APSURS 2022

Applied Sciences Undergraduate Research Symposium

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Organized by the Faculty of Applied Sciences of the Sabaragamuwa University of Sri Lanka
6th April, 2022

APSURS 2022 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 a great pleasure for me to pen this message for the Undergraduate Research Symposium (APSURS 2022) of the Faculty of Applied Sciences, capturing the theme of "Nurturing Next Generation Leaders of Innovation". As one of the eminent faculties of applied sciences in the Sri Lankan university system, the contribution of the faculty towards the generation of knowledge anticipating the challenges of the nation and beyond through new research findings would be inevitable. I believe that this initiative will contribute immensely to enhance the research capacity of students thereby enriching the research culture in the faculty and in the University as well.

I am proud of witnessing the remarkable improvement in the quantity and quality as well as the relevance of research conducted by our students. In this context, this conference will provide our students with an important platform to share their knowledge in the fields of science and technology with the rest of the world. This will be an opportunity for our students to publish their research findings presented at APSURS 2022.

I wish to thank the Dean, Heads of Departments, Chairperson, Secretary, Members of the Organizing Committee, members of the academic administrative and nonacademic staff of the Faculty of Applied Sciences, and those who have contributed immensely on behalf of the faculty to make this event a success. I hope to see more of this kind of constant academic exercise of students and staff in the faculty.

I wish you success in making all your research findings a reality in the future.

Prof. R.M.U.S.K. Rathnayaka
Vice Chancellor
Sabaragamuwa University of Sri Lanka

Message from the Dean

The Faculty of Applied Sciences produces resourceful life-long learners, with the required knowledge and skills in their respective disciplines, especially with grown mindsets to serve in academia, industry and the society at large. Applied Sciences Undergraduate Research Symposium, APSURS 2022, with the theme of "Nurturing the Next Generation Leaders of Innovation" is the climax of their undergraduateship showcasing their independent research inventions and innovations.

This inaugural undergraduate symposium of the Faculty of Applied Sciences platforms over 80 abstracts, selected through a rigorous review process by our expert scientific committee and reviewers, featuring both oral and poster presentations. The symposium presents diverse undergraduate research from five departments of study of the faculty, integrated in to three disciplines, delivering interesting discoveries in their own fields. The symposium committee has taken all the measures to deliver the best experience for our young scientists incorporating all the essential features of an eminent scientific conference.

As the dean of the faculty it is my great pleasure to see the enthusiasm of both the undergraduates and the academic staff of the faculty in working towards achieving the utmost success of this first symposium. It is also significant to hold this symposium as the inaugural event of the new building complex of the faculty which comprises of several dedicated laboratories to facilitate more advanced and innovative research in the future. I extend my profound gratitude to the undergraduates who submitted their research to this symposium, their supervisors who guided them, all the amazing members of APSURS 2022 organizing committee lead by the symposium chair for their remarkable contribution, faculty staff for their generous support, the Vice Chancellor and the university for allocating the funds and providing all the required facilities, other financial sponsors for their kind assistance, and all the well-wishers for their encouragement.

I hope this inaugural undergraduate symposium APSURS 2022 will achieve its goals of providing young scientists of the Faculty of Applied Sciences to enhance their research skills, share their findings with the research community and initiating collaborations. At the same time, I hope this scientific forum will prosper as it moves forward serving its purposes to gain international visibility and reputation in the years to come.

Dr. Rasangi Sabaragamuwa
Dean - Faculty of Applied Sciences
Sabaragamuwa University of Sri Lanka

Message from the Conference Chair

It is with great pleasure that I convey this massage on behalf of the organizing committee of the Applied Sciences Undergraduate Research Symposium (APSURS 2022). APSURS 2022 is a preeminent venue for presenting, discussing and exchanging contemporary knowledge from national and international research findings on various fields of Natural Science, Computer Science and Sport Science and Physical Education. Further, this would be a great platform to build collaborations and strengthen the partnerships among the professionals across the global.

As a start, APSURS 2022 is delighted to see over eighty undergraduates presenting the research findings of their final year research to share their significant findings to a multidisciplinary audience and the conference is enriched by the contribution of two renowned scientists to deliver the keynote speeches (**Prof. Chihaya Adachi**, Department of Applied Chemistry, OPERA, Kyushu University , Japan and **Prof. Devaka K Weerakoon**, Department of Zoology and Environment Sciences. University of Colombo) and three Plenary session speakers (**Mr. Pubudu Liyanage**, Human Resources Management Consultant, Zone24X7, **Dr. Lakshitha Pahalagedara**, Head of Business Development, Sri Lanka Institute of Nanotechnology, and **Prof. M. Elayaraja**, Department of Physical Education & Sports, Pondicherry University, India).

As the chairperman of the organizing committee, I would like to extend my sincere gratitude to Senior Professor Udaya Rathnayaka, the Vice Chancellor of the Sabaragamuwa University of Sri Lanka and Dr. R.S. Sabaragamuwa, Dean, Faculty of Applied Science for their excellent guidance to make APSURS 2022 a success. I express my sincere gratitude to the keynote speakers and plenary speakers for their precious contribution. Furthermore, the support extended by the Heads of the Departments, the editorial board and the rest of organizing committee are also duly acknowledged for all their hard work, sense of responsibility and team work.

Finally, I would like to extend my sincere wishes to all the authors and presenters for their enthusiasm and willingness shown in sharing the contemporary knowledge on their research findings at APSURS 2022.

Prof. R.M.K.T. Rathnayaka
Conference Chair APSURS 2022
Faculty of Applied Sciences
Sabaragamuwa University of Sri Lanka

Keynote Address by Professor Chihaya Adachi

OLEDs and Future Prospect of Organic Optoelectronics

Through the extensive R&D of organic light-emitting diodes (OLEDs) for more than 30 years, plenty of well-elaborated novel organic optoelectronic materials and device architectures have been extensively developed, resulted in the unique commercial utilization of OLEDs for cutting-edge smartphones, large-area TVs, and further new future display applications by taking advantage of light-weight and flexibility. From the aspect of materials science, the creation of novel light-emitting materials in OLEDs has been the central issue aimed for high electroluminescence quantum efficiency (EQE).

Starting from the development of conventional fluorescence materials (**1st generation**) during 1990-2000th, the room-temperature phosphorescence (2000-) (**2nd generation**) and thermally activated delayed fluorescence (TADF) (2012-) (**3rd generation**) continuously pioneered the novel possibilities of organic emitters, resulted in not only high-performance OLEDs but also enriched organic photochemistry. In recent days, there have been a wide variety of studies on TADF-OLEDs because of the unlimited possibilities of TADF molecular design. Further, hyperfluorescence (HP)-OLEDs have been developed since they can realize the compatibility of high efficiency and narrow spectral width, which is ideal for practical display applications. Here we report our recent cutting-edge HP-OLEDs demonstrating high OLED performance by optimizing host, TADF, and terminal emitter (TE) molecules1-3). In particular, we focus on the blue-emission, which is capable of showing narrow FWHM and high EL quantum yield. Blue HP-OLEDs based on two new TEs are fabricated, resulting in high external quantum efficiency (EQE) of over 20%, high color purity, and high brightness. In this talk, we report a designing principle for a TADF and TE in HP-OLEDs focusing on efficient FRET and no significant carrier trapping. Future, we would like to talk about the future prospect of organic optoelectronics based on the charge-transfer effect.

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Keywords: OLED, TADF, Hyperfluorescence, CT

Prof. Chihaya Adachi

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Keynote Address by Professor Devaka K. Weerakoon

How to Become an Accomplished Scientist

Young researchers aspiring to become successful scientists must tread a rather arduous path as the road to success can be full of challenges that include generating research ideas, securing a grant to fund the project, spending time to collect data, and publishing the findings in reputed journals. At each of these stages, one may have to encounter failure, rejection, all of which may result in disappointment and sometimes deviation from one's chosen career goals. However, young scientists must realize that they are not alone, and all successful scientists have also gone through similar hardships during the early stages of their careers. Therefore, the aim of this presentation is to share with you some of the trials and tribulations that I had to go through during my journey with the aim to encourage you to stay the course irrespective of all the hardships you may have to endure during the journey ahead.

I know that all of you are eager to become successful in life and are wondering what the secret to success is. However, the first piece of advice I like to give you is that aiming for success is the wrong goal, Instead, you should strive for a way to be of value and enjoy what you are doing, and success will follow. If you truly love what you do, you will be successful because it is very difficult to perform poorly at something you enjoy. Therefore, the first question you must ask yourself is are you truly passionate about your chosen career path? If the answer is no, perhaps you should explore a different career path where such enjoyment can be found. Unlike in the past, there are so many options available for a young scientist today. But at the same time, I must point out that young scientists will have to operate within a hypercompetitive milieu. Yet you should not be afraid to transition between careers or disciplines, for if you follow your heart, you will eventually find what makes you happy. I started off as a fish ethologist, then I switched to Biochemistry, Immunology and eventually settled for Conservation Biology which took me on an incredible journey of discovery across the world. Remember that accomplished scientists enjoy what they are doing, and their happiness is the key to their successful and long-lasting careers. So, for me, the most important thing is to love what I do because life is too short to spend time on things that I don't enjoy.

You must also never stop looking for opportunities. Louis Pasteur, once said that chance favors the prepared mind. Years of training, dedication, and even failure are necessary to prepare the mind. The key to preparing your mind is to be aware, you must read as much as possible and attend presentations given by various experts that will give you a broader understanding of the current state of your discipline. After all, the objective of

research is to generate new knowledge. To generate new knowledge, you must know what is not known. After nearly 30 years of formal education and another 25 years of self-learning, I learned that I really don't know many things. That is why I am passionate about seeking new knowledge to improve myself because learning is a lifelong process and what makes you a scientist is your insatiable desire to know new things.

Another important attribute one must develop early in career is the ability to communicate. We are in the business of selling ideas and the most important skill we must develop is the ability to communicate the importance of our work both orally as well as in writing. Therefore, you must strive to develop these communication skills which will make the difference between being a scientist and an accomplished scientist as the world will only know of your accomplishments based on what you share with the world about your work. Make use of all opportunities to present your work either as presentations or publications. Also, make use of the currently available online platforms such as research gate, Google Scholar, etc., to widely publicize the work you do. One of the criteria that will be used to measure your work is how it is being accepted by your peers, which will be measured by the number of times your work is cited by others.

It is also important to get to know other like-minded people. As the adage goes "It's not always what you know, but sometimes it's who you know". Gone are the when one works in an individual silo. In the modern world, people are encouraged to do interdisciplinary research. Networking will help you to learn from others as well as others to learn from you. Further, it will open pathways for collaboration which can facilitate your work. Research conferences such as this provide an opportunity for you to meet others like you as well as formulate new research ideas, get useful feedback on the work you do as well as find potential collaborators. Therefore, the main part of being a scientist is to attend many conferences as possible which will provide many opportunities to further your career.

What you must also remember is that path to success is paved with failure. There is nothing wrong with failure as you are likely to learn more from your failures rather than your successes. You must learn to convert your failures into opportunities rather than view them as problems or reasons for disappointments. Remember that failure helps us to better identify our abilities and weaknesses, makes us stronger, inspires us, and builds courage. Don't ever give up on your dreams because with perseverance they will become a reality.

To build a career in science, one must spend countless hours of hard work. However, working too hard can be counterproductive as the old adage goes "all work and no play makes Jack a dull boy". Therefore, it is important to set aside some time for yourself to rejuvenate. It is critical to balance hard work with other activities to help the mind and body de-stress. Find activities that can recharge you emotionally, mentally, and physically, such as traveling, exercising, exploring, spending time with family and

friends. I am 59 years old and am planning to make a hike to Everest base camp five days from today. I do not know whether I will make it, but I am determined to do so. It is that kind of determination that got me where I am today.

