the evaluated models, Linear Regression classifier outperformed the other three machine learning algorithms with an accuracy of 68.41%. The results are more uniformly distributed across the classes when compared with the other three machine learning algorithms Random Forest, Gradient Descent and XGBoost. Additionally, results showed that the text augmentation strategies employing BERT contextual word embeddings improved the model accuracy by 0.2%. A meagre improvement was observed due to the low quality of the dataset, and lack of contextual understanding in augmented data. Computational cost hindered the possibility of further improvement. Synonym-based augmentation showed poor performance due to a lack of contextual understanding, whereas BERT-based augmentation produced semantically and contextually relevant data, resulting in improved performance. For future work, self-training reinforced models and transfer learning need to be investigated to increase the model performance.

Key words: Deep Learning, MBTI, Personality Classification, Text Classification, Transfer Learning

Analysis of the Correlation between University Students' Academic Performance and Influential Factors

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University student's academic standing has an impact from variety of aspects of their daily lives. A range of psychological, social, economic, cultural, behavioral, geographical, and environmental factors influences the academic success of university students. This investigation focuses on factors that have an impact on undergraduate students' academic performance. The major goal of this study was to discover and evaluate the factors that affect university students' academic performance and success, as well as to predict the students' performance and achievement based on the identified factors. This study used five different Machine Learning techniques and further proposes an ensemble approach consists of K- Nearest Neighbor (K-NN) Classifier, XGBboost Classifier (XGB), and RandomForest Classifier (RF) to create a new model in analyzing and predicting the university students' educational achievement and performance. A questionnaire, which consisted of three parts, was used in collecting data for the study. Economical, psychological, cultural, geographical, social, behavioral and environmental factors can analyzed using this. The questionnaire was shared among the undergraduates in Sri Lanka. Random sampling was used to choose the participants. Two-thousand (2000) university students took part in this study. The results demonstrated that the K-Nearest Neighbor (K-NN) has the highest prediction accuracy of 83.08 %. Further, the proposed ensemble approach enhanced the accuracy and demonstrated an accuracy of 84.54 %. The correlation of the factors towards the university students' academic performance was identified. According to the results, cultural and economic factors were identified as the most influential factors for predicting the university students' academic performance and behavioral factors is the least influential factor. Furthermore, the results are important for the educational institutes to identify the most influential factors towards enhancing the university students' academic performance.

Key words: Academic performance, Behavioral factors, Economic factors, Psychological Factors

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Natural and Applied Sciences: Chemistry, Physics, Food Science & Technology and Natural Resources

- Session -

Chemistry and Physics

An Investigation of Coconut Shell Extract as an Alternative Coagulating Agent for Natural Rubber Latex

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The rubber industry in Sri Lanka is one of the most important industries, earning a significant amount of foreign earnings. Raw natural rubber processed from coagulation of natural rubber latex is the main raw material used in the local rubber industry. Formic acid is the widely used chemical to coagulate natural rubber latex. In the face of export restrictions and rising cost of this imported material, the use of formic acid in rubber processing has now become unaffordable. The use of coconut shell extract as an alternative coagulating agent for natural rubber latex was investigated in this study. Coconut shells are considered as wastes of coconut based products that have not been utilized efficiently. By using these abundant bioresources as raw materials, we were able to produce coconut shell extract at a comparatively low cost. To understand the effect of coconut shell extract as an alternative coagulant material for natural rubber latex, different ratios of coconut extracts prepared using hot water extract technique was used to coagulate the latex. Ribbed Smoked Sheet (RSS) rubber was manufactured using the coconut shell extract according to the standard manufacturing procedures. Raw rubber properties of RSS rubber were evaluated. The results revealed that the addition of coconut shell extract as an alternative to the formic acid substituent gives similar effect on the raw rubber properties of the RSS except Plasticity Retention Index (PRI). Change of sheet color of RSS could be observed with the addition of coconut shell extract as the coagulant. Overall results of the study found the potential of the application of coconut shell extract as an alternative coagulanting agent for formic acid for coagulation of natural rubber latex.

Keywords: Alternative Coagulant, Coconut Shell Extract, Natural Rubber Latex, Raw Rubber Properties, RSS

Hydrothermally Synthesized Nanostructured WO_3 Thin Films for Electrochromic Devices

E.G.O.D. Egodawaththa[1*], H.N.M. Sarangika[1], V.P.S. Perera[2], J.A.D.M. Dharmathilaka[1], and G.M.L.P. Aponsu[1]

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The greatest alternative to conventional windows and curtains is an electrochromic smart device with adjustable optical properties. Transition metal oxide plays a major role in electrochromic devices (ECDs). A simple hydrothermal method was developed to fabricate WO_3 thin films on Fluorine-doped Tin Oxide (FTO) glass substrates. Sodium Tungstate Dihydrate ($Na_2WO_4.2H_2O$) and Sodium Nitrate ($NaNO_3$) were used as the starting materials for the preparation of WO_3 thin films under different hydrothermal reaction time. The structural, chemical and morphological characterization of the thin films were conducted using different techniques including X-Ray Diffraction (XRD), UV-Vis absorption, Electrochemical Impedance Spectroscopy (EIS) and Scanning Electron Microscopy (SEM). According to the results, the particle size of the thin films was ranging from a few microns to hundreds of nanometers. XRD results showed that the WO_3 was in monoclinic phase and the average crystallite size was 56.55 nm. The band gap value of the prepared WO_3 was measured and it was 2.9 eV. The electrochromic performance of the WO_3 thin films was characterized by LiCl in Propylene Carbonate (PC) and Ethylene Carbonate (EC) as the electrolyte. ECD with the configuration of WO_3/Gel electrolyte (LiCl in PC+EC+ poly ethylene oxide (PEO))/FTO was prepared and a color change between dark blue and colorless was observed when an electric field of 3.5 V was applied across the device. A relatively high optical modulation of 12.2% at 675 nm was observed.

Keywords: Electrochromic Device, Hydrothermal Method, Nanostructured Thin Films, Optical Modulation

A Comparative Study of Raw Rubber Properties of Natural Rubber Manufactured from Latex Coagulated using Pineapple Peel Extract and Formic Acid

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Ribbed Smoked Sheet (RSS) rubber accounts for over half of the total local Natural Rubber (NR) in the country. Formic acid is the most commonly used acid as a coagulant in the RSS manufacturing process. In light of the scarcity and high cost of formic acid, together with the foreign dependency on the material, it is important to investigate locally available potential sources that could be used as an alternative to formic acid. This study aims to investigate pineapple peel extracts as an alternative to formic acid to assure the continuation of this cottage industry. The extract was used to coagulate the NR latex, in different amounts (20mL, 25mL, and 30mL) per latex volume containing 500g of dry rubber. Raw rubber properties such as Wallace Plasticity (P_0), Plasticity Retention Index, Mooney viscosity, nitrogen content, volatile matter content, ash content and dirt content were compared against the relevant properties of the rubber prepared using latex coagulated with formic acid. It was found that sheet rubber prepared using 30mL of the extract per 500g of rubber yielded comparable properties to the rubber prepared with latex coagulated with formic acid except for the nitrogen content. It was significantly lower than that of the corresponding standard rubber suggesting pineapple peel extract as a potential candidate coagulant for the manufacture of low protein NR. However, bubble formation occurred probably due to the enzymatic activity that has adversely influenced the visual appearance of RSS. It is concluded that pineapple peel extract has a potential to substitute formic acid and 30mL per 500g dry rubber is the optimum dosage to coagulate NR latex.

Keywords: Formic Acid, Latex Coagulant, Pineapple Peel Extract, Raw Rubber Properties, RSS

Fast and Efficient Ethanol Evaporation in DNA Extraction: Development of a Portable Mini Air Flow Cabinet

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Polymerase Chain Reaction (PCR) is an important technique in molecular biological studies, but residual ethanol in DNA samples can interfere with its efficiency and yield. As a result of the inhibitory effect of ethanol on Taq polymerase, secondary structures can form in the DNA template that interferes with primer binding and extension. To address this issue, this portable mini air flow cabinet (15 cm×8 cm×15 cm) was developed to dry the remaining ethanol traces rapidly. Cost of production for this tool was around 500 LKR. Under room temperature, it takes 30 to 45 minutes to evaporate the remaining (15-20 μl) ethanol in the final extraction. Scientists utilize methods such as vacuum-drying and oven-drying to speed the drying process. This apparatus uses an electrically operated fan (12 V/4500 rpm) to generate an airflow that dries the remaining ethanol from the DNA pellets. This tool takes 2.27 ($\pm$0.03) minutes to evaporate 1μl ethanol and without this tool it takes 5.32 ($\pm$0.03) minutes to evaporate the same amount of ethanol in an open room (25°C, 79% Relative humidity). Overall use of this tool has significantly reduced ($P < 0.05$) the ethanol evaporating time compared to without tool ethanol evaporating in an open room. (25°C, 79% Relative humidity). The tube holding base plate is built to give a slight tilt to the tubes at the horizontal axis, ensuring that the ethanol moves downward along the tube wall, leading to a thin spread and faster drying. The mini airflow cabinet has the capacity to dry 12 microcentrifuge tubes of 1.5 ml in a single run. This innovative tool requires little maintenance and very easy to use, making it a perfect choice for laboratories and research facilities of all sizes due to its simplicity and ease of use.

Keywords: DNA Extraction, Ethanol Inhibition, Micro Centrifuge Tube, Mini Airflow Cabinet

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Food Science & Technology 1

Effect of Wax Coating Combined with Modified Atmosphere Packaging for Shelf-Life Extension of Apple Masan (*Ziziphus mauritiana*) Fruit

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Apple masan (*Ziziphus mauritiana*) is a perishable fruit and has a relatively short shelf-life of 2-4 days at room temperature. Hence, this study was designed to evaluate the shelf-life extension of the apple masan after the application of wax coating and modified atmosphere packaging. In the first experiment, the effects of wax coating on the physicochemical and qualitative attributes of apple masan fruits were investigated during storage at room temperature (25±2°C) for seven days. The wax coating consisted of palm oil (3%), guar gum (2%), polysorbate tween 20 (2%), glycerol (30%), and distilled water (63%) according to volume-to-volume ratio. The apple masan coated with 1:1 diluted wax showed the lowest weight loss percentage (1.65±0.040%) and decay index percentage (1.49±0.031%). Moreover, wax coating delayed the change of skin color and ensured firmness in apple masan. In the second experiment, apple masan coated with 1:1 diluted wax and non-waxed apple masan were packed in modified atmosphere packaging (MAP) using low-density polyethylene (LDPE; 150 gauge) and was able to keep at room temperature (25±2°C) with 77% relative humidity for nine days. The apple masan packed with LDPE was used as a control (T1). The $KMnO_4$ sachets were used as an ethylene absorbent in the packages. The LDPE-packed absorbent containing non-waxed fruits (T2) showed less weight loss, low decay index, less chlorophyll degradation, and firmer color intensities than that of other treatments. The other treatments include LDPE packed and waxed (T3), and LDPE packed, waxed and absorbent contained (T4) fruit samples. These results confirmed that LDPE packed with absorbent contained non-waxing could be an effective means to contribute to the shelf-life extension and quality parameters of apple masan fruit stored at room temperature (25±2°C).

Key words: Modified Atmosphere Packaging, Shelf-Life Extension, Wax Coating, Ziziphus mauritiana

Effect of pH, Enzymes and Bacteria Culture on Virgin Coconut Oil Yield from Coconut Milk

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Virgin Coconut Oil (VCO) has excellent investment potential and is becoming more and more popular among the community. The present investigation deals with 18 treatments for coconut milk to find out the combination effect of extraction process for maximum yield of virgin coconut oil (VCO) from coconut milk extracted from coconut meat. Optimization of the process parameters including pH (4 and 6), cellulase enzyme concentration (0.1%, 0.2%) and *Lactobacillus* bacteria culture (5%, 10%) was analysed using factorial method. Optimum treatments were selected and quality characteristics of VCO were compared with the SLS, APCC and CODEX standards. Best conditions were determined in treatment 11 (pH 6, enzyme 0.1% w/v, bacteria culture 0%) and treatment 12 (pH 6, enzyme 0.2% w/v, bacteria culture 0%), both produced a higher yield of VCO (17.34%, 16.25%). There was no significant effect among the above mentioned three factors ($p > 0.05$). The results indicated that; pH being the most significant factor while enzyme concentration was the second most important factor that significantly influences VCO yield. Isolated bacteria culture (*Lactobacillus* strain) has no effect ($p > 0.05$) on the VCO yield. According to the ANOVA test, there was no significant difference of FFA%, Lovibond color value, and refractive index and delta k values among VCO obtained from 18 treatments while moisture content is having an effect ($p < 0.05$) on the interaction of pH and bacteria culture. Quality parameters of VCO from treatment 11 and 12 such as moisture content (0.27% and 0.23%), FFA% (0.2%, 0.25%), refractive index (1.447, 1.447), Lovibond color value (0.9, 0.3), delta k value (-0.116, -0.116), phenol content (1.632,0.98 mg GAE/g oil), radical scavenging activity (35.95%, 29.4%) and fatty acid profile (Lauric acid%) (50.004%, 50.155%) are within the SLS standards at the same time compatible with previous research findings.