In conclusion, there is no simple formula that will lead you to a path of excellence. There are many different paths to success; you just have to find your own that you are passionate about and keeps you motivated and excited about your career. Therefore, you must carefully examine your own interests and choose the career that works best for you. A young scientist must always remember that, although the end is important, the journey must be fun. So enjoy the journey to becoming a successful scientist because you are in the exciting process of discovery! I hope all of you will find what drives you and what makes you happy sooner than later so you can find your own path to success. I wish you all the very best in your future endeavors.

Prof. Devaka K. Weerakoon
Department of Zoology and Environment Sciences
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Computer Science

Plenary Speech by Mr. Pubudu Liyanage

Relevance of Research & Innovation to a Student and a Future Professional

Students need to be encouraged to take part in research due to different reasons. Research and innovation go hand in hand. Both compliments each other. Research helps in deepening the knowledge of the people and build analytical abilities and creativity. The research mindset helps professionals in every aspect. Research is an efficient learning and knowledge building tool. It plays an important part in business solution success. Research mindset helps you to create and innovate new solutions in the field of computer science/software engineering. It helps find, gauge, and seize new opportunities - through the process of research you can find many opportunities by finding your true potential. It helps us succeed in business world. Research mindset in a professional work setup will act as a tool to build knowledge and facilitate learning. It expands your knowledge base and keep you up to date. It helps you build your credibility and also narrow your scope as well – by helping you to get the exact picture of your problem. Research encourages curiosity, build better networks and give you new ideas and problem-solving ability. Innovation actively pursues you to take initiatives and solutions. You need to challenge the status quo and work in a culture of innovation. Innovation at workplace is an element of culture. Innovation at workplace is creating more effective processes, products, and ideas. If you are in a business organization, it could mean implementing new ideas, improving services or creating dynamic products. It can act as a catalyst that can make your business grow and can help you adapt in the marketplace. Innovation is critical to business today. Innovation helps your workplace to maximize the ROI, effectively achieve business goals, increase productivity and increase profitability, effectively respond to unforeseen events, capitalizing on the global entrepreneurship movement and most importantly catch up with advances in technology. You can be in a situation where your contribution helps the business to effectively respond to industry disrupters.

Keywords: Innovation, Research, Business

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Cloud Computing & Software Engineering

Analyzing and Optimizing the Performance of Big Data Platform: A Case Study Based on Apache Hadoop MapReduce Framework

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Map-reduce is among the most effective and efficient methods to handle many data sets. Different methods and techniques have been presented to map-reduce processes. Large-scale data processing and analysis can be performed using Apache Hadoop distributed framework on commodity equipment. Parameters can be tweaked in Hadoop, and they have a significant impact on the performance of MapReduce applications. Hadoop set-up parameter adjustment is an excellent way to boost the performance. New research areas have emerged based on the Hadoop map-reduce framework. Performance optimization is mainly based on different concurrent containers and a suitable Hadoop Distributed File System (HDFS). When considering concurrent containers, it is based on CPU performance, network parameters, and memory utilization. All those factors impact the performance of Hadoop map-reduce framework. In this study, we consider the above factors in optimizing the performance of the Apache Hadoop MapReduce framework. In this study, we optimize container performance and Hadoop HDFS block. The primary outcome of this project is to introduce the best system architecture and suitable Hadoop HDFS block size. This performance tuning is the most advantageous process in Apache Hadoop. In this experiment, we analyzed the default Hadoop map-reduce process performance. After the performance optimization in the Hadoop framework, this system implementation significantly improves the Bigdata Map reducing process. According to the experiment, HDFS block size depends on the Hadoop MapReduce performance. If the dataset grows larger, the HDFS block size must be increased to improve performance. Also, the concurrent container performance may highly affect the performance of the process. Also, concurrent container memory size is more effective rather than the CPU count. All of these factors were determined after multiple trials to yield accurate results. All of these factors have a significant impact on the performance of Hadoop MapReduce.

Keywords: Apache Hadoop, Concurrent Container, Hadoop Distributed File System, Map-Reduce

Multi-Objective Optimization of Fog-based Remote Healthcare Monitoring System for Covid-19 Patients

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With the advent of technology, the healthcare industry has grown increasingly technologically interconnected. Modern technology can rapidly and accurately process millions of health records of patients compared to the traditional systems. With the advancement of the Internet of Things related to the healthcare sector, it has become possible to gather patients' data from multiple geographical locations. To manage those data, cloud computing-based data management solutions have been introduced. However, such solutions face various challenges due to aspects such as latency, energy consumption, large data volumes, context-awareness, etc. As a result, the probability of processing and transmission errors has increased. To overcome those challenges, Fog Computing was introduced as an alternative to lessen the complexity of health data management. Even though the fog-based healthcare systems address many problems associated with cloud-based systems, the Quality of Service enhancement of fog computing remains a challenge. This study presents an effective architecture for a fog-based remote healthcare monitoring system for COVID-19 patients. The proposed architecture consists of 3 main layers; sensor layer, fog layer, and cloud layer and it has a visualization and alarm sub-layer which consists of a web application and an alarm system. The proposed system was evaluated using the iFogSim toolkit in terms of latency and energy consumption. The results were compared with those of a cloud-based system and it was discovered that the proposed system outperforms the cloud-based system.

Keywords: Fog Computing, QoS, Healthcare, Fog-Based Healthcare

Predictive Autoscaling for Containerized Microservices in Cloud Infrastructure

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Autoscaling ensures that cloud-based applications always have the right amount of resources to control the current traffic demand. Different types of autoscaling methodologies have been used for cloud-hosted containerized applications to dynamically scale up and down the allocated resources with the existing workload for guaranteeing application performance to the user. The Horizontal Pod Autoscaling methodology automatically scales the number of pods in a deployment, replication set, replica controller, or a stateful set based on observed processor utilization at the pod level and this method is commonly used by orchestration platforms. Mostly the public-facing cloud-hosted applications serve dynamic workloads and it is a huge challenge for autoscaling mechanisms to ensure application performance. Existing state-of-the-art autoscaling methodologies are not aware of the determination and provision of the relevant resources to application services. For dynamic workloads, it is a challenge to detect and manage application traffic for maintaining application performance. In this study, we proposed a novel predictive autoscaling methodology that detects bursts in dynamic workloads using a model and forecasts the next workload while minimizing the response time. The proposed methodology implementation containerized microservices orchestrate using Amazon Elastic Kubernetes Service and monitors the application using Prometheus and Grafana dashboard. There are many pods in a node and a collection of nodes in a cluster. The custom pod autoscaling method is used to scale pods based on CPU utilization with a target value 50%. Finally, the results of the proposed autoscaler were compared with existing Kubernetes horizontal pod autoscaler results. The slopes of two methodology graphs were compared, and the proposed approach provided the lowest slope value $(0.1014 > 0.08704)$.

Keywords: Autoscaling, Amazon Elastic Kubernetes Service, Microservices, Containerization, Cloud Computing

E-wallet for Youth: A Secure and Sustainable System for Financial Transactions

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E-wallet known as electronic wallet is a computer-based information system that makes it easier for users to conduct paperless transactions. E-wallet allows its customers various advantages compared to similar payment modes including reduced fraud, online shopping, online banking, and receiving rewards. Review of related literature revealed that there are major limitations in the existing solutions which encourage more users to adopt E-wallet. The major limitations revolve around ease of use, security concerns, sustainability, and satisfaction. The research design is based on the theoretical acceptance model, which abstracts the necessary features and creates a research framework for the research context. The features are customer intention, customer satisfaction, customer creditability, social influence, user education, variety of services, and ease of use. A quantitative research approach is used, and all judgments are made based on an online questionnaire with 90 respondents ranging in age from 16 to 30 years old. Over 90% of respondents agree with the present features when it comes to customer satisfaction. And also, over 80% of the users create awareness among their peers. However, over 70% of respondents are simply satisfied with the security. Therefore, it should improve further encryption technologies to address security concerns. All the features of the suggested model have received over 70% of acceptance. In conclusion, because the goal of this study is to find a way to get more people to use the E-wallet, encouraging service providers is one of the best solutions identified. As a future direction, simple interfaces to interact with customers are recommended which allows for increased interaction.

Keywords: Customer Intention, Customer Satisfaction, Sustainability, Adoption, E-wallet

Detecting the Code Clone Density and Measuring the Complexity of Source Code Using SonarQube

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In software development, developers often copy and paste the code, with or without modifications. In the software development sector, maintenance accounts for roughly 90% of the software lifetime cost. The concept of code cloning is regarded as one of the aspects of bad smell which complicates the maintainability of the software. In the past, the adverse effects of code clones were measured in terms of their bug-proneness, fault-proneness, tendency of experiencing constant modifications, including bug fixes, and a lifetime of clones across the software project. However, none of the studies analyzed the source code complexity in relation to the density of code clones. This study aims to analyze the association between code clone density and complexity. The study design is two-folded: analysis of duplicated files at the overall project-level and analysis of duplicated files at the individual file-level. In this study, we investigated twenty-two well-known Apache Software Foundation subject systems written in Java programming language for overall project-level and analyzed 416 source files among ten subject systems considered above for individual file-level. The SonarQube tool was utilized to detect code clones and to measure the complexity. A positive correlation coefficient of 0.927 was identified among code clone density and the complexity of overall project-level duplicated files but with a less statistical significance (p=5.201). A minor negative correlation coefficient of 0.099 was identified amongst code clone density and the complexity of its duplicated file with a statistical significance (p=0.042). According to the results, it is concluded that there is non-significant correlation between code clone density and overall project-level duplicated files' complexity and a significant negative correlation between code clone density with its individual duplicated file's complexity. Although no conclusive evidence that code clone density increases software difficulty was identified, this study can serve as a foundation for future research on code clones and software complexity.

Keywords: Code Clones, Bug-Proneness, Density, Complexity

Machine Learning

Data Mining-based Landslide Vulnerability Prediction System

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Badulla district is situated in a complex physical topography with mountain ranges and small valleys that sees a lot of landslides every year. Main causes for this phenomenon are extreme rainfall, slope aspect, unplanned agricultural activities, and unstructured irrigational activities. Thus, this study aims to develop a system to predict the severity of landslides based on the identified associations between landslides and seasonal rainfall patterns and slope in selected regions of Badulla district. Monthly rainfall data and landslide data pertaining to the period from 1999 to 2019 collected from Haputhale, Dambethenna, and Bandarawela divisional secretariats were used in the study. The forecasting model was built on the Anaconda platform with Python, and the areas of interest were selected using Arc GIS. The slope was identified from contour maps for the extracted regions in selected Grama Niladari divisions. From among different time series models, the Seasonal Autoregressive Integrated Moving Average (SARIMA) model was used to predict seasonal variance and monthly rainfall in the rainfall stations considering its higher accuracy. Based on the standard error of 301 and 311 lowest Akaike's Information Criterion (AIC) was used in the SARIMA model to fit as the best statistical model. The system issues a landslide warning for identified months based on three levels considering the severity as low, moderate, and high risk according to the identified threshold value. The possibility of a high risky landslide can be identified with a minimum threshold of 1.698 and a minimum slope of 1200m. Risk level of a landslide and the population in the considered area showed a positive correlation. This system which alerts people in high risk areas can be successfully utilized for disaster management. It can also be used for agricultural planning with minimized losses.

Keywords: Landslide, Python, Rainfall, SARIMA, Slope

Using Twitter Data for Assessing Home Violence During the Covid-19 Pandemic

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The outbreak of COVID-19 has triggered a worldwide health crisis that has influenced how we view the world and live our daily lives. It has resulted in both negative and positive impacts. Home Violence (HV) is one of the most common forms of violence, and it has grown into a huge global issue that affects everyone. Also, it is one of the adverse outcomes of the pandemic. At present, people are becoming increasingly dependent on social media platforms such as Twitter, Instagram, Facebook, YouTube, and other similar sites. They share their thoughts and opinions on daily events and occurring on these sites. Twitter is a real-time social media platform that allows users worldwide to connect via public and private messages which are chronologically structured on each account. Detecting the HV posts on social media has given immediate assistance to victims. It can create awareness about the HV and protect future victims. Moreover, it can provide valuable insights on HV to understand the severity of the issue. Our research study proposed a method to detect HV-related tweets during the COVID-19 period. More than 10,000 tweets were collected pertaining to the period from May, 2019 to April, 2021 using Twitter API. Then the data were pre-processed to clean the data. The word-embedding technique was used for pre-processed data set in data preparation. To construct the model, the data set was then split into training and testing data sets, and the Support Vector Machine (SVM) was applied. Finally, the model was evaluated using different evaluation metrics. The SVM model yielded an accuracy of 88.53%. Recall, precision, F1-score, and AUC for SVM model are 93.26 %, 97.07%, 92.00% and 84.00% respectively.