Key words: Bacteria Culture, Cellulase Enzyme, Oil Yield, pH, Virgin Coconut Oil

Development of Cake from Composite Blends of Wheat (*Titricum aestivum*) and Purple Yam (*Dioscorea alata*) Flour

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This study investigates the potentiality of incorporating purple yam flour as a wheat flour substitute to formulate cake with the objectives of encouraging the use of under-utilized purple yam, reducing the dependency on wheat flour, adding variety to cake flavors and increasing the nutritional value. The effect of substituting purple yam flour with wheat flour on the composition, texture, sensory, and flour qualities of the resulting cakes were evaluated. The following ratios of wheat flour to purple yam flour were used for cake preparation: 100:0 (A - control), 80:20 (B), 60:40 (C), 50:50 (D), and 40:60 (E). The texture parameters (hardness, adhesiveness, cohesiveness, resilience, gumminess, springiness, and chewiness) were analyzed in all cake formulations. According to the results of sensory evaluation (hedonic ranking test, 30 untrained panelists), the cake formulated with composite C was selected as the most consumer acceptable sample. The proximate composition of the selected cake formula (C) and the control sample (A) were compared and the results showed as moisture (24.15±0.67, 22.20±0.80%), crude fat (19.26±0.05, 23.91±0.04%), total ash (2.36±0.01, 2.30± 0.10%), and crude fiber (0.71±0.16, 0.64±0.10%) respectively. The flour properties (bulk density, water and oil absorption capability, swelling capacity, water activity and color) of purple yam flour were significantly different ($p<0.05$) from wheat flour. The texture profile results showed a significant difference of hardness in sample D and E compared with other samples. However, the other texture parameters (cohesiveness, springiness, chewiness and gumminess) were not significantly ($p<0.05$) varied between cake formulations. The study found that the purple yam flour can be substituted for wheat flour up to 40%, to produce cake with good consumer acceptability.

Key words: Cake, Flour Properties, Physicochemical, Purple Yam, Sensory

Effect of Milling and Particle Size on Development of Bread from Cassava (*Manihot esculenta*) Flour Combined with Wheat Flour

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Bread is made mainly using wheat, substituting cassava for wheat is challenging due to lack of a gluten network. Further the reduction of particle size affects the physicochemical properties of flour, providing specific product features. Currently bread is made incorporating only up to 30% of cassava. Hence, this study aimed to increase the cassava substitution level by decreasing particle size. To reduce the particle size, cassava was milled two (F2) and three times (F3) and their granular morphology, particle size distribution, color, and functional properties, were determined. 30% of cassava substituted bread was made using F2 and F3 and their characteristics were compared. Using the best flour, treatment composites made as 30%, 40% and 50% of cassava substitution levels, while 100% wheat bread was the control. Granular of F2 and F3 were not damaged. Mean particle size of F2 and F3 was 150-180 µm. Particle size of F3 greater than 180 µm was only 12.3%. In F2 it was 27.8%. There were no significant differences ($p > 0.05$) in color, dispersibility, water and oil absorption capacities of both flours. Swelling power, solubility index, bulk, and tapped densities were higher in F3 (5.83 ± 0.20^{ab}, 25.19 ± 3.07^{a}%, 0.4 ± 0.00^{ab} g/cm, 0.63 ± 0.00^{ab} g/cm) than F2 (5.46 ± 0.30^{b}, 13.81 ± 2.77^{b}%, 0.38 ± 0.02^{b} g/cm, 0.60 ± 0.20^{b} g/cm). Specific volume was higher in bread made with F3 (2.41 ± 0.07^{a} ml/g) than F2 (2.22 ± 0.06^{b} ml/g). Crust color (L^{*}) was increased with F3 and specific volume was decreased. Hardness of dough was increased with F3 and no significant difference in bread. Moisture, protein, fat, fiber, ash and carbohydrate content of best product were 35.46 ± 0.15^{a}%, 7.00 ± 0.00^{b}%, 3.86 ± 0.26^{a}%, 0.78 ± 0.03^{a}%, 3.08 ± 0.16^{a}% and 53.10 ± 0.38^{a}% respectively. F3 was selected as the best flour for bread making, and 40% of cassava substituted bread was selected as the best product from seven-point hedonic tests. Particle size reduction helped to increase the binding ability of cassava and increased substitution level up to 40%.

Key words: Bread, Cassava, Milling, Particle Size, Wheat

Quality Characteristics of Cakes Produced from Composite Blends of Wheat (*Triticum aestivum* L.) and 'Dhawala' Sweet Potato (*Ipomoea batatas*) Cultivar Flour

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Wheat flour (WF) is the main ingredient of bakery items like cakes. Wheat is not grown in Sri Lanka and imported spending a huge number of foreign revenues. Local cultivars of sweet potatoes are not utilized to obtain optimum benefits. Therefore, this study was conducted to identify the suitability of utilizing 'Dhawala' sweet potato cultivar as a substitute for wheat in cake production. The yield of the flour obtained from sweet potato (SPF) was 21.47±0.00%. Four cake formulas were produced; A (100% WF/ control), B (60% WF and 40% SPF), C (50% WF and 50% SPF), and D (40% WF and 60% SPF). The density of the cakes incorporated with SPF ranged between 0.51 gcm^{-3} – 0.57 gcm^{-1}. 40% SPF incorporated cake was chosen as the most consumer-accepted cake using the five-scale hedonic test. Friedman test results revealed a significant relationship between sensory attributes (appearance, aroma, taste, mouth feel, after taste) with consumer acceptability for cake formulas ($p < 0.05$) except with color. The moisture (17.78±0.01%), fat (15.75%±0.01), total ash (2.70±0.01%), and crude fiber (0.93±0.01%) contents were analyzed using AOAC methods. The total ash (2.70±0.01%) and crude fiber (0.93±0.01%) content of cakes incorporated with 40% SPF were higher than the control (2.30±0.01%, and 0.62±0.01%, respectively) while moisture and fat content of the cake were similar to that of control. Hardness, gumminess, chewiness, adhesiveness, cohesiveness, springiness and, resilience of most consumer accepted cake were 245.00±0.71 g, 160.25±0.78 g, 88.50±0.56 mJ, 0.16±0.08 mJ, 0.85±0.02, 51.48±0.21 mm, and 0.51±0.01 respectively. The β carotene content, polyphenol content, and IC_{50} value for DPPH radical scavenging of the most consumer-accepted formula were 1.48 mg/100 g, 0.005 mg/ml, and 0.066 mg/ml respectively. Therefore 40% of wheat flour can be substituted with Dhawala sweet potatoes flour in cake production while adding value to the cultivar.

Key words: Antioxidant Activity, Bakery Items, Dhawala Sweet Potato, Proximate Composition, Sensory Parameters

Comparison of Three Drying Methods for a Production of Wood Apple (*Limonia acidissima* L.) Drink Powder

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The present study was conducted to develop and compare the properties of wood apple drink powder prepared from wood apple pulp dried using different drying methods such as dehydration (65°C for 5 hrs), spray drying (inlet 140°C, outlet 80°C), and freeze-drying (-58°C, 0.26 mbar). Physicochemical properties, proximate composition, functional properties, and mineral composition of three wood apple powders were evaluated. Higher values for crude protein (6.87%), crude fat (33.05%), DPPH radical scavenging activity (IC_{50}: 0.23 ppm), vitamin C (1370.88 mg/100 g), and mineral composition (Mg and K: 1709 and 1225.20 mg/100 g, respectively) were obtained in freeze-dried powder than that of other powders. A sensory analysis (appearance, color, flavor, thickness, mouthfeel) was conducted using 5 point hedonic scale to determine the best wood apple powder for the production of the final powder. Dehydrated wood apple powder was selected as the most preferred powder. Another sensory analysis (color, aroma, flavor, thickness, sweetness, mouthfeel) was conducted to identify the best sugar to glucose concentration for the production of final powder. A 1:2.5 wood apple to sugar-glucose ratio was selected as the most preferred sample. In the final drink powder, particles with the middle diameter (111.46 nm) were obtained in a higher percentage. Total soluble solids, and viscosity of the final drink were 12.40 Brix, 5.65 mPas, and bulk density, tap density, hausner ratio, carr index and foaming capacity of the final powder were 0.73 gml^{-1},0.88 gml^{-1}, 1.21, 0.17% and 4.63%, respectively. TPC and yeast and mould counts were 0.81×10^2 to 2.99×10^2 CFU/g and 0.75×10^2 to 2.29×10^2 CFU/g respectively. pH of the final powder varied from 3.47 to 3.27 during the storage period (3 weeks at room temperature). In conclusion, dehydrated wood apple drink powder was selected as the best powder and showed the best quality parameters.

Key words: Dehydration, Freeze Drying, Spray Drying, Wood Apple Drink Powder

Formulation and Quality Evaluation of Canistel Fruit (*Pouteria campechiana*) Pulp Incorporated Ice-Cream

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Ice-cream is a sweetened frozen food that is frequently consumed as a snack or dessert. In this research, ice-cream was produced using canistel fruit, an inexpensive, locally available seasonal fruit. Many people do not like to eat canistel fruit, but it is rich in nutrients such as carotenoids, vitamin C, and minerals. In here whole milk, cream, skim milk powder, sugar, water, and canistel fruit pulp were combined to make the ice cream. Off-flavours and off-odours in canistel fruit pulp was reduced using citric acid treatment (200 g of fruit pieces soaked in 150 ml of 0.05 M citric acid solution for 30 minutes). Five formulations of ice-cream were prepared by changing the canistel fruit pulp percentage (0%, 5%, 10%, 15%, and 20%) with whole milk. Sensory evaluation was done by 30 untrained panelists using 5-point hedonic scale in order to identify the optimal incorporation level and consumer acceptance. The results of sensory analysis revealed that the 15% canistel fruit pulp incorporated ice-cream as the most consumer accepted formulation. Melting rate and texture profile of all ice-cream formulations were evaluated. Melting rate decreased, with the increasing fruit pulp content. Texture profiles of the ice-cream samples were compared with a market available ice-cream sample. As per proximate analysis the 15% sample had 63.54% moisture, 5.5% fat, 2.24% crude fiber and 0.92% total ash content. Developed ice-cream belongs to reduced fat ice-cream category according to the formulation and proximate composition of the ice-cream. Under physicochemical properties; pH (6.21±0.09 at 23.7°C), titratable acidity (1.207±0.015%), and beta carotene content (0.1532 mg/100 ml) were analyzed. According to color analysis, the lightness (L^*), redness (a^*) and blueness (b^*) in 0% sample were 83.790±1.188; -1.610±0.240, 33.875±0.884 and the 15% sample were 47.080±0.806; 0.3000±0.0566, 18.835±0.445 respectively. There is a statistically significant difference between colour values (L^*, a^*, b^*). The addition of canistel fruit enhances the yellow colour and adds extra beta-carotene content to the ice-cream.

Key words: Beta-carotene, Canistel Fruit, Ice-Cream, *Pouteria campechiana*

Development of Kohila (*Lasia spinose*) Rhizome Powder and Arecanut (*Areca catechu* L.) Husk Fiber Based Biodegradable Packaging Material

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The packaging is a vital factor in the food industry. The plastic packaging dominates the food industry which adversely affects the biodiversity of the environment. Therefore, the aim of the current study was to develop a biodegradable packaging material using Kohila (*Lasia spinose*) rhizome powder and arecanut (*Areca catechu* L.) husk fiber. Three formulations were prepared by changing the percentages of *L. spinose* rhizome powder and arecanut husk fiber. The evaluated properties were thickness, pH, moisture content, water uptake ratio, water solubility ratio, fracturability, and color. The thickness of the packaging material ranged between 1.80±0.18 mm to 1.91±0.05 mm. The moisture content was higher (7.02%±1.02%) in the sample prepared by adding 30% of *L. spinose* rhizome powder and the lowest (5.32%±0.17%) in the sample prepared by adding 10% of *L. spinose* rhizome powder. The pH of the packaging material was ranged between 5.95 and 5.55 at 25°C. The fracturability was higher (1490.7±33.9 g) in the sample prepared by adding 10% of *L. spinose* rhizome powder while 30% of *L. spinose* rhizome powder showed the lowest fracturability (846±413 g). The 30% *L. spinose* rhizome powder contained sample showed the highest water uptake ratio (49.99%±7.83%) and the highest water solubility ratio (7.83%±0.52%). The color of biodegradable packaging material was defined by L^*, a^*, and b^* values which ranged between L^* (50.95 - 52.15), a^* (9.20 – 11.70), and b^* (21.90 – 24.40). Approximately, 40% in each sample decomposed during the soil burial test. In conclusion, the biodegradable packaging developed with 30% *L. spinose* rhizome powder and 25% arecanut husk fiber had the highest thickness, pH, moisture content, water solubility ratio, water uptake ratio, least fracturability, and better alternative for single use plastic cups.