Keywords: Tweets, Home Violence, Covid-19, Support Vector Machine

Machine Learning-based Approach for Predicting Covid-19 Deaths

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Covid-19 is a highly contagious infectious virus that became a pandemic and had a major impact on global public health, resulting in deaths and serious health repercussions. It affects the human body in a variety of ways, including respiratory problems and multi-organ failure, all of which can result in death in a short period of time. In the absence of comprehensive medical treatment and with the risk of new viral variants emerging, the global mortality rate rises every day regardless of the fact that strict social separation, lockdowns, and safety precautions are in place. Excessive attention on early treatment options could help reduce mortality risk of individuals affected by the virus. Laboratory tests, medical check-up reports, and clinical biomarkers can be used to determine an individual's health status. In this backdrop, various researchers have proposed machine learning algorithms to reliably forecast the severity of Covid-19 disease. Multiple machine learning algorithms are used in this study to compare and choose the best model for predicting how long a patient will survive a coronavirus infection. Furthermore, the author determined which variables had the highest impact on the model's accuracy. Two machine learning algorithms namely Decision Tree and Random Forest were applied to predict the mortality rate. Data from 4229 individuals infected with Covid-19 were used in the study. The potential for effective death prediction was evaluated using 16 variables based on clinical laboratory data of Covid-19 infected patients. The data was standardized and processed using various pre-processing techniques before being fed into the models. From among the two models, Decision Tree yielded a higher accuracy of 95.75%, an average precision, recall, and F-measure of 0.958%, and a lower mean absolute error rate of 0.051. The findings suggest that using the Decision Tree algorithm to estimate the mortality of Covid-19 patients can lead to a more accurate final prediction model.

Keywords: A Decision Tree, Random Forest, Covid-19, Mortality Prediction

Generative Adversarial Network-based Data Augmentation for Papaya Disease Detection using Deep Learning

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Fruit diseases are a severe problem for all farmers, especially for fruit growers. A major challenge for large farms is the spread of diseases that make the fruits unfit for consumption, which also significantly impacts on farmer's income. Farmers must detect disease early in its life cycle in order to prevent it from spreading. Traditional fruit disease detection and identification rely on a person's ability to see the diseased fruit. Even though this approach sufficiently caters for small-scale farmers, it requires a high level of expertise to correctly identify the disease. Machine Learning and Image Processing techniques have been used in recent research to develop automated solutions for this problem. Papaya which is a popular fruit in Sri Lanka which is also having a high postharvest loss has been considered in this study. Among various papaya diseases, the most prevalent papaya diseases in Sri Lanka namely anthracnose, black spot, powdery mildew, phytophthora, and ringspot were selected. Data were collected from public image sources from the internet and from actual fields. VGG 16 as a Convolutional Neural Network technique was used to develop a computerized model for detecting papaya diseases. Literature reveals that many of the image-based disease recognition systems possess limitations due to insufficient data. Therefore, it is believed that novel data augmentation methods have promising advantages. In this approach, Deep Convolutional Generative Adversarial Network (DCGAN) was used to develop the data set. The VGG 16 model accuracy was found using the same pre-processed data set with and without being subjected to DCGAN. According to the results, the VGG 16 model showed a high accuracy for all diseases. Accuracy values for Anthracnose, black spot, powdery mildew, phytophthora, and ringspot were 90%, 85%, 70%, 65%, and 90% respectively. The results revealed that the proposed DCGAN model outperforms the basic data augmentation approaches.

Keywords: Artificial Neural Network, Source Code, Java Parser Library, Abstract Syntax Tree

CS-ML-04

Identification of the Type of the Respiratory Failure by Analyzing the ABG Test Results Using Machine Learning

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Arterial blood gas (ABG) analysis is crucial for determining oxygenation and blood acid levels. It is essential for identifying the clinical status and contributes to healthcare strategy plans that are both cost-effective and efficient. ABG is most commonly used in emergency care units (ECU) and intensive care units (ICU). Most of the time, doctors and nurses face difficulties diagnosing the type of respiratory failure using ABG test results. So, in this research study, supervised machine learning approaches such as Extreme Gradient Boosting (XGBoost), Adaptive Boosting (AdaBoost), Catboost, Random Forest, Naive Bayes, Support Vector Machine (SVM), LightGBM, K-Nearest Neighbors (KNN), Neural Network (NN), and Decision Tree were applied to determine the type of the respiratory failure. Since it is a multi-class classification problem, the target variable consists of three classes: No respiratory failure, Type-1, and Type-2. The results of 700 patients from a Sri Lankan public hospital were collected for this study. XGBoost outperformed all other approaches in diagnosing the type of respiratory failure, yielding the highest accuracy of 98.65 percent and the lowest error rate of 1.35 percent. The dataset was also subjected to K-fold cross-validation using five folds to see if the XGBoost outperformed against varying training and testing data percentages. The cross-validation method yields findings with an accuracy of 98.45 percent and an error rate of 1.55 percent. Finally, XGBoost was used in the development of the prediction model. The findings of this study provide important insights for a future researcher who wants to employ hybrid and deep learning approaches to figure out what causes respiratory failure and how to anticipate the type of respiratory failure.

Keywords: Arterial Blood Gas (ABG), Supervised Machine Learning, Respiratory Failure

Artificial Neural Network-based Approach to Predict the Soil Fertility

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Agriculture is one of the most important economic sectors in any country. As the world's population grows, governments increase their crop production every year. In this regard, a wider variety of factors that affect the crop yield must be considered, including soil, rainfall, light, water, and temperature. Soil is one of the most significant factors for better production; simultaneously, the use of suitable soil fertilizer is a top priority for improving agricultural productivity. Many factors influence soil fertility, including climate, water, soil acidity, and soil nutrition. Traditional methods used by farmers are not sufficient to determine the soil characteristics to predict soil fertility. Agricultural crop productivity analytics is an emerging area of study in which the capabilities of data mining are utilized. In this study, to predict the soil fertility, K-Nearest Neighbour (KNN), Artificial Neural Networks (ANN), Logistic Regression, Naive Bayes, and Support Vector Machines (SVM) have been considered and tested against specific evaluation metrics for the highest classification accuracy. For this purpose, 600 records of data consisting of five selected attributes were analyzed. A portion of the data was obtained from the Kaggle Machine Learning Repository, while the rest of the data was acquired from the Agricultural Office, Batticaloa, Sri Lanka. Since it is a binary classification problem, the target variable consists of two classes namely the suitability and unsuitability of the field for fertility. Based on the results, ANN showed a higher accuracy than the other four algorithms. ANN was executed along with one input, hidden, and output layer. Finally, ANN produced the results with 95% accuracy for predicting soil fertility, and provided a lower error rate of 5%. Accordingly, the final prediction model was developed using ANN.

Keywords: Agriculture, Artificial Neural Network, Crop Productivity, K-Nearest Neighbour, Support Vector Machine

CS-ML-06

Future Prediction and Analysis of Tea Export in Sri Lanka in Terms of Influencing Factors

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According to figures from the Sri Lanka Tea Board, the amount of tea exported fluctuates greatly depending on the time of the year. Analyzing and predicting tea export based on the type of tea exported would be highly beneficial for various stakeholders in the industry. Investigating the relationship between tea export and important factors aids in identifying the elements that contribute to fluctuations in tea export volume. Accordingly, this study focused on the collection of data specific to the future prediction and analysis of tea export in Sri Lanka in terms of influencing factors and to analyze them based on a thorough identification of existing research gaps. Monthly tea export data over the past ten years, as well as prices and volumes of various tea types over that time period were used in the study. These historical data were used to assess and determine the significance of the correlation between the key factors and their variation patterns in order to forecast tea export volume. This study used a variety of prediction and forecasting methods with the Multilayer Perceptron, a type of feedforward Artificial Neural Network emerged as one of the most effective methods for developing accurate prediction models. The accuracy of the results was tested and evaluated using the confusion matrix. The prediction model yielded an accuracy of 98% with a mean absolute error of 0.02%, root mean squared error of 0.12%, 0.985 precision, and 0.984 for both Recall and F-Measure. The study further demonstrated that the identified factors have a satisfactory level of correlation in determining the tea export in Sri Lanka, with the year, month, and tea type having the highest influence.

Keywords: Machine Learning, Sri Lankan Economy, Tea Export, Tea Types

Face Mask Detection System using Neural Network Architecture

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Face masks are a vital precautionary measure in the fight against the Covid-19 pandemic. This study aims to develop a face mask detection system suitable to deploy on single board computers (SBCs) by comparing the performance of three Convolution Neural Networks (CNN) namely on MobileNet, MobileNetV2, and EfficientNet. The system was implemented using tensorflow and keras with OpenCV for the computer vision component. Models were trained on a publicly available balanced dataset in Kaggle consisting of 10000 training, 992 testing, and 800 validation data. Same batch size and epoch hyperparameters were used with Adam optimizer to train each model. Loss, accuracy, precision, and recall were used as metrics to compare the model performance. MobileNet outperformed the others, attaining a test accuracy and precision of 97.93% and 97.84% respectively. MobilNetV2 showed an accuracy of 96.12% and a precision of 96.57% ranking the second. Trained models were compressed to TensorflowLite models in order to be deployed in Raspberry Pis efficiently. Real time inference performance of the models were measured in both standard hardware and Raspberry pi 4 by connecting to a camera feed. MobileNet, MobileNetV2, and EfficientNet each reached average inference times (in seconds) of 0.816, 0.751 and 1.418 for standard hardware and 0.332, 0.221, and 0.776 for the Raspberry pi. Results on the accuracy and performance indicate that both the MobileNet versions are deployable in the real world. These types of models that are deployable on SBCs enable data security, low latency, and low cost in real world deployment of face mask detection systems. Offline deployment is possible as data is referenced on device compared to a server implementation while securing monitored individuals' privacy. The system can be further developed as a distributed system consisting of multiple SBCs deployed in a wider area.

Keywords: Neural Network Architectures, Raspberry Pi, Covid-19

Identification of a Machine Learning Architecture for Potato Disease Classification Using Leaf Images

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Agriculture is a vital economic sector for any country. Therefore, improving the agriculture sector properly is much needed; especially computer technology has been widely used for improving the productivity of the cultivation. Potato is one of the mostly consumed vegetables, but it is susceptible to a variety of diseases. The commonly used way to identify them is by looking at the leaves of the plant. Therefore, if artificial intelligence can be utilized to recognize them, it can be used to provide immediate responses. Accordingly, the main aim of this study is to identify a machine learning algorithm that is fast, and more accurate to identify diseases that affect the potato leaf such as late blight and early blight, using multiclass image classification. Image data for the study was acquired from the Potato disease library of the Kaggle repository. It contains three subclasses named early blight, healthy, and late blight which contains 2152 images in the above three classes. VGG16, efficientNetB0, and Support Vector Machine (SVM), Extreme Gradient Boost (XGBoost) were chosen as deep learning-based algorithms and machine learning algorithms, respectively. Initially, models were trained and a test split was done with Keras preprocessing library. Then a comparison was done among the classifiers, considering the accuracy, validation, and loss, and then the best one was selected for the potato disease identification. The factors and parameters affected to increase the power of the models were then considered. The test accuracies achieved by the classifiers were 92%, 95% for CNN models, 83% for SVM, and 86% for XGBoost as average model accuracy approximately in testing phase. These findings would lead to the development of a model that is best suited for detecting potato leaf diseases. Future researchers will be able to program a flying drone using the aforementioned model and computer vision to identify plant diseases immediately.

Keywords: Computer Vision, Deep Learning, EfficientNet, Machine Learning, Support Vector Machine, VGG16

Multilayer Perceptron-based Source Code Classification

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One of the most crucial stages in the software development life cycle is the implementation stage. Source code is the most critical component in a software application. Developers develop new source code from scratch or reuse old program code functionalities according to project's requirements. Instead of developing source code functionalities, most programmers devote considerable time seeking and searching old source files. Therefore, it is critical to have an effective and efficient way for searching source code functions. Topic modeling is one way for extracting topics from source code. Even though statistical modeling techniques have been used to implement several topic modeling approaches, they possess several limitations. Non-formal code components such as method names, identifiers, and comments are used in this regard. The syntax of a language refers to the rules that define its structure. Without syntax, the semantics of a language are nearly impossible to comprehend. Addressing these concerns, the author used a machine-learning algorithm to predict the source code functionality names. The results are solely dependent on the syntax or algorithm of the source code. This study focuses on three Java project functionalities: primary number, Selection sort, and Fibonacci number. The data set was acquired from the Git open-source repository which is an open-source platform supported by developers worldwide. Four hundred and fifty software projects were analyzed, and 23 variables were considered. The source code components are extracted using the Java parser library, creating an abstract syntax tree to extract the source code features precisely. Then an algorithm is developed to get the count matrices of source code features. The data set was then fed into an Artificial Neural Network machine learning model which yielded 95.4% accuracy rate, 95.5% precision, 95.4% recall, and 95.4% F1-score, with a low error rate of 0.033.

Keywords: Artificial Neural Network, Source Code, Java Parser library, Abstract
Syntax Tree

Classification of Telecommunication Customers based on Profitability: A Supervised Machine Learning Approach

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In this modern world the telecommunication industry plays an important role. At the same time, the telecommunication industry is facing a serious problem of losing its potential customers. Customer relationship management is the combination of practices, strategies and technologies that companies employ to manage and analyze customer interactions and data throughout the customer lifecycle. Customer retention is one of the most difficult challenges in the telecommunications industry. Most researchers focus on developing suitable models to classify customers based on their profitability levels for many different businesses. This study has proposed a supervised machine learning approach for the classification of telecommunication customers based on profitability. Three classes namely high profitable customers, low profitable customers, and average profitable customers were considered based on their purchasing behaviours. Around 10,000 post-paid subscriber details with 12 attributes were collected and analyzed in the study. As a result, the classification technique has been used to reduce the size of the feature set and to classify them based on profitability. Various supervised machine learning algorithms were applied on the data set to choose the best algorithm for developing the final prediction model. Decision Tree, LightGBM, Random Forest, Support Vector Machine, XGBoost, AdaBoost, Naïve Bayes, CatBoost, Artificial Neural Network, and K-Nearest Neighbor algorithms were considered for the analysis. Out of 10,000 pre-paid subscribers, 5000 are high profitable customers, 3000 are low profitable customers, and the remaining 2000 are average profitable customers, with the Support Vector Machine algorithm outperforming all other classification algorithms. It generated the best results, yielding the highest accuracy (77.80%) while producing a low error rate of 22.20%. Accordingly, the Support Vector Machine algorithm was identified for developing the final prediction model for the telecommunication customer classification based on profitability.

Keywords: Customer Profitability, Classification, Supervised Machine Learning, Ada Boost, Decision Tree, Telecommunication, Support Vector Machine

Predicting the Rainfall and Crop Price to Select Suitable Crop: A Case Study in Badulla District

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The agricultural sector is becoming increasingly significant in the global economy. The daily growth of the world population necessitates a high level of crop production and yield rate in order for people to live. However, as the human population grows, the environment also changes as a result of human activity. So, it has led to difficulties in weather prediction, which is essential to crop cultivation. This demands a proper mechanism for predicting weather for farming. Farmers will be benefited if they can have an estimate of how much yield rate they can harvest and what is the price range they will be able to get for their efforts. As a result, machine learning technologies have become novel and trending technology among the agricultural sector due to their ability to provide accurate predictions regarding farming. Among all of these, selecting the suitable crops for cultivation has become critical. This study has proposed a machine learning approach to predict the right crop for a specified period. Decision Tree Regression and Random Forest Regression machine learning models have been used in the study to predict the rainfall and price of the crops. To select the best performing models, the authors have used root mean square error and R square value for the coefficient of determination. In the case of rainfall prediction, the Decision Tree obtained 12.07 and 0.03 for RMSE and R squared respectively. In the case of price prediction, Random Forest obtained 10.58 and 0.92 for RMSE and R squared respectively.

Keywords: Machine Learning, Weather Prediction, Price Prediction, Yield Prediction

Designing an Emotionally Realistic Chatbot Using Deep Learning

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Emotions are extremely important in human contact. With the exponential growth of information and communication technology over the last decade, chatbots are becoming an increasingly popular choice for interacting with users in most industries. Deep learning has recently gained popularity in various industries, and it can be used to solve the issues in developing emotionally realistic chatbots. The study introduces an emotionally realistic chatbot using deep learning based on Natural Language Processing (NLP) and Long Short-Term Memory (LSTM). To identify eight emotions from user inputs, the study employed a dataset called "Emotion Dataset for Emotion Recognition Tasks" along with a self-made dataset. The chatbot has been developed using TensorFlow and a deep learning model. The chatbot model consisted of two hidden layers and a typical feed-forward neural network. By using LSTM-based text emotion categorization, the chatbot delivers a higher level of accuracy than the existing learning methods. The results reveal that the system with emotion characteristics produces a statistically significant improvement in chatbot credibility when compared to the system without emotion variables. This effort could be utilized to create chatbots that can recognize a wide spectrum of emotions and be used for more critical activities, such as mental health care assistants. In the future, the model will be rewarded for emoji responses that are relevant to the sentiment. This will entail the use of Bi-LSTM, which provides the highest level of accuracy.

Keywords: Chatbots, Deep learning, Natural Language Processing, Emotionally Realistic, LSTM

Product Recommendation System using Market Basket Analysis and Emoji Based Feedback

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Market basket analysis (MBA) or affinity analysis, in the context of e-commerce, is a business intelligence technique for predicting consumer buying decisions by reviewing purchase history and generating association rules. It is connected to the detection of hidden patterns in huge product databases. An effective analysis can improve a company's profitability, quality of service, and customer satisfaction. Therefore, the main aim of this study is to find an efficient way to rate and recommend products based on customer feedback and purchasing habits, as well as to gain a better understanding of current customers' behavior in order to predict future behavior and provide the best product recommendation for their next purchase. As a result of this study, a superior product recommendation system was developed using both MBA and textual/emoji feedback from customers, which eliminated the drawbacks of existing systems. The findings of this study show that analyzing both purchasing history and feedback leads to improved product recommendations for customers' next purchases. The Apriori algorithm model was developed to discover patterns for implementing association rules for recommender systems to find frequent item sets and significant relationships. The minimal confidence and minimum support values used in mining rules to determine the best-related product categories and items are the most important metrics. By analyzing and evaluating feedback data, the customer satisfaction level was determined using the Fast text embedding model. The results of the study reveal that the product recommended appears to be more realistic and applicable because of the use of the Apriori algorithm and Fast text embedding models.

Keywords: CApriori Algorithm, Fast text Embedding Model, Machine Learning, Market Basket Analysis, Recommendation System

Public Perspective on the Adverse Effects of Covid-19 Vaccines: A Study based on Social Media

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The worldwide pandemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has afflicted the majority of the world's population. Thanks to the invention of COVID-19 vaccines, the governments worldwide have been able to control the pandemic in some way. However, it can be noted that the majority of people are hesitant to share their experiences on official platforms after being vaccinated. As a result, information about vaccine-related adverse effects other than clinical trial results has become challenging to identify. However, many people tend to share their opinions about vaccines through social media platforms since the COVID-19 vaccination campaigns started worldwide. This study aims to identify the public perspective on the adverse effects of COVID-19 vaccines, based on an analysis of social media data. As an initial step, the researchers tried to detect valid Tweets that contained details on adverse effects of COVID-19 vaccines. Tweets related to COVID-19 vaccines were collected through the Kaggle repository, which resulted in over 4257 tweets after data cleaning and removing duplicates. Collected tweets were manually labeled into two categories: tweets related to the adverse effects of COVID-19 vaccines and tweets not related to the adverse effects of COVID-19 vaccines. After the data pre-processing, Support Vector Machine (SVM) algorithm and Term Frequency-Inverse Document Frequency (TF-IDF) word embedding technique were used to classify the COVID-19 vaccine-related tweets. The TF-IDF technique was used to extract features from the text that can be input into SVM. The best performance of classification, which used SVM, yielded an accuracy of 80.00 % on the test dataset. The recall, precision, and F1-score were 0.85, 0.41, and 0.56 respectively. Overall, this research reveals that the SVM algorithm can be used to identify the information related to COVID-19 vaccines on social media to explore public opinion about its adverse effects.

Keywords: Adverse Effect, COVID-19, Support Vector Machine, Social Media, TF-IDF

Natural Resources
&
Applied Sciences

Plenary Speech by Dr. Lakshitha Pahalagedara

Role of a Scientist; The World Needs You..

One important aspect of a scientist is his/her ability to make a positive impact through knowledge. That impact is their capacity to move research results from the laboratory into new or improved products and services in the market place. The success in translating research results into practice accelerates the beneficial aspects of research. Also, it has a major impact on the country's socio-economic aspects towards a knowledge-driven economy the social and environmental aspects of the entire world. The speaker will discuss about his own experiences on carrying out fundamental research and how to use the expertise and experiences gained through fundamental research to drive applied research. Furthermore, the speaker will discuss his experiences in converting research outcomes into refined products and process through strategic planning, business development and technology transfer. Commercialization of research provides new products & services that can be used to solve some of the life's most pressing problems and a scientist could play major roles at each and every step in this crucial process!

Dr. Lakshitha Pahalagedara
Head of Business Development
Sri Lanka Institute of Nanotechnology - SLINTEC
Homagama

Food & Nutritional Sciences

Formulation and Quality Evaluation of Palmyrah (*Borassus flabellifer*) Pulp Incorporated Vegetable and Yeast extract

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Nutrient-rich Palmyrah (*Borassus flabellifer*) fruit pulp is being used for formulating diversified food products. The present study was targeted for the formulation of palmyrah pulp incorporating vegetable and yeast extract as a food spreader. The sensory evaluation was done to identify the best formula through the nine-point hedonic scale with 30 non-trained sensory panelists, and the attribute of appearance, aroma, mouthfeel, color, and aftertaste were evaluated. The highest mean sum of ranks was received for the formula, which contained palmyrah pulp, vegetable, and yeast extract of 25%, 25%, and 50% respectively. The physicochemical properties of the formula indicated pH, titratable acidity, brix^0, water activity, and viscosity values of 4.76 ±0.01, 1.69 ±0.04 g/100ml, 54.98^0±0.02, 0.55±0.01, and 28,241.8±118.1 mm^2/s respectively. The proximate compositions of the product indicated crude protein, crude fat, crude fiber, ash, total carbohydrate, moisture, and total energy contents of 17.12±0.49%, 0.72±0.02%, 0.63±0.04%, 14.51±0.16%, 15.43%, 51.29±0.80% and 195.78 ±0.04 kcal/100g respectively. 3.25 g/100g of sodium and 16.92±0.26 g/100g of salt were also recorded in the product. In conclusion, 25% palmyrah fruit pulp can be effectively incorporated into vegetable and yeast extract containing food spreader formula with desired physicochemical, microbiological, and acceptable sensory properties with 42 days of shelf life period.