Key words: Arecanut Husk Fiber, Biodegradable Packaging, *L. spinose*, Physicochemical Properties

Optimization of the Extraction of Thebu (*Costus speciosus*) Leaves

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Thebu (*Costus speciosus*) leaves show various biological activities such as anti-diabetic, anti-oxidant, anti-cancer, anti-inflammatory, and diuretic activities. These activities are provided by the bioactive compounds found in *C. speciosus* leaves including phenols, flavonoids, steroids etc. The objective of this study was to optimize the extraction of *C. speciosus* leaves with regard to its antidiabetic and antioxidant activity. In this study, dried *C. speciosus* leaves (20 g) were macerated and extracted with water, 70%, 80%, and 90% v/v ethanol-water mixtures at 60 °C for 48 hours. DPPH radical scavenging activity, total phenolic content, and alpha-amylase inhibition activity were determined as functional properties. Aqueous extract showed the highest yield (19.53%) and the lowest yield was shown by 90% v/v ethanol (16.32%). Aqueous extract showed the lowest IC_{50} value for amylase inhibition activity (0.68±0.034 mg/mL) followed by 80% v/v ethanol leaf extract (0.78±0.146 mg/mL). Acarbose was used as the positive control and its IC_{50} value was 0.71±0.028 mg/mL. Methanol was used as the negative control. The 90% v/v ethanolic extract showed the lowest IC_{50} value for DPPH radical scavenging activity (0.06±0.008 mg/mL). Ascorbic acid was the positive control and its IC_{50} value was 0.23±0.014 mg/mL. The total phenolic content of ethanolic extracts was higher than that of aqueous extract and 90% v/v ethanolic extract showed the highest total phenolic content 9.91±0.024 GAE (mg/g). In conclusion, 90% v/v ethanolic extract showed the highest antioxidant activity and total phenol content. The aqueous extract showed the highest antidiabetic activity. The antioxidant and total phenol content of the plant extract increases with increasing the ethanol concentration. *In-vivo* test for the maximum tolerable intake to consume *C. speciosus* based products is suggested for further studies.

Key words: Aqueous Extraction, *Costus speciosus*, Ethanol Extraction, Functional Properties, Maceration

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Comprehensive Analysis of Physicochemical and Functional Properties of Banana Peel Powder from Four Commonly Available Banana Varieties (*Musa* spp.) in Sri Lanka

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Banana (*Musa* spp.) is the most widely cultivated and consumed fruit in Sri Lanka. Due to the postharvest losses and industrial usage, a large amount of banana peel is generated as a byproduct. Peels from four varieties namely "Rathabala", "Embul", "Seeni", and"Puwalu" were collected from the same agro climatic zone in Sri Lanka. The chemical composition, physicochemical properties, technological properties and functional properties of banana peel powder (BPP) were evaluated after dehydration of fresh banana peel. Tea infusions were developed based on the highest functional properties and the best tea formulation was selected. There was a significant difference ($p < 0.05$) in the proximate composition and vitamin C content of BPP and Vitamin C was the highest in Puwalu BPP. There was a significant difference in physicochemical properties of BPP. All BPP types had low a_w (0.37±0.01 - 0.49±0.00) that was beneficial for retarding microbial activity. pH of BPP samples were 4.61±0.00 to 6.43±0.01. Color values of BPP were significantly different. There was no significant difference ($p < 0.05$) of a_w, pH and colour during 4 weeks of storage. Antioxidant potential, phenolic and flavonoid content of BPP samples were significantly different and Puwalu BPP sample showed the highest antioxidant potential (12.26±0.54 ppm), total phenolic content (12.71±0.28 GAE mg/ml) and flavonoid content (219.25±0.39 QE mg/ml). The anti-hyperglycemic potential of Puwalu BPP was 231.5±29.40 ppm. Among formulations of tea infusion with 100%, 75%, 50%, 25% and 0%, Puwalu BPP The most preferred tea sample was 75% of Puwalu BPP with BOPF tea and showed good functional properties.A high nutritional content is present in BPP. Therefore, BPP can be used as a potential food source or immunity boosting beverage and is better for value addition.

Key words: Antioxidant Potential, Anti-Hyperglycemic Potential, Flavonoid Content, Phenolic Content

Food Applications, Sensory Analysis, and Quality Characterization of Edible Food Wrap Developed from Coconut Protein Isolate

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Edible food wraps are popular nowadays as they are environmentally friendly and supply additional nutritional benefits to the consumers' diets. This study investigated the potential of developing an edible food wrap from coconut protein isolates and the applicability of formulated food wrap for different food products. Food wraps from coconut protein isolates were developed using three levels (10, 15, and 20%) of glycerol, and the physicochemical characteristics were analyzed and compared to find the best. According to the results, 10% glycerol added food wrap reported significantly low levels of moisture content, swelling index, transparency, rehydration ratio, water solubility, and water uptake ratio compared with other treatments ($p < 0.05$). The light and water vapor transmission rates were also lowest in the food wrap made with 10% glycerol. The antioxidant activity of food wraps was not significantly different at $p < 0.05$. Food wrap with 10% glycerol was selected as the best and it was used for two food applications (sausage and sushi). The suitability of prepared food wrap for sausage and sushi was compared with commonly available edible casings/wraps, using sensory evaluation (5-point hedonic test) and other quality characteristics (cooking loss, emulsion stability, moisture reduction, increment of fat content, microbial analysis, etc). The sensory evaluation of sausage with food wrap didn't show significant differences in sensory attributes except for appearance ($p < 0.05$), compared to the sausage with edible casing. Consumer preference for sushi with food wrap was significantly higher compared with seaweed wrap ($p < 0.05$). The microbial counts for both sausage and sushi with food wrap were not beyond acceptable levels during the period of shelf life evaluation. The study highlights the feasibility of using coconut oil cake as a potential raw material for protein extraction in food wraps.

Key words: Coconut Protein Isolates, Edible, Food Wrap, Glycerol

Utilization of Palmyrah (*Borassus flabellifer*) Tuber Flour as an Ingredient in Development of Instant Vegetable Soup Cube

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The present study was carried out to add value to palmyrah (*Borrasus flabellifer* L.) tuber flour. Among the six different treatments, 3 hrs boiled water soaking treatment was selected for debittering. Then, the optimum tuber flour percentage was determined as 50%. Physicochemical, proximate, and microbial analysis and functional properties were determined for the developed instant vegetable soup cube. Results were analyzed using the non-parametric, one-way ANOVA Tukey test method at a 5% significance level. Sensory analysis was performed by 5- point hedonic scale test and ranking test and data were analyzed using the Friedman test. Water activity, pH, hardness, total phenolic content, and antioxidant activity of the best product, were 0.482, 5.38, 955.66 g, 150.42 mg GAE /100 g, and 13.25% respectively. Moisture, fat, protein, carbohydrate, crude fiber and ash contents were 16.71, 1.37, 6.79, 64.9, 5.04, and 5.19% respectively. The cube had an excellent mineral content as Na;1607 mg/100 g, K;435 mg/100 g, Mg;166.8 mg/100 g, Ca;164 mg/100 g. The color value of the best product was L^* (65.07), a^* (0.10), and b^* (15.94). The hardness, calorific value, and salt content of the best product were 955.66 g, 260.47 kcal/100 g, and 12.11% respectively. The packaging materials are aluminum foil and LDPE. Microbial content, physicochemical properties were predicted with storage. The study results showed that the instant vegetable soup cube developed by adding palmyrah tuber flour had an extended shelf life, as well as significant nutritional and functional properties.

Key words: Palmyrah Tuber Flour, Physicochemical properties, Proximate Composition, Sensory Properties, Vegetable Soup Cube

Formulation of Instant Flavored Beverage Powder from Milk of Virgin Coconut Oil Residue

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The white residue or meal that remains after the extraction of virgin coconut oil is known as virgin coconut oil (VCO) residue. The study focuses on value addition for VCO residue by formulation of an instant flavored beverage powder from extracted milk of VCO residue. Instant flavored beverage powder was produced with two flavors as wood apple and coffee. Powders containing 35% wood apple and 1% coffee were selected by sensory evaluation for further analysis. The best dilutions ratios were 1:2 and 1:3 for wood apple incorporated powder and coffee incorporated powder respectively. A control sample devoid of flavor or sugar was used to examine the physical attributes of these two treatments. According to the findings, wood apple incorporated powder showed higher bulk density (0.675±0.01 g/ml), lower carr index (1.202±0.005) and lower hausner ratio (0.168±0.003). However, coffee incorporated powder showed high solubility index (85.798±0.391%) and low wettability time (264.667±27.154 s). The proximate analysis was also carried out. The moisture content, crude fat, crude protein, and ash contents of all samples differed significantly ($p>0.05$). According to the total phenolic and DPPH assay, wood apple incorporated powder had higher total phenolic content (12.018±0.091 mg GAE /100 g) and coffee incorporated powder had higher scavenging activity than other samples. With one month of storage, there was a color deterioration (L, a^* and b^*) ($p>0.05$) in both samples stored in refrigerator and polypropylene bottles. There was an increase in range (0.23-1.86) $\times 10^2$ (CFU/g) and (1.09 – 1.50) $\times 10^2$ (CFU/g) of total plate count and yeast and mold count respectively in above mentioned stored samples. The values were below 10^5 CFU/g. Also, using polypropylene bottles as a secondary package proved the best storage option for the produced powders by having lower color deterioration and microbial content than refrigerated samples.

Key words: Coffee, Physical Properties, VCO Residue, Wood Apple

Changes in Beverage Consumption Habits During Covid-19 Pandemic; A Case Study of Sri Lanka

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COVID-19 caused dynamic changes in individuals' lifestyles. This study investigates the changes in beverage consumption among Sri Lankans, during the COVID-19 first lockdown period. An anonymous online questionnaire was conducted including questions about sociodemographic characteristics, beverage consumption frequency "before" and "during" the lockdown, and opinions. The sample size was calculated by using the formula for estimating a population proportion with absolute precision. Changes in the beverage consumption frequency were analyzed by using the Wilcoxon test method. Factors affecting beverage consumption frequency were identified using the binomial regression model. To find out whether the respondent's beverage consumption behavior actually became healthier during the pandemic era, Spearman's correlation test was carried out to check "beverage consumption frequency" versus consumer opinion towards "beverage consumption behavior became healthier during the lockdown period". Participants (n=600) were randomly selected (aged 31.227±11.06 years) and their gender distribution was balanced at 50%. All types of beverages have shown significant changes in consumption frequency during the pandemic ($p < 0.001$), except illegal alcohol (p=0.316). Gender, age, marital status, home location, and monthly income were commonly affected variables. According to Spearmans' correlation test results; soft beverages (-0.132), RTS beverages (-0.047), energy drinks (-0.170), legal alcohols (-0.217), and illegal alcohol (-0.280) have negative correlations while, hot beverages (+0.220), homemade fruit or vegetable drinks (+0.161), traditional ayurvedic beverages (+0.255) and dairy-based beverages (+0.084) have positive correlations. Around 80% of participants believed, their beverage consumption behavior became healthier during the lockdown period. Study reveals there is an observable change in beverage consumption habits; family influence, and immunity-boosting aspects are the major root causes for these observable changes, while "Influence of family" (41.5%) had the highest effect. This study recommends studies on quantitative measurements of individual beverage consumption and informing people more about the immunity boosters in foods and beverages.

Key words: Beverages, Consumption Behaviors, COVID-19 Pandemic, Pandemic Impact

Development of Gluten Free Dessert Pizza Dough Utilizing Sweet Potato Flour and White Rice Flour

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Gluten protein plays a major role in baked goods. Celiac disease (CD) is a systemic condition mediated by the immune system. This study focused on developing gluten-free pizza dough targeting for people with celiac disease. Xanthan gum and guar gum were used as a replacement of gluten from flour composites. An online survey was conducted to study the consumer awareness of gluten free foods and three flour composites were developed by using sweet potato flour and rice flour with different ratios. Functional properties such as results swelling capacity, solubility index, water absorption capacity, oil absorption capacity, emulsion activity, emulsion stability, foam capacity, foam stability, gelatinization temperature, least gelatinization concentration, bulk density and tapping density, proximate composition, an particle size of the flour composites were studied and the flour composite 03 was used for pizza development. Texture profile analysis, sensory evaluation test, colour analysis, expansion value analysis and proximate composition were done for pizza sample 342. A total of 387 individuals responded to the online survey, 55.44% were males and 26.42% are females. There are 66.06% of participants having stated that they know about gluten free foods. According to functional properties of flour composites, Flour composite 03 which contains 75% sweet potato flour and 25% rice flour was used as the best flour composite for further developments. The flour composite showed the following results swelling capacity (16.63 ml), solubility index (4.13%), water absorption capacity (187.33%), oil absorption capacity (158.00 %), emulsion activity (40.42%), emulsion stability (48.66%), foam capacity (18.31%), foam stability (9.16%), gelatinization temperature (79.33°C), least gelatinization concentration (0.30 gml^{-1}), bulk density (0.65 gml^{-1}) and tapping density (0.68 gml^{-1}). Whiteness index of flour composite 03 is 68.18%. The 1% Xanthan gum added pizza (sample 342) was selected as the best formulation through the sensory analysis results. The expansion value of sample 342 is 57.14%. The proximate analysis of sample 342, composed of moisture (3.87%), ash (3.55%), fat (8.55%), protein (9.81%) and fiber (5.48%). This pizza is gluten free pizza and flour composite 03 have acceptable value for functional properties of flour for bakery product developments.

Key words: Celiac Disease, Gluten Free, Pizza, Rice, Sweet Potato

DEffect of Arrowroot (*Maranta arundinacea*) Flour on the Characteristics of Developed Cookies

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Consumption of wheat flour-based products has raised several concerns due to its contribution to several non-communicable diseases. This study assessed the effect of replacing wheat flour with arrowroot flour on the characteristics of developed cookies by varying the proportion of arrowroot flour from 70 to 100% (w/w). Blanched arrowroots flour has shown better functional qualities and color than raw arrowroots flour. According to the results, up to 100% arrowroots flour substitution was achievable without impacting the cookies' overall acceptability. Sensory panelists' best recommendation is the 90% arrowroots flour incorporated cookies. Cookie's crude fiber content (1.72±0.16 to 4.02±0.05%) was significantly ($p<0.05$) increased after adding arrowroots flour. However, crude protein content (5.09±0.30 to 2.53±0.05%) was significantly ($p<0.05$) decreased. The diameter of cookies (49.73±0.81 mm to 46.94±0.08 mm) significantly ($p<0.05$) decreased with the rising substitution level of arrowroots flour. The substitution significantly ($p<0.05$) increased the hardness of cookies due to their weak gluten network. The water activity of the cookies was significantly ($p<0.05$) increased (0.28±0.01 to 0.31±0.01) after adding arrowroots flour due to having high water absorption capacity. Arrowroots flour affected the cookie color, however, it was not changed with the flour percentage. Shelf life studies showed that moisture content (3.55±0.03 to 5.52±0.04%), and microbial quality parameters of cookies would remain within safe limits throughout the 6^{th} week storage period. Evaluation of flour's functional characteristics and color analysis revealed that arrowroots flour is a good alternative to wheat flour. According to the results of this study, arrowroot flour can be used as a potential substitute for wheat flour in the Sri Lankan food industry.

Key words: Arrowroots Flour, Cookies, Sensory, Storability, Wheat Flour

- Session -

Natural Resource Management 1

Quantification of Industrial Carbon Footprint and Introducing a GHG Reduction Plan for a Textile Industry in Sri Lanka

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The garment sector is the largest industrial polluter in the world, responsible for around 10% of the worldwide carbon footprint. This study shows how the carbon footprint can be calculated and GHGs reduction techniques could be introduced to a textile industry, aiming enhanced environmental performance and sustainability. The four major steps used to calculate carbon footprint were, identification of boundary of the study, scope of analysis, data collection and data analysis. Primary data covering the Scope 1 (i.e., Generator, Boiler, Fire extinguisher), Scope 2 (i.e., Grid electricity) and Scope 3 (i.e., Accessories, Staff, Waste transportation) emissions were collected by conducting industrial visits. Published materials, Intergovernmental Panel on Climate Change (IPCC) guidelines and GHG protocol guidelines were used as secondary data. Interviewing the workers and the staff was also utilized to generate some effective carbon management strategies that could be introduced. The average fuel consumption was analyzed by one sample t statistical test in Minitab 8 statistical software. Total GHGs emissions related to Scope 1, Scope 2 and Scope 3 were 749 t CO2e, 957 t CO2e, and 1,151 t CO2e, respectively. To develop a carbon management plan, the general manufacturing process of the facility and the related environmental impacts were analyzed and investigated by cost benefit analysis. According to the GHG reduction plan replacing fluorescent bulbs with LED tube bulbs (4.05%), replacing fluorescent bulbs with LED task bulbs in sewing section (0.2%), introducing adsorption chiller technology to reduce electricity cost for air conditioning (35.5%), introducing a solar power panel system (15%), sensor taps to optimize consumption time and minimize the water wastage (0.001%) and introducing Hippo water saving device for toilet system (0.06%) are the recommended carbon reduction opportunities in the studied textile industry. Further research is recommended to seek for causes that contribute to rising carbon footprint other than electricity consumption, while suggestions for lowering organizational carbon footprint are also discussed.

Keywords: Apparel Industry, Carbon Management Plan, Environmental Performance, Green Economy

Application of a Constructed Floating Wetland for Treatment of Wastewater: A Case Study in Horana Export Processing Zone in Sri Lanka

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Constructed floating wetland (CFW) has been a popular phytoremediation based water treatment method for water purification purposes since the turn of the century. Natural macrophytes form floating hydroponic mats on the water's surface and a root system that acts as a natural filter. This study was conducted at Horana Export Processing Zone to evaluate the potential use of floating wetland plants of Cyperus iria, Heliconia psittacorum and Canna indica for removing pollutants from wastewater. The CFW unit (size of 0.75 m × 0.46 m × 0.15 m (L×W×H)) was made with coconut husk chips, rice hulls, and soil media. Triplicate CFW with varying plant densities and three units without plants as control treatment were established in 90 L tanks. Water samples were collected over an 8 week period for analysis. Water quality parameters (BOD, COD, TSS, TDS, Nitrates, Phosphates and Heavy metals (Pb, Cr, Ni)) were measured once a week. One Way ANOVA Repeated measure analysis (95% confidence interval) with Tukey's Post Hoc Test was carried out. Canna indica showed high removal efficiency in TSS, COD, Cr, Ni and nitrates as 58.1%, 73.0%, 72.0%, 86.6%, and 59.5%, respectively. Cyperus iria showed high reduction efficiency in BOD (56.7%) and phosphates (87.2%). Heliconia psittacorum showed high reduction efficiency in TDS (71.6%), Pb (58.0%). The results of the study suggested the selected Cyperus iria, Heliconia psittacorum, Canna indica could be potential plant species used in the CFW system to improve treated wastewater quality.

Keywords: Biofilms, Constructed Floating Wetland, Hydroponic Mats, Macrophytes, Phytoremediation

Pollution Assessment on E-Waste Contaminated Soil in Sri Lanka

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E-waste is a generic term for numerous types of obsolete electrical and electronic equipment that have been carelessly dumped. Along with technological development, e-waste has become an emerging environmental problem in many parts of the world including Sri Lanka. Narammala is one of the main areas in Sri Lanka where e-waste collection has been done as a source of income. The soil is polluted due to improper e-waste management practices in this area. The objective of the present study was to identify the main e-waste generation sites, explore the impact of e-waste on soil, and propose a solution for a proper e-waste management strategy. The study focused on Ginigathpitiya and Koulwewa villages in the North Western Province and a questionnaire survey was performed to identify major e-waste generation sites. Heavy metal concentrations in 20 soil samples within 200m distance from major e-waste generation sites were collected by using stratified random sampling method. This Study found that top soil from one major e-waste generating site in Ginigathpitiya was contaminated with Cu (1.89 - 67.56 mg/kg), Zn (2.05 - 24.27 mg/kg), Cd (0.05- 1.70 mg/kg), Pb (0 - 14.96 mg/kg), Cr (0.44 -1.71) and Ni (0.09 - 5.09 mg/kg) while another one major e-waste generating site in Koulwela was contaminated with Cu (0.62 - 110.16 mg/kg), Zn (0.76 - 56.66 mg/kg), Pb (0.24 - 64.50 mg/kg), Cd (-3.17 – 1.84 mg/kg), Cr (0.49 - 4.37 mg/kg) and Ni (0.14 - 4.12 mg/kg). Two sample T-Test revealed different distribution pattern of Cu(-1.23),Zn(-0.15),Pb(-2.28), and Cd(-1.05) in both villages. Nevertheless, a significant level of high heavy metal concentrations indicates high soil pollution occurred in Koulwewa. The metal levels can be minimized by encouraging e-waste collectors to adopt proper e-waste management practices. In addition, conducting awareness campaigns and updating the existing regulations and policies are also recommended.

Keywords: Bioremediation, Environmental Pollution, Heavy Metals, Soil pH, Waste Management

The Impact of Flood Hazard on Small and Medium Entrepreneurs in the Ratnapura Divisional Secretariat Division, Sabaragamuwa Province, Sri Lanka

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The direct and indirect impacts of natural hazards are affecting trade activities and their stability all over the world. Small and medium-sized entrepreneurs (SMEs) are affected comparatively higher than large scaled entrepreneurs in Sri Lanka, as they are relatively resource necessitated and less able to recover from the impacts. The present study assesses the detrimental experiences with flooding and will provide valuable knowledge for fostering entrepreneurial resilience in future events. Thus, this study aimed to investigate the full range of both long-term and short-term impacts flooding experienced by SMEs in the Ratnapura Divisional Secretariat, Sabaragamuwa Province, Sri Lanka following the floods of May 2017. The flood-affected 500 SMEs were surveyed during the study. The optimum sample number for the survey was calculated by Cochran formula, and 96 SMEs were randomly selected from the flood affected SMEs. Primary and secondary data were collected in preparing the five-point Likert scale questionnaire that was carried out individually with respondents of each SMEs. The Relative Importance Index (RII) was used to rank the impacts on SMEs. The main finding in this study within short-term impacts is that the stocks were severely damaged (RII=0.891) and following that property damage (RII=0.833) is highly affected to SMEs. Under Long-term impacts, disrupted cash flow (RII=0.858) and structural damages (RII=0.795) extremely affected the SMEs. Since flooding has seriously damaged the public infrastructure system, entrepreneurs have to obtain alternate or emergency logistic support from the government as well as insurance claims to run their operations. Therefore, the findings of this study propose some strategic plan and policy framework and adaptations for disaster risk reduction among SMEs in Sri Lanka.

Keywords: Flood, Hazards, Impacts, Relative Importance Index, Small and Medium Entrepreneurs

Synthesis of Manganese Dioxide/Reduced Graphene Oxide Nanocomposite for Oxidative Degradation of Methylene Blue

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Dyes are serious environmental contaminants having negative effects on human health. Due to the tenacity and resilience of dyes to natural degradation, the careless dumping of wastewater containing azo dyes has turned into a significant environmental problem. Researchers have focused their efforts and made substantial attempts to address this problem since dyes cannot be removed from the environment by standard wastewater treatment procedures. Manganese dioxide (MnO_2) – reduced graphene oxide (rGO) nanocomposite was synthesized by using $KMnO_4$ and rGO. MnO_2-rGO nanocomposite was used as a model for the efficient removal of methylene blue (MB) from an aqueous medium. The nanocomposite obtained was characterized by Fourier transforms infrared spectroscopy, X-ray diffraction, and thermogravimetric analysis. The effect of pH, dosage of the nanocomposite, MB initial concentration, and reusability of nanocomposite were studied. MnO_2–rGO nanocomposite showed high performance for oxidative decolorization and removal of MB. Typically, 25 mL of MB (10 ppm) can be decolorized in 15 min with 25 mg of the MnO_2–rGO nanocomposite with 98% decolorization efficiency. The optimum pH is 7 for MnO_2-rGO nanocomposite. Moreover, the dye decolorization rate was decreased with increasing MB concentration. The Pseudo-second-order model (R^2 = 0.9958) was the applicable kinetic model. The nanocomposite material exhibited recyclability and durability with the degradation value of 76% for MB after three consecutive cycles. Results revealed that the MnO_2-rGO nanocomposite is capable of successfully degrading MB in aqueous solutions.