Keywords: Palmyrah Extract, Yeast Extract, Vegetable Extract, Food Spreader

Development and Quality Analysis of Coconut Milk (*Cocos nucifera* L.) Based Palmyrah (*Borrasus flabellifer* L.) Fruit Pulp Drink

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Plant-based or non-dairy milk alternatives are a growing trend in new products development. The palmyrah (*Borrasus flabellifer* L.) fruits have excellent nutritional and functional properties with unique organoleptic characteristics. Fruits are highly wasted during their peak season due to low industrial utilization. The present study was carried out to give value addition and promote utilization of palmyrah fruit, targeting the ready-to-serve beverage market. Coconut milk (*Cocos nucifera* L.) based palmyrah fruit pulp drink was developed with four product formulations by changing the pulp percentage (T_1=0%, T_2=20%, T_3=40%, and T_4=60%). The pulp was treated with acid and heat treatment to reduce and mask its bitterness. The proximate composition, physicochemical, functional, and microbial properties were determined for all product formulations. Tukey method was used to compare the mean values of different treatments. The T_2 treatment was selected as the best formula for further development. The product pH (5.2), TSS (12° brix), titratable acidity (0.04 mg/L), specific gravity (1.04), viscosity (124 mm^2/s) did not vary significantly during the storage at room temperature. Moisture, fat, protein, carbohydrate, crude fiber and ash contents of the product were 83.29%, 3.4%, 1.63%, 9.92%, 0.21% and 1.55% respectively. The mineral contents recorded in the product were Na (1.52 mg/100g), K (17.17 mg/100g), Ca (5.01 mg/100g) and Mg (11.81 mg/100g) respectively. The colour values recorded are L*(60.28), a*(7.16) and Tb* (34.62). The functional properties were determined by DPPH assay (IC50 112 mg/ml) and total phenolic content recorded was (35.31 GAEmg/100g). The drink had low calorie (73.94 kcal/100mL), medium sugar (8.26 g/100ml), and low salt (0.15 g/100ml) contents. The product could be kept for more than 4 weeks without affecting its microbial and physicochemical quality parameters. Overall results conclude that the newly developed palmyrah pulp-based coconut milk drink is a product with significant nutritional and functional properties.

Keywords: Coconut Milk, Palmyrah Pulp, Physicochemical Properties, Proximate Analysis, Sensory Properties

Extraction and Modification of Palmyrah Tuber (*Borassus flabellifer* L) Starch and Its Applicability as a Thickener

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Palmyrah tuber is a seasonal product of palmyrah palm (*Borassus flabellifer* L). Palmyrah tuber flour is used to make starch-based products. However, the native starches have restricted industrial applications. Therefore, modifications of native starches are carried out to provide starch products with specific properties. In the present study, three different starch modification techniques (pre-gelatinization, acid modification and dextrinization) were used to produce modified palmyrah tuber starches. The physicochemical and functional properties of the native and modified palmyrah tuber starches were evaluated and compared. The resultant modified starches were compared with the native palmyrah starch and a commercially available starch to find out their applicability as a thickener. The extracted native starch yield was $16.04 \pm 0.56\%$. The recovery yields of modified starches ranged between 75.90 - 91.96%. The crude protein, lipid and fiber contents of modified starches significantly decreased compared to native starch (at $p < 0.05$). The water and oil absorption capacities of palmyrah starches were significantly increased ($p < 0.05$) after the modification processes. The dextrinized palmyrah starch showed significantly ($p < 0.05$) the lowest swelling power and the highest average solubility. The pre-gelatinized palmyrah starch showed a significantly decreased level of syneresis of its gel. The gelatinization temperature, amylose content (9.2 - 21.69%), amylopectin content and the whiteness index (92.29 - 95.75) varied among the native and modified starches. The total phenolic content (0.12 ± 0.00 mg GAE/g) and the antioxidant activity (DPPH-IC$_{50}$ value 81.99 ± 0.18 mg/ml) were higher in pre-gelatinized starch. The sensory scores and the apparent viscosity were higher for pre-gelatinized and acid-modified starch incorporated soup mixes than the native and dextrinized starch. The study revealed that the modification processes can greatly improve the physicochemical and functional characteristics of native starch and the feasibility of the application of modified palmyrah starch as a thickening agent.

Keywords: Functional, Modified starch, Palmyrah, Physicochemical, Thickener

Evaluation of Functional and Antioxidant Properties in *Alocasia macrorrhiza* Corm Flour

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Alocasia macrorrhiza is an edible corm native to Sri Lanka. Despite its nutritional and medicinal benefits, it is not consumed in Sri Lanka due to its acridity and is regarded an underutilized corm. These corms can be processed into flour after applying thermal processing which can alter the properties of flour. The present study aimed to evaluate functional properties and antioxidant properties of flours after milling raw, boiled and roasted corm into flour. The water and oil absorption capacities (166.61 ± 14.43 and $132.58\pm5.34\%$ respectively) of raw corn flour was significantly similar to that of commercial wheat flour (116.67 ± 15.28 and $160.00\pm5.00\%$ respectively). Moreover, the flour showed better solubility characteristics than wheat flour. The swelling power of the flours ranged between 3.01 ± 0.01 and 7.34 ± 0.13 g/g and these values were lower than swelling power of commercial wheat flour. The gelatinization temperatures of flour samples were in the range of 72.67 ± 2.08 to $89.67\pm0.58°C$ which was higher than commercial wheat flour. Higher bulk densities showed by all samples while the highest bulk density (0.71 ± 0.02 g/cm^3) and tapped density (0.89 ± 0.00 g/cm^3) were shown by roasted corm flour. The processed corm flour showed moderate flowability while raw corm flour showed poor flowability. Total phenolic contents of raw, roasted, and boiled corm flours were 50.01 ± 1.36, 77.42 ± 1.67, and 49.39 ± 1.75 mg GAE/ 100 g, respectively. However, total flavonoid contents were not significantly different among flour samples. The roasted corm flour showed the highest radical scavenging activities with a minimum IC_{50} value (66.70 ± 2.52 mg/ml) for DPPH assay and reducing power (155.7 ± 20.6 mg TE/100 g) compared to raw and boiled corm flour. The boiled corm flour showed the highest radical scavenging activities with a minimum IC_{50} value (9.96 ± 1.23 mg/ml) for ABTS assay. In concluding, thermally processed corm flours showed higher functional and antioxidant properties than raw corm flour.

Keywords: Alocasia macrorrhiza, Antioxidant Properties, Functional Properties, Thermal Processing

Investigation of Total Phenolic, Total Flavonoid Contents and Antioxidant Activities of Karankoku (*Acrostichum aureum* L.) Under Different Extraction Conditions

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There are numerous wild plant species in Sri Lanka that are edible and capable of improving consumer health. *Acrostichum aureum* L. (Karankoku) is an important wild edible plant species found especially in Sabaragamuwa province in Sri Lanka and, its nutritional properties are still not well explored. This study was carried out to determine the nutrient composition, antioxidant activity in different crude extracts and to screen the phytochemicals of *A. aureum.* Water, ethanol, and chloroform were used to prepare the crude extracts. The antioxidant activities of crude extracts were tested via TPC, TFC, DPPH, ABTS, and FRAP assays. AOAC standards were used to determine the proximate nutritional composition including, ash, moisture, crude protein, crude fat, and crude fiber. In DPPH, ABTS, and FRAP assays, the highest antioxidant activity in crude extracts was found in water extract followed by ethanol and chloroform extracts. Preliminary phytochemicals screening for crude extracts was done to determine the presence of alkaloids, tannin, saponin, flavonoid, and carbohydrate, protein compounds. Moisture and ash contents of the fresh herb were 81.426% and 3.92%, while crude fat, crude protein, and crude fiber content were 2.61%, 11.49%, and 32.78% in dry weight basis. The results showed that most of the screened phytochemicals in *A. aureum* are potent antioxidants and have the capability of free radical scavenging. The water extract in crude showed the highest radical scavenging activities with the value of DPPH assay (IC$_{50}$ at 0.6178±0.1496 mg/ml), ABTS assay (IC$_{50}$ at 0.08390±0.00178 mg/ml), and FRAP assay (62.98±13.75 mg TE/g). There was a good correlation between phenolic, flavonoid compounds with antioxidant activities.

Keywords: Acrostichum Aureum L., Antioxidant Activity, Phytochemicals, Proximate Composition

Physicochemical, Phytochemical and Microbiological Analysis of Bottled Tender Jackfruit (*Artocarpus Heterophyllus* Lam.) in Different Brine Solutions During Storage

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Jackfruit (*Artocarpus heterophyllus*) is a tropical tree with high genetic diversity, which bears seasonal fruits. Fruits from all the maturity levels, viz. tender, mature, and ripened have been delicacies of people for centuries. This study investigated the bottled tender jackfruit with hot filling as a preservation technique with four different treatments of varying aqueous brine formulations (% w/v): T_1 (2% salt and 0.1% citric acid), T_2 (2% salt, 0.1 % citric acid and 0.1% SMS), T_3 (2% salt and 1% fresh lime juice), and T_4 (2% salt, 0.1% SMS and 1% fresh lime juice), and the variations in physicochemical, phytochemical, microbiological, sensorial and textural properties with the storage time. The proximate analysis results showed no significant difference ($p<0.05$) among the four treatments. The derived browning indices based on L*, a* and b* values gave the highest for sample T_3 (24.47) and lowest for sample T_2 (20.58). There were no significant changes ($p<0.05$) in total soluble solids across treatments or with the storage time. Initial pH values and titratable acidities showed no significant variation across the treatments, however, increase in titratable acidities (%) were observed with storage time; with the highest value in T_2 (0.193±0.012), and lowest in T_3 (0.173±0.021), and T_4 (0.173±0.010). The total phenolic content (Folin ciocalteu assay), antioxidant activity (DPPH assay) and ascorbic acid content (dye method); of the raw fruit, recorded as: 116.28±1.13 mg GAE100g^{-1}, 1.090±0.035 mgml^{-1}(IC$_{50}$) and 2.474±0.030 mg100g^{-1} respectively showed reduction in all treatments after bottling. The highest retentions of these were in T_2 (104.27±1.82 mg GAE100g^{-1}, 1.927±0.006 mgml^{-1} and 1.236±0.053 mg100g^{-1}), whereas the least were in T_3 (78.24±10.77 mg GAE100g^{-1}, 2.454±0.066 mgml^{-1} and 1.145±0.057 mg100g^{-1}) after two months. All the samples were microbiologically safe after six weeks of storage, as revealed by the total plate count, yeast and mold counts and tests for *E. coli.* From the two sensory evaluations conducted (boiled and cooked with spices), the most and least preferred samples were T_2 and T_3 respectively. Texture analysis was conducted with Brookfield CT3 texture analyzer where the parameters related to hardness were evaluated; samples showed softening with storage and cooking. Thus, T_2 was emerged out to be the best treatment in terms of preserving, physicochemical, phytochemical, sensorial and textural properties as a whole.

Keywords: Tender Jackfruit, Bottling, Brine Solutions, Properties, Storage

The Effect of Packaging Materials and Storage Temperatures on Shelf Stability of RDB Palm Olein

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The oxidative stability is a considerable factor which affect the quality and shelf stability of edible oil. There had been reported issues of quality degradation of RBD palm olein before the expiry date due to this. The packaging material and storage temperature play an important role in shelf stability thus the objective of the current study was to investigate this effect on shelf stability of RBD palm olein. Plain PET bottles, shrink wrapped PET bottles, PET pouches (PET+ PE + Nylon) and glass bottles were tested as packaging materials in this study. Physicochemical parameters were evaluated to measure the shelf stability for 60 days at 37 °C, 27 °C and 19 °C. The consumer preference, awareness and requirements of alternative packaging material were assessed via a Google questionnaire. The results showed that Free Fatty Acid (FFA) value increased with higher storage temperatures and the sample in glass bottle showed the lowest FFA values (0.083±0.002% at 37 °C). Secondary oxidation occurred in most of samples at higher temperatures. The oxidation was also lower in glass bottle than the others while initial peroxide value showed as 1.43±0.02 meq/kg. Initial iodine value showed as 60.963±0.542 which did not significantly vary among the packaging materials and storage temperatures. Color was affected of the samples in pouch at all temperatures while it was affected at the highest temperature tested for other packaging materials. The initial cloud point indicator was 8 °C which showed no considerable change with the time. The shelf life reduced at 37 °C temperature than 19 °C in all samples and the highest shelf life is rejected as 1.2 years in glass bottles, in rapid testing for 2 months. It was revealed that the glass bottle showed the highest shelf stability according to the measured parameters while it was the most preferred (60%) packaging material based on the survey results. The manufacturers indicated the concerns about the cost, size and shape in selecting a packaging material. Nevertheless, the manufacturer expressed the willingness of modifying the existing packaging to enhance the shelf stability.