Keywords: Methylene Blue, Nanocomposite, Pollutants, Reduced Graphene Oxide

Impacts of Land Use Land Cover Changes on Soil Loss in Madu Ganga Watershed Area During 2002 to 2022

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Soil erosion is one of the critical environmental and health issues faced by humans. Various natural and anthropogenic factors contribute to accelerate soil erosion, which in turn causes soil degradation. Land use land cover (LULC) changes in catchments is one of the major factors that contribute to man-made soil erosion. The prime aim of this study is to estimate the impact of LULC changes on total soil loss in the Madu Ganga estuary area between 2002-2022. Madu Ganga estuary is a highly urbanized area with large scale land use land cover alterations by human activities. Soil erosion modeling is helpful for predicting soil loss in highly urbanized landscapes. The Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) model is introduced by Stanford University for the valuation of ecosystem services and goods. Through this, InVEST Sediment Delivery Ratio (SDR) model is developed to assess sediment delivery into a watershed area. The Modeling approach was developed under the Geographic Information System (GIS) based environment for the past 20 years with 5-year intervals. Estimated mean total soil loss of the Madu Ganga watershed area for years 2002, 2007, 2012, 2017, and 2022 were 1.17, 1.61, 2.00, 6.56, and 6.61 t ha-1 year-1 respectively. Pearson correlation test was performed to build a relationship between vegetation cover and total soil loss in the area. The results of the analysis indicated a negative correlation (r= -0.014 p=0.778) between vegetation cover and total soil loss in the area. The findings of the study indicated that, during the past 20 years LULC changes have contributed to accelerate the soil loss of the area. Further the findings of the study emphasize the necessity of the implementation of LULC plans and policies to reduce soil loss in the watershed area.

Keywords: InVEST SDR, Land Use Land Cover Change, Madu Ganga, Soil Erosion, Soil Loss

Development of a Soilless Potting Media Using Elephant Dung and its Applications

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Zoo habitats have negative repercussions of high trash generation that is in conflict with the primary objectives of conservation. Thus, this study aimed to add value to elephant dung accumulated in zoos, through evaluating its applicability as an element in soilless media for developing seedling pots, and as a material to make seed balls. To test the applicability of elephant dung in potting media, the following media were prepared; P1: elephant dung + wood ash + clay (2:1:1), P2: elephant dung + chicken manure + clay (2:1:1), P3: elephant dung + sawdust + clay (2:1:1), P4: elephant dung + clay (2:1) and P5: only soil as the control media. The experiment was replicated six times with 30 pots. The water holding capacity, dry weight, and chemical composition of each potting medium and the seed germination times, and the growth rates of plants potted in each medium were analyzed (n=6 for each potting medium) and compared using one-way ANOVA. All the parameters differed significantly across the five-potting media ($P < 0.05$). The result revealed that the selected macronutrients were high in different combinations viz., Nitrate (P3), Phosphate (P2), K, Cu, Zn, and Cd (P1) compared to soil (P5). P3 showed rapid germination, the lowest dry weight, and the highest water-holding capacity. Plants potted in P2 showed the highest growth rate. The usability of elephant dung in seed balls was evaluated by estimating the germination percentage of seed balls produced by mixing elephant dung and clay at a 2:1 ratio. The germination percentage of seed balls was measured according to the environmental conditions, i.e. riverside, forest area, roadside, and control settings (n=25 for each environmental condition). This study showed that the seed ball approach can be utilized to restore vegetation at a minimal cost, indicating germination rates of over 52% in all selected natural environmental conditions.

Keywords: Elephant Dung, Germination Percentage, Growth Rate, Seed Ball, Seedling Pot

Resource Efficient and Cleaner Production Assessment in an Apparel Industry in Sri Lanka

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The apparel industry contributes to a significant portion of Sri Lanka's exports while the sector occupies 15% of the country's employment. Apparel manufacturing is one of the most resource-consuming industries that generate vast amounts of waste. Energy and water consumption in the apparel industry are also significantly high. Therefore, this study aimed to identify proactive strategies to reduce pollution and generation of waste at the source by changing both processes and use of materials in an apparel industry in Sri Lanka. The study employed the cleaner production methodology developed by the United Nations Industrial Development Organization. In this study, material, energy and water were identified as the main input variables of the processes. The main output variables were produced garments, wastewater generation, and solid waste. With respect to the studied apparel manufacturing facility, the annual production capacity was 7748940 pieces in 2022. The average daily electricity and water consumption for the year 2022 were 0.103 kWh per piece and 0.0605 m^3 per person, respectively. A volume of 0.039 m^3 of wastewater has been generated per person. The total CO_2 emission per day was 2.4 tCO_2e. The highest portion of electricity is consumed by sewing machines and then by air compressors and air conditioners. Currently, generated solid waste is subjected to recycling. Water consumption practices determined by behavioral variables were identified as a major root cause of higher expenses for resource consumption which can be reduced by around 65% through reusing treated wastewater.

Keywords: Apparel & Textile, Recycling, Resource Efficient Cleaner Production

The Spatial Distribution of Water Quality Correlated to Chronic Kidney Disease of Unknown Etiology in Monaragala District, Sri Lanka

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Chronic Kidney Disease of unknown Etiology (CKDu) is a major public health issue worldwide, affecting most agricultural communities. The first sign of CKDu is increased albumin excretion in the urine. CKDu has been most prevalent in the dry zone in Sri Lanka over the last two decades. Despite the fact that many scientists have proposed various risk factors, the primary cause of CKDu is still unknown. The purpose of this study was to determine the spatial distribution of physiochemical parameters in water in the DS divisions in Monaragala district of Uva Province, Sri Lanka, and interpolate with CKDu. Sixty-six water samples were collected from dug wells and tube wells representing groundwater, reservoirs, rivers, and tanks representing the surface water. pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Alkalinity, Total Hardness, Major Cations (Na, K, Ca, Mg), and Major Anions (Fluoride, Chloride, Nitrate, Phosphate, and Sulfate) were analyzed using standard methods and compared with water quality standards. The spatial distribution of water quality parameters was developed by the Inverse Distance Weighted (IDW) tool, and the CKDu patients' distribution map was also developed in ArcMap 10.8 software. According to the comparison with the water quality standards, total hardness, total alkalinity, fluoride, chloride, nitrate, phosphate, Ca, and Mg were found to be at higher levels than standards. The distribution of CKDu patients in the map was overlapped by the above parameter distributions, which indicates that water quality has a significant impact on CKDu prevalence in the Monaragala district of Sri Lanka.

Keywords: CKDu, GIS, Monaragala, Spatial Distribution

Common Fungicide Usage and New Trends in Plantation Sector, Sri Lanka

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The plantation sector plays a vital role in the Sri Lankan economy, with tea, coconut, rubber, toddy palm, oil palm and sugarcane being the primary crops involved in the industry. Fungicides are an integral part of this sector, as they have a significant impact on crop protection. Disease management is crucial in plantation crops, making it essential to understand the current fungicide usage to implement new decisions effectively. To achieve this, published research data and government publications were thoroughly reviewed, referring to the performance report and annual report issued by ministry of Agriculture, science direct and google scholar. Fungicides are imported to Sri Lanka as formulated forms. Bordeaux mixture is a major fungicide used against fungal diseases like bud rot present in coconut cultivations. Farmers commonly encounter rust, black rot, and blister blight like fungal diseases in tea cultivation. Copper hydroxide, hexaconazole, and tebuconazole are mainly used to control fungal disease in tea. In rubber, Oidium leaf disease, Colletotrichum leaf disease and leaf fall disease caused by Colletotrichum and Pestalotiopsis are mostly reported fungal diseases in recent years. Sulfur dust, Bordeaux mixture, carbendazim, hexaconazole, and mancozeb are commonly used to control fungal diseases in rubber. Tebuconazole and hexaconazole are frequently used in sugarcane cultivation. Against this backdrop, a new trend in Sri Lanka is the use of biopesticides, such as Trichoderma, to control fungal diseases. Despite this, chemical control remains the major method used for fungal disease due to its ease of use, effectiveness, and crop insecurity. One of the major challenges is the lack of knowledge among farmers and laborers about the safe use of fungicides. Offering extension services and awareness campaigns are necessary to impart the knowledge needed for handling chemicals and sprayers effectively.

Keywords: Bio Pesticides, Fungal Diseases, Fungicides, Plantation

- Session -

Natural Resource Management 2

Microplastics in Leachate Draining from Selected Landfill Sites in Sri Lanka

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Microplastics in leachate are a global concern due to their pervasiveness and potential risks to biota. Secondary microplastics are formed through physical, chemical, or biological processes that break down plastic waste deposited in landfills. Despite reports of microplastics in leachate and sediment worldwide, there has been no investigation of their presence and characteristics in Sri Lanka. This study aimed to address the research gap by assessing the abundance of microplastics in leachate and sediment at ten dumpsites in Sri Lanka: Karadiyana, Muthurajawela, Rathnapura, Balangoda, Gohagoda, Rathgama, Niyagama, Kurunegala, Matara, and Ja-ela. Density separation and wet peroxide digestion was performed to extract microplastics from sediment and leachate samples. The extracted microplastics were separated into three size categories (2-5 mm, 1-2 mm, and 0.5-1 mm) and chemical characterization was performed using FTIR spectroscopy. The microplastics were further characterized according to their shape and color. The results showed that the abundance of microplastics in leachate ranged from 0.52 to 5.95 mg/L while in sediment, it varied from 61.00 to 1173.40 mg/kg. The highest microplastic abundances were found in Balangoda leachate (5.95 mg/L) and Ja-ela sediment (1173.40 mg/kg). The mean microplastic abundance in leachate and sediment was 2.06±1.96 mg/L and 363.36±353.33 mg/kg, respectively. Polyethylene was the most abundant polymer type in both leachate (54.72%) and sediment (63.7%). Fragment shapes were commonly present in the microplastics, and more than 50% of the microplastics found in the leachate and sediments were in 1-2 mm size range. White-colored microplastics were prominent in both sediments and leachate. The study highlights the potential risks of microplastic exposure to the general population in Sri Lanka, as the surrounding waters of the dumpsites are used as public water supplies.

Keywords: Leachate Treatment, Plastic Waste, Polyethylene Microplastics, Urban Plastics

Effect of Different Soil Moisture Contents on Maize (*Zea mays*) Seed Emergence

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Maize (*Zea mays*) is one of the most-widely grown grains in Sri Lanka. However, farmers who cultivate maize have been facing both water logging conditions and low water conditions for a long period due to irregular rain patterns. This study was conducted to examine the survival of the maize seedling under various soil moisture conditions. The emergence of three varieties of maize i.e. open pollinated variety (OPV) Badra, the local hybrid variety MI Maize Hy and the imported variety Pacific-999, were examined at different soil moisture levels. Soil moisture was controlled under six treatments. High moisture levels (H) were maintained by using both drip irrigation and capillary action. By varying the water application, low moisture (L), normal moisture (N), and intermediate moisture (I) levels were maintained. Soil moisture was measured daily using a Time–Domain Reflectometer (TDR) and the number of seeds that emerged was examined. All treatments including H1, H2, L1 and N showed low emergence 19%, 13%, 4%, and 17%, respectively, irrespective of the variety. The highest mean moisture levels were H1 and H2, and excessive water levels led to the deterioration of seeds. In response to a lack of water in the soil maize undergoes a series of modifications including poor seedling growth and wilting symptoms. Further, pre-treating maize with anoxia or hypoxia boosts its resistance to waterlogging conditions. As a result, limited seed emergence was observed. A good emergence of seed (60–70%) was observed when soil moisture was at the field capacity level (29.3%). Successful emergence could not be observed when the moisture level was lower than the field capacity. According to the findings, it is suggested that the planting season of the selected varieties be adjusted based on soil moisture content.

Keywords: Field Capacity, Maize, Seedling Emergence, Soil Moisture

Assessment of Carbon Storage in a Selected Plantation in Deraniyagala, Sri Lanka

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The complex process of absorbing carbon dioxide by leaves from the atmosphere and storing it in the soil carbon pool is known as soil carbon sequestration. A quality vegetation cover accelerates this process. Carbon storage in the soil helps to increase the soil quality in several ways viz giving soil structure, and storing nutrients and water that are required for plants and soil organisms. Therefore, carbon storage in the soil of agricultural lands is important to enhance productivity. Thus, this study aims to estimate the current status (as in the year 2022) of carbon storage in a selected plantation in Deraniyagala, Sri Lanka. The Integrated Valuation of Ecosystem Services and Trade-offs (InVEST) carbon storage and sequestration model was used for this estimation. This model uses four carbon pools that are in the environment; carbon stored in above-ground biomass, below-ground biomass, soil, and dead organic matter. As a function of the storage in the four carbon pools, this model estimates the total carbon storage in the study area. The estimated mean total carbon storage in this plantation was 200.5 t/ha ranging from 0 to 257 t/ha. Furthermore, this study shows that carbon storage in soil is the most prominent among other carbon pools. It was 73.16 t/ha ranging from 0 to 100 t/ha. It indicates that the land owner has maintained suitable soil conservation measures. Furthermore, the newly introduced compost project may affect the amount of carbon stored in the soil. The findings of this study will help to implement soil and vegetation conservation practices in agricultural lands to enhance soil health and agricultural productivity through increasing the status of carbon storage and finally achieve the country's Sustainable Development Goals.