Keywords: Oxidation, Packaging Materials, Rancidity, RBD Palm Olein, Stability

Nutritional and Antioxidant Properties of Sri Lankan Tropical Almond (*Terminalia catappa* L.) Nuts

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Sri Lanka being a country which experiencing a nutrition transition has an urgent need to search new food sources to nourish the people. Therefore, this study aimed to evaluate the nutritional and antioxidant potential of underutilized fruit; tropical almond (*Terminalia catappa*) (TA) nuts as a novel food source. The nutritional profile was estimated in terms of moisture, protein, fat, ash, carbohydrate content and energy value while the mineral composition was analyzed using Inductively coupled plasma mass spectrometry (ICP-MS). Further bioactive compounds and antioxidant properties of TA nuts were estimated. Interestingly the moisture content of the dried nuts was 7.50 ± 0.95 lower than recommended value of 10% for edible nuts. It showed $21.32\pm0.27\%$ of protein which contributed to 38-46% of Dietary Reference Intake (DRI) of protein of an adult. Further, the protein fraction contributed nearly 13% of total energy of the TA nut. More than half ($53.76\pm2.41\%$) of weight of the nut was fat, contributing 55.42-122.15% of DRI. The carbohydrate content was $13.0\pm1.21\%$ while $7.42\pm0.41\%$ was fibre. The carbohydrate fraction showed a 10% of contribution to DRI of carbohydrate. Similarly, the nut showed an energy value of 580.56 kcal/100 g indicating it as a good source of energy. The TA kernel showed high mineral content, specifically Na, K, Ca, Fe, Zn and Mg contents were 72.5, 123.25, 643.5, 32.25, 11.45 and 46.25 mg/100 g respectively. The high K, Ca and Fe content with low Na content was a good indication in terms of human nutrition. Moreover, TA nut showed antioxidant activity with an IC_{50} of 53.77 ± 3.44 mg/ml for DPPH, 7.68 ± 1.23 mg/ml for ABTS and reducing power of 230.57 ± 9.65 mM Trolox eq/100 g in FRAP assays. Hence, TA nut could be recommended as an excellent source of protein, micronutrients and energy along with high antioxidant capacities which is beneficial to improve the nutritional status of the Sri Lankans with value addition.

Keywords: Antioxidant Capacity, DRI, Nutritional Value, *Terminalia catappa*,
Underutilized Fruit

Formulation of Healthy Breadsticks Using Palmyrah Resources and Garlic

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Palmyrah tuber flour possesses many health benefits such as curing constipation and strengthening the body, but its characteristic bitterness makes it mediocre. De-bittering of the flour made it more palatable. The objective of this study was to formulate de-bittered palmyrah tuber flour based bakery item which is both tasty and healthy. In this study, antioxidants extracted from palmyrah fruit pulp and garlic have been added to the de-bittered palmyrah tuber flour and this enriched mixture has been used to make breadsticks, the traditional pencil-shaped ready to eat bakery products. Three different de-bittered flour combinations (30%, 40% and 50%) were analyzed through the sensory evaluation by using nine point hedonic scale and 30 untrained panelists. Fifty (50) % de-bittered tuber flour combination had the highest mean score; hence it was selected to formulate the breadsticks. To compensate for the loss of health benefits incurred during the process of de-bittering, different oil composition (B1-100% virgin coconut oil (CO), B2-100% carotenoid extract enriched oil (CEO), B3-100% garlic incorporated oil (GIO) and B4-50:50% CEO:GIO) incorporated breadsticks were prepared and sensory evaluation was performed on them. According to the sensory result, the four different treatments were selected and further evaluated for their physicochemical, nutritional and functional properties, and compared with the commercial sample. The results were analyzed by using one-way ANOVA and Tukey pairwise comparison test in Minitab-19. The four treatments were showed higher mean value for fibre (7.40 ± 0.02^a -7.44 ± 0.02^a), total phenolic content (63.09 ± 2.36^c -77.32 ± 0.65^a) and free radical scavenging activity (IC_{50} value 1.16 ± 0.02^d - 2.43 ± 0.231^b) than commercial sample. Microbial counts were below the safety margin in the vacuum packed breadsticks during one month storage. According to the antioxidant properties results, it was concluded that the B3 breadstick sample was the best sample that beneficially provided a healthy snack for consumers.

Keywords: Antioxidants, Breadsticks, Carotenoids, Garlic, Palmyrah Tuber Flour

Formulation of a White Wine from Carambola *(Averrhoa carambola)* Fruit and Evaluation of Its Physicochemical Characteristics

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Wine is said to be the oldest fermented beverage and the moderate intake of wine is known to avoid heart and circulatory problems and, improve digestion while, anti-inflammatory and anti-obesity properties of wines have been reported. Carambola fruits are highly susceptible to spoilage and postharvest loss is high. Wine production is a value addition to these fruits. The aim of this study was to formulate a wine from well ripen carambola fruits and to evaluate its physicochemical characteristics. Four wine samples were prepared using fermentation of carambola fruit juice using *Saccharomyces cerevisiae* for 14 days. Cloves, cardamom, pepper, and cinnamon were added to give more pleasant flavor to the wine. The physicochemical properties of carambola juice were: pH 3.64 (at 25.9 °C), Titratable Acidity (TA) 3.3×10^{-4} %,Total Soluble Solids (TSS) 6.60 of brix (at 25.9 °C) and Specific Gravity (SG) 1.009. During the fermentation period, the pH value and TSS increased while TA and SG decreased in all four samples. Sample No 04 showed the highest pH value: 3.99 (at 26.5 °C) and sample No 01 reported the lowest pH value: 3.78 (at 27.1 °C). Total Phenolic Content (TPC) of wine samples were measured as mg of Gallic acid equivalents (GAE mg/ml) using Folin-Ciocalteu assay. Sample No 01 showed the highest TPC value (0.543 GAE mg/ml). DPPH scavenging assay was used to evaluate the antioxidant activity and sample No 01 showed the highest antioxidant activity (IC50 - 0.0687C mg/ml). The α-glucosidase inhibition assay was used to detect the antidiabetic activity of prepared carambola fruit wine and sample 01 showed the highest inhibition activity (IC_{50} – (-0.266C mg/ml)). Alcohol content was measured by using ebulliometer. Sample No 02, 03 and 04 was in the normal range of alcohol content (5-13% ABV) of a wine. The organoleptic properties of the wine samples were evaluated by thirty untrained panelists according to the nine-point hedonic scale. According to the sensory evaluation, sample No 02 was better in appearance, color, taste, after taste, aroma, acidity, sweetness and overall acceptability than other three samples. Thus, sample No 02 was selected as the best wine formulation.

Keywords: Antidiabetic Activity, Antioxidant Activity, Carambola, Fermentation, Wine

Case Study on Detection of *Salmonella* spp. in Market Available Ice Creams at Jaffna Peninsula, Sri Lanka

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During the summer, ice cream is a widely consumed item. In Sri Lanka, high-quality ice cream manufacture has become a key component of the dairy industry. Salmonellosis is still a major public health issue around the world. During the previous decade, a large number of *Salmonella* positive cases were reported from the Jaffna peninsula in Sri Lanka. This study aimed to detect *Salmonella* spp. based on SLS regulation (SLS 516 Part 5:2017; ISO 6579-1:2017) in market available ice creams at Jaffna peninsula, Sri Lanka. Thirty vanilla ice cream samples were collected randomly from Valikaamam, Vadamaraadchi, Thenmaraadchi in Jaffna peninsula. Conventional cultural and biochemical identifications (TSI test, urea agar test, L-Lysine carboxylation test, indole test, β- galactosidase test and VP test) were carried out to isolate and detect the organism. Experiments were carried out during December 2021 to February 2022. The results revealed that the peninsula was contaminated with *Salmonella*. Two (IC16 and IC22) of thirty samples (6.7%) were biochemically positive for *Salmonella* spp. The pH of icecream samples was found to be between 5.6 and 6.5 at 25°C. Contributing factors of ice cream for *Salmonella* contamination include poor sanitary practices during processing, use of contaminated ingredients, contaminated scoop water, post-process contamination and improper storage temperatures. Contaminated samples suggest the need to maintain strict hygienic control over the ice cream production, handling, processing, storage and distribution of ice cream should be maintained to protect consumers against health hazard. The HACCP system should be implemented in the ice cream sector to improve the quality of products made in Jaffna and ensure consumer safety.

Keywords: Ice Cream, Jaffna Peninsula, Salmonella, Micro-Biological Quality, Pathogens

Formulation and Quality Analysis of Palmyrah (*Borassus flabellifer*) Pulp Based Bread Spread

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A bread spread was developed using palmyrah as the base. The product was formulated with four different treatments by changing the amount of palmyrah fruit pulp and cocoa powder as ingredients. The final formula was selected through a sensory analysis with 30 untrained panellists. The final selected formula has pH 5.79±0.02, water activity 0.72±0.00, moisture content 36.08±0.77% and Titratable acidity 0.03±0.00g citric acid/100ml. The final selected formula has included 52.5% pulp, 25% peanut, 2.5% cocoa powder, 15% sugar and 5% coconut oil. Different packing materials such as polythene, Polypropylene cup and glass bottle were tested for the storage of the bread spread. In comparison to the polythene and Polypropylene cup, the glass-bottled sample performed better after a week of storage indicating 6.19±0.00, 30.47±0.35, 0.73±0.00, 43.66±0.52 and 0.02±0.00, respectively, for pH, TSS (brix), water activity, moisture (%), and Titratable acidity (g citric acid/100ml). The Bread spread with preservative could store at room temperature for three weeks and significantly different pH of 5.64±0.01, TSS of 56.60±0.10, Titratable acidity of 0.02±0.01g citric acid/100ml, water activity of 0.73±0.00, and moisture (%) 45.65±0.00 were recorded for the samples in compared to the samples that did not contain preservatives. Bread spreads prepared with white sugar has moisture (%), protein (%), fat (%) and ash (%) contents of 44.79±0.01, 8.66±0.02, 12.70±0.01 and 0.76±0.00 respectively. Furthermore, the spread contained reducing sugar 46.69±0.01 mg/100mg and minerals of Ca 12.47±0.06 mg/100g, Mg 72.30±0.05 mg/100g, Na 1.09±0.01 mg/100g and K 1.00±0.01 mg/100g. The Bread spread formula, in which white sugar was replaced with palmyrah treacle, showed significant differences in the moisture 43.29±0.15%, protein 9.88±0.02%, fat 14.30±0.02%, ash 1.25±0.01%, reducing sugar 35.30±0.00 mg/100mg and minerals of Ca 47.50±0.10 mg/100mg, Mg 92.40±0.38 mg/100mg, Na 0.39±0.00 mg/100mg and K 1.42±0.01 mg/100mg in compared to the control sample that did not contain palmyrah fruit pulp.