Keywords: Carbon Storage, InVEST, Carbon Storage and Sequestration Model, InVEST Plantation

An Assessment of Airborne Microplastic Distribution in Sri Lanka by Using Lichens

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Airborne microplastics (AMPs) have been found in our atmosphere, and they have currently received significant global attention since they can enter the human body through inhalation, dermal contact, or ingestion and may pose a serious potential threat to human life in the future. This study was carried out based on an open dumpsite and a plastic crusher plant located in Kanadola, Sri Lanka, which have a high potential as a source for anthropogenic microplastic contamination in the air. Lichen samples were collected by using stratified random sampling, and this area was divided into three zones based on the distance from the plastic crusher plant; a close contact zone (50 m), an intermediate zone (50-100 m), and a remote zone (100-200 m). Background control samples were collected from the Kumbalgama area. Lichen samples were digested with acid digestion, and visual inspection of microplastics was carried out using a stereomicroscope. Identification of microplastics was performed using a hot needle test. The total number of AMPs per 1 gram of dry weight of lichen in each sampling zone was statistically analyzed using one-way ANOVA (95% confidence interval) to compare sampling zones. The results showed that each sampling zone has statistically significant difference ($P > 0.05$), and a post hoc test using the Tukey test revealed that the close contact zone, remote area, and control zone have statistically significant difference ($P > 0.05$), but the close contact zone and intermediate zone do not ($P > 0.05$). Overall, it was found that the lichens can be used as a bioindicator and passive depositional sampler for qualitative and quantitative analysis of AMPs.

Keywords: Airborne Microplastics, Atmosphere, Lichen, Passive Depositional Sampler, Stratified Random Sampling

Effects of Herbicides (Glyphosate) Application on Heavy Metal Accumulation in Topsoil and Tea Leaves

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Weeds compete with tea mostly for light, water, and nutrients, which have a variable impact on the yield of tea. Herbicide use is the most famous method in tea plantations to control weeds. Glyphosate is a widely used herbicide in tea plantations to control weeds. However, its excessive use may increase human exposure to heavy metals. Thus, the prime aim of this study was to determine the levels of Copper (Cu), Zinc (Zn), Nickel (Ni), Chromium (Cr), Iron (Fe), Manganese (Mn), Lead (Pb), and Cadmium (Cd) in tea soils, fresh tea leaves, and black tea leaves (processed) of both herbicides-applied tea plantation plots and herbicide-free tea plantation plots in Sri Lanka. Metal contamination levels were determined using Atomic Absorption Spectrometer (AAS) after sample preparation was carried out using the Microwave Digestion System. The data were statistically analyzed using the student's t-test (95% confidence interval) to compare the difference in metal concentrations between herbicide-applied and herbicide-free tea plots. According to the obtained results, available Fe, Ni, and Pb levels of soils of herbicide-applied tea plantation plots are significantly higher ($p<0.05$) than the soils of herbicide-free tea plantation plots. Further, the Fe level in the soils of herbicide-applied plots exceeds the maximum permissible limit (50000 mg/kg) according to the World Health Organization (WHO). Furthermore, Zn and Pb levels of fresh tea leaves in herbicide-applied plots are significantly higher ($p<0.05$) than those in herbicide-free plots. In addition, Cr and Pb levels of black tea leaves were significantly higher ($p<0.05$) in herbicide-applied plots. Overall, it can be concluded that the long-term application of glyphosate in tea plantations has an impact on heavy metal accumulation in soil and tea leaves. Therefore, it is important to practice integrated weed management techniques to reduce herbicide use in tea plantations.

Keywords: Glyphosate, Heavy metals, Herbicides, Soil, Tea

Removal of 2,5-Dichlorophenol from Air Using Zeolite Based Catalysts

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Volatile organic compounds (VOCs) are classified as hazardous air pollutants since they have negatively impact on the ecosystem and cause a variety of health issues. The 2,5-Dichlorophenol (2,5-DCP) is the selected VOC in this study. Due to its recalcitrant characteristics, 2,5-DCP is not easily biodegradable. The 2,5-DCP is classified as a high production volume chemical. To limit VOC emissions, a simple enclosure is not enough. Catalytic degradation has proven to be an efficient method to treat VOCs. Among VOC controlling techniques, the use of zeolite-based catalysts is a promising strategy. Therefore, this study focused on the degradation of 2,5-DCP using Cu-modified zeolite catalysts. The adsorptive degradation capability of 2,5-DCP over Cu/Y and Cu/ZSM (Zeolite Socony Mobil)-5 zeolite was investigated. ZSM-5 zeolite was synthesized via microwave assisted hydrothermal method. Powder X-ray diffractometer (PXRD), Fourier-transform infrared spectroscopy (FTIR), and Raman spectroscopy were used to evaluate the quality characteristics of Cu/ZSM-5 zeolite. Results revealed the presence of ZSM-5 zeolite. The adsorption of 2,5-DCP on Cu/Y and Cu/ZSM-5 zeolite was studied. The variable effects of zeolite dosage, contact time, temperature, initial 2,5-DCP concentration and 2,5-DCP volume were investigated. Adsorption capacities and removal efficiencies were studied to investigate optimal conditions for 2,5-DCP degradation. The qualitative and quantitative data of the 2,5-DCP degradation process were obtained and analyzed via gas chromatography-mass spectrometry (GC-MS). At optimum conditions, dosage, time, temperature, concentration and volume are to be 8 mg, 60 minutes, 100 °C, 4 mM and 200 μl respectively. Pseudo second-order kinetic model fitted well with the adsorption data ($R^2 = 0.8377$). The GC-MS and Raman spectroscopy data revealed that both Cu/Y and Cu/ZSM-5 zeolite has degraded 2,5-DCP. Cu-loaded Y zeolite and ZSM-5 zeolite can be applied as promising adsorbents in the removal of 2,5 dichlorophenol.

Keywords: Adsorption, Catalyst, Chlorophenols, Volatile Organic Compounds, Zeolites

Determination of Secondary Seed Dormancy in Brinjal and Finger Millet during Storage Period

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Brinjal (*Solanum melongena*) and finger millet (*Eleusine coracana*) have high nutritional and medicinal values. Non-deep dormancy of brinjal and finger millet seeds is a problem encountered in Sri Lanka. The study aims to identify the factors affecting the temporary seed dormancy in brinjal and finger millet and determine possible ways of breaking the dormancy. The analysis was made with three factor-factorial design using storage condition, crop, and dormancy breaking treatment. Storage conditions were cold-light, cold-dark, and ambient conditions for brinjal and finger millet crop species while dormancy-breaking treatment included potassium nitrate (KNO_3) or gibberellic acid (GA3), imbibition, and normal germination. Seeds of the brinjal variety "Padagoda" and the finger millet variety "Oshada" were stored for one month under each storage condition, and seed quality parameters were tested twice within two-week intervals using imbibition, normal germination, seedling vigor index after applying dormancy-breaking treatments. The germination percentages of brinjal and finger millet and the seedling vigor index of brinjal were evaluated for each test. Storage condition was not significant ($P < 0.05$) for the germination percentage of brinjal and finger millet, and the seedling vigor index of brinjal. The germination percentages of brinjal resulting from imbibition, and GA3 gave higher significant differences ($P < 0.05$) while these tests were not significant for the seedling vigor index of brinjal. Imbibition, normal germination, and KNO_3 treatment gave higher significant differences ($P < 0.05$) in germination percentages of finger millet. In conclusion, storage conditions did not affect brinjal and finger millet germination within one month of storage while imbibition improved the germination and seedling vigor index of brinjal and KNO_3 improved germination of finger millet.

Keywords: Germination Percentage, Imbibition, Non-deep Dormancy, Seedling Vigor Index

Analysis of Microplastics in Inflows and Outflow of Kandy Lake in Sri Lanka

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This study presents the results of the first investigation into microplastics in the water of Sri Lanka's Kandy Lake. Microplastics (MPs) pose a growing environmental threat due to their small size (less than 5 mm). Plastic granules can be manufactured or degraded from larger plastic trash. Microplastic concentrations in freshwater sediments are like those in the most polluted sea sediments, and are produced by a special biogeochemical cycle that affects ecosystem health, productivity, and biodiversity. The concentration of this particle component is important for ecological processes in inland water bodies. Near the Joy boats service, Hillwood Stream, Near the Malwatta Viharaya, Near the Mahamaya School, Near the wetland bridge, Near the Buddhist Publication Society and Outflow of the Kandy Lake and processed for microplastics to assess the presence of MPs in the Kandy Lake. 21 samples were taken three times, 3 each from one location and 1L for each sample. Plastic separation was accomplished by density separation using NaCl followed by wet peroxide digestion, and identified by micro-Raman spectroscopy. MPs were found in every water sample, and they are widely distributed in the lake. The main type of polymer found to be low-density polyethylene (41.78 %) and other microplastic types are Polypropylene, Polyvinyl Chloride, Polystyrene, Polycarbonate and Polybutylene. The mean microplastic abundance was 3.096 mg/L, ranging from 1.10 – 5.55 mg/L from 136 different polymers. Near the Joy boat service site (5.55 mg/L) had the highest microplastic because it is in the town and crowded area and Near the Buddhist Publication Society site had the lowest microplastic abundance because that place is not a crowded area as other sites. Commonly present microplastic shape was fragment (69.23 %) because fragmentation causes the particles to break down into ever smaller pieces. The microplastic's most prominent color was Black in all the samplings. Black particles dominate due to styrene-isoprene rubber, PE, and PVC. This study shows how microplastics are distributed spatially in Kandy Lake.

Keywords: Fragment, Kandy Lake, Microplastics, Polyethylene, Raman Spectroscopy

The Knowledge About the Biodiversity and Biodiversity Conservation of the Society

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This research was conducted based on a questionnaire survey related to Biodiversity and Conservation to reveal the status of awareness of the terms “Biodiversity and Biodiversity Conservation” among the Sabaragamuwa University community and to acquaint them with biodiversity conservation. One hundred and twenty individuals including males and females above 20 years of age were randomly selected from the Sabaragamuwa University premises to conduct this questionnaire. They were categorized as academic staff, non-academic staff, and students. To begin the questionnaire survey, we first asked what biodiversity is and what biodiversity includes. Furthermore, we asked about the consumption of bushmeat by humans, knowledge of people on environmental protection agencies in Sri Lanka, the knowledge about the endangered animal species in Sri Lanka, knowledge of forest products, climatic change and threats to wildlife in Sri Lanka, and some suggestions were gained from the individuals to protect Biodiversity in Sri Lanka. The data obtained from this questionnaire were recorded and the results were analyzed. According to the results, 99% of the them know about the term “Biodiversity” but most people do not have a proper knowledge about what biodiversity is. Most of them were well aware of the Department of Wildlife Conservation and Central Environmental Authority as Environmental protection agencies. Sinharaja forest was observed as the most visited protected area. Elephants and Leopards are known by respondents as endangered animal species in Sri Lanka. All respondents (100%) believe that most of the threats to biodiversity occur due to human activities and 90% of them consume bushmeat knowingly contributing to such threats to biodiversity.

Keywords: Biodiversity, Biodiversity Conservation, Bushmeat, Protected Areas, Sabaragamuwa University.

Effect of Soil Erosion on Surface Water Quality in Upper Walawe River Basin

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Walawe River Basin, the fourth-largest in Sri Lanka, has emerged as a focal point for the management of water quality because of its size and population density. The catchment is highly agricultural and the land use activities in the catchment have the potential of deteriorating the surface water quality. However, very little research has been carried out to evaluate the effects of catchment land use on surface water quality in the upper Walawe basin. Therefore, this study aims to investigate the connection between soil erosion in the catchment and water quality in the Upper section of the Walawe River basin. Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) Sediment Delivery Ratio (SDR) model was used to assess the soil erosion in nine microcatchments within the upper Walawe River basin. Water quality parameters were recorded in streams draining through selected micro catchments and the association between soil erosion and water quality was analyzed using the Pearson correlation test at a 0.05 significance level. The results of the study indicated mean soil erosion of the micro-catchments ranging from 0.84 to 18.1 t ha^{-1} yr^{-1} with an annual average of 11.75 t ha^{-1} yr^{-1}, which is ∼2.35 times greater than the soil erosion tolerance (5 t ha^{-1} yr^{-1}) in Sri Lanka. Pearson correlation test was conducted to assess the relationship between soil erosion of the microcatchments and water quality variables. The results indicated a significant positive correlation between soil erosion and potassium (K) levels in the water. In conclusion, this study provides valuable insights into the complex interactions between soil erosion, and water quality in the study catchment.