Keywords: Palmyrah, Bread Spread, Quality Analysis

Development of Jackfruit *(Artocarpus heterophyllus)* and Mung Bean *(Vigna radiate)* Based Instant Healthy Soup Mix Powder

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Soups have gained popularity among consumers worldwide, as a convenient food type and a healthy source of nutrients. The present study was carried out to formulate and develop a jackfruit *(Artocarpus heterophyllus)* and mung bean *(Vigna radiate)* based soup mix powder. Three formulations of soup mix powder were prepared using the jackfruit flesh flour and the mung bean flour in percentage ratios of 75:25, 65:35 and 55:45 respectively. The best formulation was found by a sensory evaluation, with thirty untrained panelists. The proximate analysis and other physicochemical properties and the keeping quality of the selected best formulation were evaluated. The soup powder with the formulation of 55% of jackfruit flesh flour and 45% of mung bean flour was selected as the best formulation and the sensory attributes (appearance, color, aroma, taste, after taste, and viscosity) of the selected formulation recorded significantly higher sensory scores at $p < 0.05$. The best formulation comprised of 7.45% moisture, 45.64% crude fiber, 14.06% crude protein, 2.80% crude fat, 3.22% ash and 26.83% carbohydrate. The bulk density and the tapped density of the product was found as 649 kgm^{-3} and 830 kgm^{-3} respectively. The wettability, sinkability, dispersibility and solubility of this soup powder were 52.95 seconds, 6.83 seconds, 41.67 seconds and 82.46%, respectively. The viscosity of the selected product was 16.5 cP. After three weeks, the moisture content of the soup mix was recorded as 8.03±0.06%. Although, the total plate count of soup powder was increased, it was under the permissible limit even after three weeks of storage. The soup mix powder formulated with 55% of jackfruit flesh flour and 45% of mung bean flour could possibly fulfill the nutritional demand also ensuring the convenience of the local community. However, further studies should be conducted to identify the detailed nutritional profile and the functional properties of the product.

Keywords: Jackfruit, Mung Bean, Shelf life, Soup

Evaluation of the Capability of Using Jackfruit (*Artocarpus integer*) Peel as a Low-cost Raw Material in Waffle Cone Production

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Jackfruit (*Artocarpus integer*) is one of the commonly consumed staples in Sri Lanka. However, more than 50% of the fruit is discarded as waste, primarily as the peel. Therefore, this study was aimed at evaluating the capability of using the mature jackfruit peel as a low-cost raw material in waffle cone production. Three different formulations were prepared by, replacing 60%, 50% and 40% of wheat flour in the standard formulation with Jackfruit peel flour (JFPF), to develop the best formulation for waffle cone production. The control sample contained 0% JFPF. The best formulation for the waffle cone was selected by a sensory evaluation using 30 untrained panelists, and also by evaluating the color, water activity, baking time and holding time. The 50% JFPF incorporated waffle cone was selected as the best formulation, since it showed significantly high sensory scores at $P<0.05$. The baking times of 60%, 50%, 40% and 0% JFPF incorporated samples were 120.50±4.20, 123.75±6.02, 128.00±3.16 and 201.5±52.70 seconds, respectively. Only the 50% JFPF sample (20.667±1.52 min) gave the nearest value for the standard holding time of 18 minutes. However, the 0% JFPF sample gave the nearest values for the standard color values (L*=51.72±0.72, a*=12.95±0.35, b*=28.48±0.12). The proximate analysis was carried out for best formulation (1.24% ash, 3.25% crude fat, 3.42% crude fiber, and 0.07% crude protein) and the shelf life of the selected waffle cone was evaluated using the moisture increment (2.25% to 4.32%) and the total plate count method. The moisture increment was only about 2% and the total plate count (5×10^3 CFU/g) was also under the permissible limit after four weeks. Based on the above results, the 50% JFPF incorporated waffle cone showed the feasibility of using JFPF as a low-cost raw material for waffle cone production and the reduction of nutritional value of JFPF during cone processing should be studied further.

Keywords: Jackfruit Peel Flour, Low-Cost Raw Material, Waffle Cones

Consumer Awareness, Perceptions and Preferences Towards Micronutrient Fortified Foods

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Food fortification is increasingly recognized as an effective public health intervention to alleviate nutritional deficiencies. It is the practice of adding vitamins and minerals to commonly consumed foods during processing to increase their nutritional value. However, there are many contradictory ideas and misperceptions in the society regarding fortified foods. Therefore, the present study was carried out to find the consumer awareness, perceptions and preferences towards micronutrient fortified foods (MFF) by designing a structured questionnaire which was randomly distributed among the consumers via social media and web links. The data collected from the respondents (n = 250) were analyzed by SPSS software using chi-square statistical tool. Age, gender, marital status, employment status, educational level, eating preferences, health condition and monthly income level were considered as the socio-demographic characteristics of the respondents. According to the statistical analysis, the consumer awareness strongly correlated with age, gender and educational level (at $P<0.05$). The awareness of MFF, was higher among the participants who were suffering from micronutrient deficiencies. However, about 50% of the respondents were not aware about the food fortification. The majority of the respondents (53.9%) didn't know about the regulations pertaining to MFF and they requested awareness programs on food fortification. Both consumer preferences and perceptions towards MFF, showed positive relationship with the educational level of the survey group (at $P<0.05$). The people who were in the low-income category (<10,000 LKR) have negative perceptions on purchasing MFF. Further, the respondents were not willing to spend extra money to purchase MFF and they preferred mandatory food fortification over voluntary food fortification. The study revealed that the awareness on micronutrient fortification of foods is still lacking among consumers and it is a timely requirement to aware the general community about MFF to combat micronutrient deficiencies in future.

Keywords: Awareness, Consumer, Fortified Food, Micronutrients

Investigation of Total Phenolic, Flavonoids and Antioxidant Activity of Miyana-Dalu *(Duplazum esculentum)* Under Different Extraction Conditions and Cooking Methods

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Miyana-dalu *(Duplazum esculentum)* is one of the nutritious edible ferns. Nevertheless, the nutritional value of these greens can be altered during preparation and processing. Availability of literature on the phytochemical profile of this plant is limited and such investigation will depend on extractions. In this study, six different cooking treatments by adding salt, coconut oil, coconut milk and spices individually or as a combination, were compared with the raw extract. At the same time the raw extract was obtained with three different solvents (ethanol, chloroform, distilled water) and two different extraction methods (blending and ultra-sonication) to compare the effect of extraction conditions on phytochemical content and antioxidant activity. The initial screening tests showed, positive results for carbohydrates, flavonoids, saponin and steroids. Highest TPC (8.23±0.35 GAE mg/100g), TFC (1.91 ±0.13m g QU /ml), FRAP (11.41 ± 0.08 mg TE/ 100g) and the lowest IC50 for DPPH (0.025 ±0.00 g/ml) values were observed of the cooked samples with coconut milk, salt and spices. The raw extract gave significantly higher values for all the parameters than all the cooking methods compared (TPC=36.16±0.23 GAE mg/100g, 1.08± 0.04 QU mg/ml). Among the extraction solvents, ethanol extract gave the highest TPC, TFC, FRAP and the lowest IC50 values. Ultra-sonication resulted higher TPC values than pulverizing. Both TPC and TFC showed positive correlation with the DPPH radical scavenging activity. It is rich with fiber (4.64±0.84%) and protein (2.34±0.26%). This study concludes that ethanol is the most efficient solvent for phytochemical extraction among the three solvents tested for investigation of bioactive compound profile for further studies while ultra-sonication being the best extraction technique. The raw form is rich with bioactive compounds cooking with coconut milk which is the most used preparation method, revealed to be the best in preserving the potential health benefits.

Keywords: Antioxidant, *Duplazum esculentum*, Phytochemical Screening, TFC

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Physical Sciences & Technology

Evaluation of Cross-Contamination of Unlined Metal Cans with Fire Debris Containing Petrol

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Metal cans are one of the regularly utilized containers for fire debris sampling. When lined cans are used, co-extraction of interfering compounds from the can's lining may cause false data interpretation. Accordingly, unlined metal cans are recommended to avoid this potential problem. Since unlined metal cans are not vapor tight, heavy loaded volatile matter can escape easily and even trace quantities can leak during the extraction procedure. Therefore, this research was carried out (a) to examine the potential cross-contamination and (b) to interpret data correctly when such cross contaminations occur through unlined metal cans. Volatile compounds were solvent extracted using heated passive headspace adsorption by charcoal strips followed by acetone. Analyses were done using gas chromatography/mass spectrometry (GC/MS) and the data were interpreted was carried out by visual comparison of the total ion chromatograms or extracted ion profiling (EIP), considering target compounds concerning the reference chromatogram. Petrol-free cans, which were kept closely with cans containing known volumes of spiked petrol from 1 μL – 50 μL, eluted all the target compounds. But the eluting patterns of chromatograms were different from reference petrol. Typically, 1,2,4-trimethylbenzene is the prominent peak of the reference petrol chromatogram. In cross contaminations, the co-eluting peak of 1-ethyl-3-methylbenzene/1-ethyl-4-methylbenzene appeared tallest, which is second prominent peak in the reference located in the castle group, at low quantities of spiked petrol samples. Considering high quantities of spiked petrol samples, both co-eluting peak and 1,2,4-trimethylbenzene appeared with almost the same peak heights or prominent peak height for the 1,2,4-Trimethylbenzene. Therefore, misinterpreting of false-positive results can be avoided by examining these pattern distortions. Further, comparison samples should be examined for background interference prior to concluding as cross-contamination since they can distort peak patterns.

Keywords: Arson, Castle group, Fire Debris, GC/MS, Interferences

Identifying Intrinsic Parameters Using Orbital Properties of Cataclysmic Variable Stars

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A theoretical study of the mass transfer process of non-magnetic cataclysmic variable (CV) stars was carried out. 11 CV systems were selected in different subcategories of CVs and the orbital period analyzing process was performed using both Fourier and Lomb-Scargle algorithms to determine which algorithm generated the best results of periodicity for the obtained light curves of these selected samples. The percentage error of the determination of the orbital period for both algorithms was discussed. The calculated orbital periods of the above sample of CVs were then used for the determination of the mean temperature of the accretion disks of these CVs by using the techniques explained in spectroscopic Balmer emission lines and Stromgren photometry observations. Finally, a correlation was obtained between mass transfer rates which were determined using various techniques and algorithms and the mean temperature of the accretion disk.

Keywords: Accretion Disk, Cataclysmic Variable Stars, Mass Transfer Rate, Orbital Periods

Application of Wheatstone and Maxwell's Bridges to Detect Security Fence Breakdown Positions

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Electric fences have long been used for herding animals such as horses around the world. In Sri Lanka, such electric fences can be seen widely used to prevent human-animal conflicts, especially with regard to elephants. Although these fences show a stronghold in restricting the animals, few of them are able to overcome the weaknesses associated with them. The main reason for such weakness is the use of insulating material such as wood logs when arranging the fences. Therefore, it is necessary to identify an alternative method to inform the people living near the fences when there is a breach in the fence. To address this issue, this study focuses on identifying the areas which can improve the work of the fence. For this purpose, a change in the impedance due to a breach of a fence post was considered. To detect such changes in the impedance, Wheatstone and its modified concepts known as Maxwell's bridge were used. As the animal activity breaches the fence post, it creates an unbalance in the bridge circuit which can be amplified as a signal to inform the people. To investigate the matter, this study set up a dummy fence and used it with breach and un-breach situations along with the impact of the distance between fence posts. Results show that even a small act on the physical breakdown of the fence is able to generate detectable impedance unbalance in the circuit. In addition, to obtain such results, the only modification needed to be done is the installation of a few circuitries in the energizer hut.

Keywords: Electrical Fence, Wheatstone Bridge, Maxwell's Bridge

Further Enhancement of Physical Properties of Unglazed Traditional Cookware

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Red clay is one of the cheapest types of clay commonly found in Sri Lanka. The potsherds and roof tile pieces unearthed all over the island, bear witness to the use of clay for various purposes in the past. The present study explores the possibility of using the fillers and fluxes treated with red clay for the preparation of cookware and tiles. Eight samples of the traditional earthenware were prepared with different compositions. The first three samples were prepared using 15 wt%, 20 wt% and 25 wt% of red clay. Among the prepared three samples, 15 wt% red clay sample found to be best for further studies for improvement of physical properties. The optimized sample was treated with fillers and fluxes of fumed silica, alumina, talc, rice husk ash, and calcite to investigate their physical properties such as density, viscosity, thickness, particle size, drying or firing shrinkage, firing color, loss on ignition, water absorption, and modulus of rupture. It was found that all fillers and fluxes could be used to improve certain important properties of red clay. The optimum firing temperature for all the samples was 800 ^{o}C. Results of this study show that all the physical properties of earthenware and tiles have been enhanced comparable with other similar high-quality materials. Findings of this study hence useful for production of quality cookware and tiles for domestic and exportation purposes.