Keywords: nVEST model, SDR, Soil Erosion, Upper Walawe River Basin, Water Quality

Evaluate the Impact of the Yield of Mukunuwenna, (*Alternanthera sesilis*) with Combinations of Commonly Used Fertilizers

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Farmers in Sri Lanka use a higher range of fertilizers to increase the yield of leafy vegetables and mostly, fields are located near aquatic ecosystems. Hence, a higher amount of fertilizer use can lead to major health issues, reduced yields, and ecosystem damage. Therefore, it is essential to find a better fertilizer combination and empower farmers about the detrimental effects of increased fertilizer application on the crops. The current study used 9 treatments of different fertilizer applications for the growth of *Alternanthera sesilis* in five replicates and was conducted over 10 weeks at a protective house. Three harvests were made, and on the appropriate days, fertilizer applications were made. Those were T9 - DOA Recommendation (DOAR), T1 - DOAR+ Inorganic foliar fertilizer application (IFA), T2 - DOAR + Organic foliar fertilizer application (OFA), T3 - DOAR + Urea and MOP 4% & 2% liquid, T4 - DOAR basal +IFA, T5 - DOAR basal + OFA, T6 - DOAR basal + Urea and MOP 4% & 2% liquid, T7 - Total organic fertilizer (TOF) + OFA, T8 - TOF + Organic solid fertilizer application and DOAR was Urea + TSP + MOP in appropriate amounts. According to the yield, T1, T9, T2, and T3 are significantly different from T8, T6, and T7 after 10 weeks. T1 had the highest yield, whereas T7 had the lowest. All other treatments received lower yields than T9. Results show that the ideal fertilizer treatment for increasing the yield of green vegetables is an inorganic foliar application with the DOAR combination. Results of this study further reveal that applying too much fertilizer might result in decreased production and application of organic fertilizer alone would not result in greater yields of leafy vegetables.

Keywords: *Alternanthera sesilis*, Fertilizer, Leafy Vegetables

Sports Sciences & Physical Education

- Session -

Sports Sciences

Biomechanical Aspects of the Body Segments and Center of Gravity Movements on the Pommel Horse: "Kolyvanov" Dismount in Gymnastics

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The biomechanical applications are the main procedure to refine the high difficulty elements in artistic gymnastics. Therefore, the study is desired to explain specific biomechanical aspects about gymnast's Center of Gravity (CG) movement and alignment of body segments executing the "Kolyvanov" dismount movement pattern on the Pommel Horse (PH). The national gymnasts (n=03; weight=52.23±3.04kg; height=1.64±0.05m) who have a capability to perform this element were taken for this study. During "Kolyvanov" movement pattern, the body segment angles and CG displacements were recognized by using a setup of six high-speed cameras (Miqus M3; 100Hz) with Qualysis software. The video analysing was done through the human movement analysing software (Kinovea 0.9.5). A three dimensional (3D) graph of CG displacement was designed according to the correct movement pattern of the 2022-2024 Men's Artistic Gymnastics Code of Point. The CG displacement was defined by three dynamic equations on the Cartesian coordinates system and alignment of the body segment angles during major six positions (Front support, Left arm side support, Back support, Right arm side support, Press up, Handstand) of the "Kolyvanov" were described by the supportive eighteen equations. The body height is the major variable of the equations. Based on the biomechanical evaluation, gymnasts and coaches can identify the execution errors of the "Kolyvanov" movement pattern compared with the 3D graph and predict the correct CG displacement movement pattern of the dismount according to gymnast's body height.

Keywords: Artistic Gymnastics, Technical Corrections, Video Analysis, Visible Strength

The Impact of Friction Force and Parabolic Arc Patterns on the Initial Acceleration Interacting with Block Start Obliquities: 100m Sprint

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The importance of this study was to understand the aspects of the sprint start technique of the sprinters and their maximum level of performance differs due to the starting point of the starting blocks. The objective is to design a biomechanical model that identifies the effect of starting block Foot Pendle Obliquities (FPO) on athletes' performance. Further, we determined the relationship between the Centre of Gravity Positioning (COGp) and block clearance force production (BCfp) accuracy of each athlete, that interacts with the obliquities change. Considering the athlete's BCfp at the peak performance for each obliquity, a block start force plate was designed using Load cell Type- SQB/SQB-A/-SS/-ASS, Graphical Programming Language (Python and C++), Visualize Data from Sensors Using Arduino Mega 2560 Microcontroller Board, and an HX711 Amplifier Module + Cool term Programming. The COGp of Sri Lankan national level athletes' (n=4) based on the Body Height and Segment Angles was defined. The athletes were fitted with Qualisys 3D Motion Capture Analysis Software and a High-speed video camera (240 Hz) was set up to observe the performance of initial acceleration. The data were collected and analyzed to determine the impact of friction force, and parabolic arc patterns of the athletes' initial acceleration. The relationship between BCfp and parabolic path performance showed a significant positive person correlation ($p<0.05$). At the optimum performance of initial acceleration, the corresponding range of force production was 1450N - 1600N and the effective notch foot pedal angle was 3, 2 (50^0, 60^0) to 4, 2 (40^0, 60^0). The accurate parabolic arc path of COGp is also observed. Therefore, the biomechanical model may be applied to predict the performance of each short sprinter. Athletes' technical modifications for FPO, body segment positioning, and COGp's parabolic arc will also be helpful to observe during the early acceleration phase.

Keywords: Biomechanical Model, Block Clearance, Force Production, 3D Movement Analysis

The Optimum Range of Motion of Elbow to Strengthen the Rotator Cuff Muscles from Pronated Grip Pull-Ups

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The most of rotator cuff (RC) muscle injuries occurr due to the lack of strength in the RC muscles. The pull-up is one of the exercises that can be used to strengthen the RC. Thus, the study provides a specific range from the pronated grip pull-up that in RC muscles strengthening. The baseball players (n=4) who mostly engage with overhead movement and completed up to ten repetitions of pull-ups were used in this study. The wireless electrodes with Delsys Trigno electromyography (EMG) sensors were used to conduct the surface EMG test and 2D video recording (sagittal plane) were conducted simultaneously as data gathering methods. The videos were analysed using the human movement analysis software (Kinovea 0.9.5) and the Lab Chart Reader software 8.1.22 was utilized for the EMG signal analysis. According to the results of the EMG test for the infraspinatus muscle (one of the RC muscles), the elbow angle from 94^0 to 135^0 at the eccentric phase has shown the activation. Therefore, it is recommended to adapt the elbow angle from 94^0 to 135^0 while performing pronated grip pull-ups in order to strengthen the RC muscles of baseball players. Although, the conclusion of this study is disputable since the sample is not generalizable. Thereby, more researches are required to identify all the RC muscles activation in pull-ups motion with players of other sports.

Keywords: Chin-Up, Infraspinatus, Rotator Cuff Tears, Exercise Biomechanics

Relationship Between Disordered Eating, Menstrual Dysfunction and Musculoskeletal Injury Among Selected National Athletes in Sri Lanka

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The female athlete triad is a well-known syndrome that has an impact on two interconnected conditions such as Eating Disorder (ED) and Menstrual Dysfunction (MD). Females have particular reasons to sustain injury situations. Musculoskeletal injuries are defined as any injury to the bones, muscles, ligaments, nerves, or tendons that causes discomfort. The main purpose of this study was to find the relationship between eating disorders, menstrual dysfunction, and musculoskeletal injury among selected female national athletes in Sri Lanka. The study was conducted as a retrospective cohort study. One hundred female athletes who represent the national level in selected sports between the ages of 20-30 were selected as a sample from a random sampling method. The sample consisted of Basketball (14), Cricket (28), Football (22), Hockey (22), and Netball (14) playing females excluding mothers and pregnant women. Data were collected through Eating Disorder Examination Questionnaire (EDE-Q) which includes information regarding ED and MD and Modified Standard Musculoskeletal Injury Questionnaire. Spearman correlation test, ANOVA, and Tukey pairwise comparison test was used to analyze data using Minitab 19 software. The average ED, MD, and MI of athletes were 12.9, 20%, and 1.3 respectively. There was no relationship between ED and MD ($r = -0.022$, $p > 0.05$); ED and MI ($r = 0.122$, $p > 0.05$) and MI and MD ($r = 0.079$, $p > 0.05$). ED and MI were not significantly different among athletes engaged in different sports categories ($p > 0.05$). Furthermore, MD was also not significantly different among athletes engaged in different categories of sports ($p > 0.05$). In conclusion, there is no relationship between eating disorders, menstrual dysfunction, and musculoskeletal injury among female athletes.

Keywords: Eating Disorder, Female Athletes, Menstrual Dysfunction, Musculoskeletal Injury

Designing a Biomechanical Model to Improve the Reverse Punch Technique in Karate

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Reverse punch (RP) is the most common punch used in karate contests, aiming to hit the target at a medium range in a short amount of time while delivering maximum power. The aim of this study was to design a biomechanical model that describes the most effective RP. The model is intended to provide a quantitative assessment of how the kinematics, kinetics, and performance-related variables of the kumite event affect the performances. RP was analysed with and errors were identified. Movements were captured using high speed camera setup (240Hz), data were analysed aid of human movement analysing software (Qualisys). The performance of an athlete can be determined or anticipated by comparing the previous and current errors. The optimal performances were examined after engaging in the projected plan, based on the two factors of punch velocity and area between lower limbs. Player A (height=1.68 m) has a punch velocity of 1.7 ms^{-1} and an area of 2959.7 cm^2, while player B (height=1.65 m) has a lower punch velocity but a larger area for RP. Further analysis and other factors such as technique, form, and body mechanics would be necessary to determine the effectiveness and overall power of each athlete's RP. A biomechanical model was developed in this work using 3D motion analysis and motion equation formation for punching speed and time calculations. The results showed that the area and velocity of the punch increased over time, reaching a peak before declining. The outcomes partially satisfy the target level, but they may still be enhanced by using a superior technological strategy. In addition, this biomechanical model can be utilized to enhance performance and reduce posture mistakes when engaging in karate punching.

Keywords: Biomechanical Model, Karate, Kinematics, Reverse Punch, Speed

The Relationship Between Selected Body Composition and Maximum Strength of Elite Sri Lankan Women Weightlifters

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Maximum strength and body composition appear to be major factors influencing the performance of a variety of sports. Especially, the sport of weightlifting requires maximum strength and body composition in which two technique movements and whole-body lifts are performed in the competition. Therefore, the purpose of this study was to determine the relationship between selected body composition and the maximum strength of elite Sri Lankan women weightlifters. The cross-sectional study used a purposive sampling method and was carried out using Pearson's correlation (r). A total number of twenty-eight (n=28) Sri Lankan women elite weightlifters participated as the study sample. The "TANITA RD953 body composition monitor" was used to measure selected body composition (BMI, muscle mass, body fat, total body water), and one repetition maximum (1RM) of three tests (Bench press, deadlift, squat) was applied to measure the maximum strength. The correlation between the maximum strength and body composition was statistically significant ($P < 0.05$). The results indicated that lower body maximum strength has shown a positive correlation with BMI ($p = 0.006, r = 0.504$), body fat ($p = 0.100, r = 0.318$), and muscle mass ($p = 0.078, r = 0.339$). The upper body maximum strength has shown a positive correlation with BMI ($p = 0.000, r = 0.629$), body fat ($p = 0.210, r = 0.244$), and muscle mass ($p = 0.001$, $r = 0.527$) but interestingly both upper and lower body maximum strength was negatively correlated with total body water respectively ($p = 0.234, r = -.233$) and ($p = 0.023, r = -.427$). From a general perspective, these results revealed that body composition variables positively correlated with maximum strength but total body water was negatively correlated with maximum strength.

Keywords: Body Composition, Correlation, Elite Women Weightlifters, Maximum Strength, Weightlifting

- Session -

Physical Education

How Does Teaching Games For Understanding Induce Student Skill Acquisition

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Teaching games for understanding (TGfU) is a model that allows students to learn about the game and practice skills and techniques within the context of a game rather than apart from it. This study aims to determine the impact of TGfU induce students' skill acquisition. The random sampling method was used for the present true experimental research design to select forty (n=40) school students (Age: 13±1 years), and they were randomly divided into two groups (treatment: 20 and control:20). The intervention program was applied to the experimental group twice per week and, 40 min per session during eight weeks, while the control group followed their normal teaching procedures. Test of Secondary Basic Sport Skills test was applied before (pre-test) and after (post-test) intervention for both the groups. From the collected data, standard descriptive statistics was used to characterize the study population, while the results were analyzed by Mixed ANOVA with Bonferroni post hoc analysis were used to analyze the interaction, main effects, and significant mean differences. The main results show significant time group interaction on all measured variables. While comparing both the training groups, a significant group main effect was shown on all measured variables except Layup, Tennis serve, and Volleyball serve. The main time effect shows all measured variables were significant but through pairwise comparison Throwing and Receiving in the control group were non-significant. Finally, these data revealed that both the teaching methods are effective at improving students' skills, but the TGfU program is significantly better than the other teaching method and provides sufficient opportunities for the development of fitness and movement skills related to the control of body rhythm, movement aesthetics, sequencing, creativity, composition, and stability.

Keywords: Motor Learning, Skill Acquisition, Teaching Games, Tactical Perspective

Motivations for E-Sport Consumption in Sri Lanka

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The popularity of E-Sports competitions has grown significantly over the past ten years, with top-level tournaments drawing crowds that are comparable to those at traditional sporting events. The purpose of this study was to determine the factors that motivate people to consume E-Sports in Sri Lanka and how the demographics and franchises influence the frequency of E-Sport consumption. Under quantitative research, an empirical analytical scientific approach has been used to conduct this study. By using the opportunity sampling technique 450 spectators from nie provinces in Sri Lanka who were familiar with the E-Sports participated in this study. All participants completed an online questionnaire which consisted of 45 questions based on Rockel's (2020) League of Legends and modified according to the Sri Lankan context. Entertainment, knowledge, social interaction, arousal and skill were considered as E-Sport motives and E-Sports consumption was measured according to the time they have been engaged. SPSS software and MS Office package were used to evaluate data. The study has provided evidence of a positive relationship between E-Sport motive and E-sport consumption ($r = 0.264$, $p < 0.05$). Furthermore, the demographic factors such as, province, gender and level of education had a significant association with E-Sport consumption ($p<0.05$) and age was not significant with E-Sport consumption ($p > 0.05$). The most used franchises in Sri Lanka to consume E-Sports were Facebook gaming, YouTube, Twitch, and ESPN accordingly. This study expands our understanding of how motivation affects E-Sports, which can help the Sri Lankan community to better understand the value of E-Sports.

Keywords: Consumer Behaviour, E-Sport Consumption, E-Sport Franchisers, Motives

Women Participation in Adventure Sports as Tour Guides at Knuckles Range of Sri Lanka

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Tourism has been identified as one of the fastest-growing economic sectors in the world. This industry is multidisciplinary and therefore involves different stakeholders for its activities. Among them, tourist guides play a major role in the tourism industry. However, this sector has less female participation as tour guides. Therefore, the prime aim of this study was to determine the existing barriers to women's participation in adventure sports as tour guides. The study was conducted under the qualitative approach from the postmodernist research philosophy. Based on the above factors a case study was used to continue this study. Before the main data collection, a pilot test was conducted to create a benchmark. Primary data was gathered through discussions, and direct observations. Framing research design in narrative analysis has been used to finalize the data. Data were collected from five female tour operators who are trekking guides in the knuckles zone. Snowball method was used as sampling technique and data were collected through discussion. Considering the pattern of the data, thematic analysis was used do analyzed the data. The major findings of the study were identified under three themes such as barriers, opportunities, and suggestions for future enrichment. Major barriers were cultural based society, lack of job reputation, narrow mindedness, unethical behavior of local tourists, and lack of knowledge. Reasonable income, and work-life balance were opportunities for female tour guide operators. Moreover implementing and amending rules and regulations for safety of women tour guide were identified as suggestions for the future enrichment of female tour guides. Further postmodern approach highlight the role of conflict in social life for female tour operators and it should be important underlying for consideration in future enrichment of female tour guides. Therefore, this study has more opportunities, huge demand with a broad range of female tour guides in Sri Lanka. Tourism industry can be introduced as one of the best occupations for women.

Keywords: Female Trekking Guide, Sports Tourism, Tour Operating

Impact of Coach Education for School Coaches on Long Term Athlete Development Principles - A Mixed Method Study

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Coach education programs (CEP) throughout the world have lately been constructed around long-term athlete development (LTAD), a six-stage paradigm centered on children and adolescents' physical, mental, emotional, and cognitive development. The LTAD model is extremely important for coaches working with children. However, empirical research on LTAD coach education for school sports coaches has not yet been conducted. The purpose of this study was to evaluate the impact of the CEP on school sports coaches' knowledge of LTAD and assess whether they applied it to their coaching practice. An explanatory sequential mixed-method design was used. With institutional ethical approval, thirty (n = 30) school sports coaches were recruited through the purposive sampling method. A one-day CEP was conducted for coaches. After completing the CEP, they were handed the coach assessment survey questionnaire. Based on the quantitative results, twelve school sports coaches participated in a semi-structured interview after six weeks to obtain qualitative data at the end of the survey questionnaire. Coach evaluation survey results show that all 13 categories (perceived benefits, perceived future benefits, enjoyment, and future goals) received very high ratings (4.86 to 5.00/5). Four primary themes emerged from the interview data: "learned knowledge", "helpfulness", "confidence", and "sports performance". The study results and findings indicated that the CEP for coaches is highly effective and coaches developed knowledge through rich learning situations relevant to their coaching context. The study can be concluded that the CEP for coaches is highly effective and it will be helped to improve their coaching practice. The study may contribute to the development of future CEP and make practical recommendations to assist other coaches in critically evaluating and exploring the use of contemporary best practices in their practices.

Keywords:Coach Education, Coaches, Coaching Practice, LTAD

Development and Validation of a Physical Literacy Knowledge Questionnaire for Physical Education Teachers

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Physical literacy (PL) provides kids with the movement skills they need to engage in physical exercise for the rest of their lives. Internationally, there is no psychometrically validated questionnaire to measure the PL knowledge level of the teachers and coaches working with children. Therefore, the aim of this thesis was to design a physical literacy knowledge questionnaire that satisfied acceptable psychometric criteria of validity and reliability. With ethics committee approval, 336 participants from three groups (Physical Education (PE) teachers, n = 170; university academic staff, n = 6; and undergraduate PE students, n = 160) were recruited for this study using convenient sampling. The reliability and validity of the questionnaire were tested with Cronbach's alpha using the Statistical Package for the Social Sciences (SPSS) software version 23. The Physical Literacy Knowledge Questionnaire is a 3-point Likert-scale survey consisting of 40 items. The Cronbach's alpha test conducted shows that the university academic staff scored 0.746 (moderate level), PE teachers scored 0.611 (moderate level), and undergraduate PE students scored 0.773 (high degree of correlation) for the items in the instruments. The findings of this study indicate that the questionnaire was suitably valid and reliable to determine the physical literacy knowledge of Sri Lankan physical education teachers.

Keywords: Physical Literacy, Knowledge, Physical Education Teachers

Factors Influencing on Performances of Sri Lankan Players in Commonwealth Games 2022 Birmingham, England

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Among the Sri Lankan team (110 athletes) participated in the 2022 Commonwealth Games (CWG) Birmingham, only four athletes won medals. The purpose of this study is to identify effective factors on performance of Sri Lankan athletes in the CWG and to compare the factors affecting those who have won the CWG medals and those who did not win medals. The population was selected from those who engaged with the Sri Lankan team practices for 2022 commonwealth games. The athletes (n1=10) and national coaches (n2=10) were selected as a sample from the population through the purposive sampling method. The data were collected from one-to-one direct interviews and the collected data were analysed by thematic analysis. Training and preparation, coaching and guiding, facilities, and external environmental factors are the main effective themes in the performances. Base on the analysed results foundation of an athlete's career, training plan, performance analysis, and nutritional consultation were the effective sub themes to the training and preparation. Coaches' education level, the relationship between coach and athlete, and coaching experience were the influencing factors to coaching and guiding. Standard playing areas and equipment, and high performance centres were the related elements to the facilities. Social and cultural aspects, environmental changes and the economical barriers were the interrelated external environmental factors. In congruence with interview and literature studies, lack of childhood sports foundation, non-relevant talent identification, undefined training plan, irregular performances analysis, obstructed nutritional plan, lack of standard playing area, high cost of standard equipment, impoverished high performance centres and most certainly not havnig environmental chambers, lack of support from the government, education institutions and spectators, cultural myths, gender discrimination, economic inflation, COVID-19 pandemic, and high altitude environment have negatively affected to the athlete performances. These factors have contributed less to medal winners.

Keywords: Commonwealth Games 2022, Effective Factors, Performances, Sri Lankan Athletes

Personality Attributes of Athletes and Non- Athletes in Sabaragamuwa University of Sri Lanka

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Personality is the distinctive patterns of actions, thoughts, and feelings that are shaped by biological and environmental causes and alter through time. The purpose of this study was to compare the personality traits of athletes and non-athletes in Sabaragamuwa University of Sri Lanka along with one specific objective to compare the personality traits among faculties. Under quantitative research design, a cross sectional study was conducted by selecting 203 undergraduates using a multi-stage sampling technique. According to the baseline survey there were 128 athletes (63%) and 75 non-athletes (37%). Data were collected through standard questionnaire under The Big Five Personality Test. Data were analysed by using descriptive statistics and MANOVA test. Results revealed that athletes tend to score higher in extraversion (23.60±6.05), conscientiousness (18.64±8.09), and emotional stability (20.62±5.62) while non-athletes tend to score higher in openness (19.86±6.09) and agreeableness (13.78±6.72). Further, there was a significant difference between athletes and non- athletes' personality traits such as extroversion, conscientiousness, neuroticism, and openness ($p < 0.05$). However, the difference of agreeableness personality trait was not significant between athletes and non-athletes ($p > 0.05$). The mean values for personality traits of the Faculty of Applied Sciences have shown the highest average at 3.7 and the Faculty of Graduate Studies having the lowest average of 2.73. Additionally, athletes have been found to have a greater drive for achievement, higher levels of confidence and competitiveness, and better stress management skills. In conclusion, it was confirmed that the sportsmen were far ahead in the personality traits of extroversion, neuroticism, conscientiousness, and openness. That is, the development of these characteristics of a person has been strongly and positively affected by playing sports.

Keywords: Athletes, Non- Athletes, Personality, Personality Traits

Impact of Psychological Intervention Actions on Gender in Decision Making

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Karate as a complex and demanding combat sport, represents an intense cognitive process underlying decision-making behavior during the performance. It's based on psychological actions, and it's a complex dynamic process for everyone. Any individual players are put up with various choices of alternative actions and help to take corrective action during the bout, it's called as Decisions-Making. Hence, males and females have different ways to deal with decisions during combat. After a long observation on a karate match, it can be observed that most of the karateka did not take the correct decisions during the match. According to that, this study was to identify the impact of psychological intervention actions on gender in decisions making of young karateka at the Sabaragamuwa University of Sri Lanka. The purposive sample method was used, under the quasi-experimental research design to select thirty Karateka ($n = 30$), with five to ten years of training experience, and they were divided into gender groups (Male:15 and female:15). A pretest was conducted giving the standard Questionnaire and observed karate fights by outstanding. Psychological intervention actions were applied to all subjects in eight weeks. While personal examination, goal setting, tactical thinking, operational thinking, performance task, study conditions of the contrary, etc., were applied during the eight weeks. After being post-assessed through the standard questionnaire. Descriptive statistics and ANCOVA were used to analyze the data using SPSS 21. The results indicate that all measured variables (thoroughness, control, hesitancy, social resistance, optimizing, principles, instinctiveness,) have significant differences between male and female decision-making skills $p<0.05$ (.000, .000, .000, .000, .008, .002, .000). Furthermore, results show that mean difference of the male was higher than females. Finally, observing the practical performance revealed that the psychological intervention actions of the females are not sufficiently better than the males in terms of decision-making behavior to improve karate performance during combat.

Keywords: Decisions Making, Intervention Actions, Sports Performance, Sport Psychology

Evaluation of Sports Nutrition Knowledge in Elite Level Sri Lankan Athletes

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Nutrition is a factor in sports performance, injury prevention, and maintaining the health status of athletes. Nutritional knowledge (NK) has the potential to affect eating patterns and improve an athlete's performance. Despite the importance of NK, the level of sports nutrition knowledge (SNK) of Sri Lankan elite-level athletes has not been evaluated. Therefore, this study aimed to evaluate the current level of SNK among Sri Lankan elite-level athletes. This study was conducted quantitatively, and a cross-sectional questionnaire was used to evaluate the SNK. A total of one hundred and fifty (n = 150) elite-level athletes were recruited for a survey using a stratified, purposive sampling method. The study participants were from nine different sports, including track and field (n = 30), netball (n = 10), volleyball (n = 20), karate (n = 20), weightlifting (n = 16), taekwondo (n = 14), football (n = 20), table tennis (n = 10), and badminton (n = 10). The collected data were analyzed by descriptive statistics, means and one-sample t-test. Athletes with an overall score of at least 46 out of 60 for the questionnaire that indicate they have higher knowledge about sports nutrition. In this study, the mean score on the SNK test was 34.76±2.47. According to this study, NK scores indicated that the differences between the means of the different sports were statistically significant ($p<0.05$). These results suggested that inadequate SNK among elite-level Sri Lankan athletes varied according to their sport. Athletes should have a good understanding of nutrition in order to maintain the necessary levels of health, body composition, and sports performance. Moreover, coaches also must have adequate knowledge of sports nutrition to guide athletes. Future research should concentrate on evaluating the impact of nutrition education interventions for athletes and coaches.

Keywords: Elite Athletes, Nutrition, Nutrition Knowledge

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