Keywords: Fillers, Fluxes, Physical Properties, Red Clay

Utilization of Polyethylene Terephthalate Dust and Wastewater Sludge as Eco-Brick Materials

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Finding a solution for wastes is a crucial point in the industrial sector. This study is mainly focused to find an effective solution for wastes; polyethylene terephthalate (PETE/PET) plastic dust and sludge that are generated from plastic recycling process in Eco-Spindles (Pvt) Ltd by developing an eco-brick as a construction material to prevent the environmental impacts. In this recycling process, the PET-based plastic dust and wastewater sludge are produced. Different mixing ratios of PET-plastic dust and sludge respectively ranging from 250g to 400g and from 50g to 250g, were used to prepare eco-bricks by using same amount of cement and sand (i.e., each 500g). The prepared bricks were tested to identify the mechanical properties; compressive strength and the physical properties; density, water absorption and linear expansion. Of the eco-brick samples tested, the highest compressive strength was recorded of the brick with 17% (i.e., 250g) of PET plastic dust and 14% (i.e., 200g) of sludge after curing age of 28 days. The highest density was in the brick with 17% of PET plastic dust and 14% of sludge. The brick prepared using the mixing ratio of 17% of PET plastic dust and 14% of sludge showed the lowest water absorption. The highest water absorption was recorded for the brick with the mixing ratio of 28% (i.e., 400g) plastic dust and 3% (i.e., 50g) sludge and there is no significant variation of linear expansion of brick. And also, there is a strong negative linear relationship between compressive strength of bricks and water absorption. The carbon uptake of bricks was ranged from 3% to 5%, thereby showing carbon storing potential. So, the brick prepared using 17% of PET plastic dust and 14% of sludge can be identified as the most suitable eco-brick for the construction purposes while enhancing green building concepts.

Keywords: Environmental Impacts, PET Plastic Dust, Plastic Recycling Process, Wastes

Binding of Amoxicillin to Hemoglobin

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Hemoglobin is responsible for transporting oxygen throughout the body. Because of the enormous molecular weight and the structure of hemoglobin, there could be a possibility that a certain drug will not be reversibly released from the Hemoglobin molecule once bound. Because of its size, such a Hemoglobin bound drug will form a complex that will be unable to diffuse through blood arteries. As a result, the free concentration of the drug may be affected. The goal of this study is to determine the Amoxicillin binding capacity to Hemoglobin and to predict the free dug availability for pharmacological action. Equal volumes of amoxicillin (0.8 mg/mL) and Hemoglobin (4 mg/mL) in pH 7.4 buffer were mixed and incubated at 37 °C for 1,2,3 and 6 hours. A 1 ml sample of the incubated reaction mixture was dialyzed (14-12 kDa), against pH 7.4 buffer solution for three hours. The concentration of Amoxicillin in the dialysate was measured using High-Performance Liquid Chromatography. The concentration of amoxicillin in the dialysate was constant from 1 to 6 hours indicating that the amount of amoxicillin bound to the Hemoglobin was maximum at 1 hour and was a constant throughout. Since the initial drug concentration was sufficient to saturate the Hemoglobin, the ratio of the bound drug to the unbound drug was 1: 13. Further computations of the moles of bound drug and initial moles of hemoglobin revealed that two Amoxicillin molecules were bound to one Hemoglobin molecule confirming that Hemoglobin has two binding sites for amoxicillin.

Keywords: Amoxicillin, Drug Binding, Hemoglobin

Determination of Persistence Capacity of Kerosene on Different Fabrics

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In arson crime, petroleum derivatives are often used as fire accelerants. Common accelerants available are gasoline, diesel, and kerosene, which are highly used for setting a fire crime because, they are cheap, easily ignite and highly available in the market. The most common fire crime, ignitable liquids are used to accelerate the fire and spread it in the considerable area to commit a crime. Kerosene is one of the most used accelerant in arson crimes in Sri Lanka because, kerosene has low flash points, and therefore usually they are evaporate quickly and is easy for flammability. During the intentional fire, small amount of used ignitable liquid may be splashed on the arsonist's clothes, shoes and gloves etc. Therefore, the presences of ignitable liquids on these evidence can be considered robust to conform to the arsonist responsible for fire crime. This research aims to determine how the persistence of kerosene residues on the perpetrator's clothes could help investigate fire crimes and prove beneficial for forensic cases. Therefore in this study, the persistence of kerosene residues on commonly used two different types of fabrics (cotton and polyester) is investigated. Samples were prepared by spiking four different volumes of kerosene (10, 30, 50 and 100 μl) on the fabric. After that, these samples were kept to expose to air to evaporate in a controlled period (up to three weeks) at room temperature. Next, extraction and characterization of kerosene residue from test samples were conducted via passive headspace extraction and gas chromatography-mass spectrometry method, respectively. Further, kerosene residues were detected in cotton and polyester fabric samples after up to 24 and 16 hours of drying for 100 μl. The obtained results showed that the persistence capacity of kerosene is higher on cotton fabric than the polyester fabric.

Keywords: Arson, Kerosene, Fabric, Gas Chromatography-Mass Spectrometry, Passive Headspace Extraction

Effect of Different Roasting Temperatures on the Quality of Instant Coffee Cubes Production from *Coffea robusta*

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Coffee is one of the most widely consumed beverages around the world. *Coffea arabica* and *Coffea robusta* are the two common coffee varieties that have grown in commercial production and both of them are differed distinctly in flavor, caffeine contents and other phytochemical compounds such as chlorogenic acid and antioxidants, which are having beneficial properties and allowed coffee to be a functional food. This study aimed to determine the effect of temperature and time profile of roasting on the quality of instant coffee cubes prepared from *Coffea robusta*s and to determine the appropriate treatment (roasting time-temperature combination) out of the three treatments to obtain the best instant coffee cube. Several important phytochemical parameters, shelf life and sensory attributes were evaluated after the production of instant coffee cubes using Association of Official Analytical Collaboration (AOAC) standard methods, Sri Lanka Standards (SLS) 516 and using 30 untrained panelists with a 9-point hedonic scale respectively. Output from the three treatments; Treatment 1: roasting temperature of 80°C for 45 minutes, Treatment 2: roasting temperature of 140°C for 30 minutes and Treatment 3: roasting temperature of 220°C for 10 minutes showed significant impact on some parameters. The treatment of roasted temperature at 220°C for 10 minutes was the best treatment to produce instant coffee cube with higher coffee liquor concentration converted from higher fat content of 12.15%, with least water activity of 0.7574, comparatively higher caffeine content of 2.21%, carbohydrates content of 63.46%, water activity 0.7574, pH of 5.58; Total Soluble Solids 34. However instant coffee cubes produced from the third treatment (at 220°C for 10 minutes) had low antioxidant activity and low Chlorogenic acid content of 0.88±0.4 compared to the other treatments although sensory panelists prefer instant coffee cubes made from the third treatment which have better shelf life attributes.

Keywords: Coffee Cube, Freeze-Dried, Functional Beverage, Instant Coffee, Roasting

Detection of Adulteration in Food Using Spectrometric Sensor

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Food is essential for a human being to survive. Therefore, for safe consumption, the quality of the food is important. Due to the ever-increasing demand for food products, adulteration is a very common process for gaining extra profit. Liquid foods, such as milk, honey, wines, fruit juices, and other cheap liquids are easily mixed with adulterants. Artificial liquid foods prepared accordingly hinder the natural quality of food, but seem to be real products. Therefore, by following a wide range of laboratory methods, experts can identify adulterants and even estimate the amount of adulterant and compound composition. But all these detection methods are not easy to use, time-consuming and expensive. In the modern era, research papers in this particular field have shown that different types of spectroscopy and different techniques operated at a vast range of wavelengths have been used to identify contaminants in liquid products. But, recent studies have also focused on the development of low-cost portable devices to detect food mixing in field conditions and to obtain qualitative results in product composition. Accordingly, in this work, an AS7265x sensor with a spectrometric concept was used to detect impurities in liquid products. This multi-spectral sensor can detect spectra ranging from Visible to NIR and can detect any change in the spectrometric profile against the original profile recorded in the system for qualitative analysis of the liquid food samples such as juice, honey, and dairy products. So, the consumer can identify the quality of the food product in advance.

Keywords: Liquid Samples, Adulterations, Spectrometric Sensor

Temperature Guidance to Utilize the Rice Production of Specific Districts in Sri Lanka

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Rice is the most common staple food in Sri Lanka, and rice cultivation is one of the country's main industries, with a significant impact focused in a few large regions. Rice production is fraught with environmental, economic, and social issues in Sri Lanka. One of the driving factors that directly impact rice production is temperature. Temperature guidance was generated utilizing numerical weather prediction (NWP) data and the R programming language using multiple linear regression as a technique to provide temperature forecasts. Linear regression analysis, innovative trend analysis, and the modified Mann-Kendal test were used to do trend analysis individually for the districts of Anuradhapura, Kurunagala, and Ampara, that were having a substantial impact on rice production.A trend analysis of average, maximum, and minimum temperature and rice harvest over the previous 30 years has indicated some positive correlations. These findings will be useful in future research when developing temperature guidelines for districts that follow the above-mentioned guidance-making technique.

Keywords: Temperature, Weather Forecasting, Rice Harvest, Trend Analysis

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Natural Sciences & Environmental Conservation

Potential of School Children as Active Participants in Biodiversity Conservation; A Case Study from Bandarawela Education Zone

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Global biodiversity is in danger due to anthropogenic threats causing an accelerated loss of species. Conservation education plays a key role in combatting biodiversity loss, urging the need to engage communities including school children in biodiversity education and participatory conservation. Various stakeholders have already begun such initiatives, which have seldom been built into the school education system. Hence the present study intended to examine the knowledge on biodiversity and conservation of school children in the Bandarawela Education Zone. Our questionnaire survey involving eight schools representing both Sinhala and Tamil mediums of instructions (n=155; 85 Sinhala and 70 Tamil), revealed a low level of interest in biodiversity among children, especially on flora (6.5%). However, most of them have a particular species of interest (63.2%), but 27.1% represent interests in non-native species). A review of the current school curriculum for children aged 12-15 years in Sri Lanka revealed only less than 3% of contact hours on biodiversity and conservation education, whereas students of advanced level biology stream aged 16-18 years have 46.7% of the same. The only noteworthy extracurricular activity that involves biodiversity conservation was the "Environment Pioneers" program. Interviews on extracurricular conservation education/training opportunities provided by external stakeholders revealed a lack of attention on the study area, despite their long-term involvements elsewhere, especially around major cities. The ability to improve school children's knowledge on biodiversity and conservation through a one-day tailor-made awareness program was evaluated with the comparison of means between pre- and post-test scores (Paired sample t-test). Pre-test results showed a poor (only 35%) biodiversity and conservation consciousness among school children, while the perceptions on biodiversity among Sinhala and Tamil medium students were different. The t-test revealed that a one-day training program is not capable of improving these conditions (with significant reduction of marks in post-test; p=0.036), suggesting the need for long-term actions to enhance their conservation literacy.

Keywords: Conservation Education, School Children, Education System, External Stakeholders, Environmental Consciousness, Conservation Literacy

Taxonomy of Lichenicolous Fungi Isolated from Selected Lichen Species in Belihuloya

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Lichenicolous fungi are the parasitic fungi that only lives on the lichen thallus. Sometime these lichenicolous fungi can reduce the relative growth rates of the lichen thallus. In this study, lichenicolous fungi were isolated and identified from selected lichen species in Belihuloya area. Wangedigala and Paraviyangala are the sample collecting areas which have identical climatic features for lichen growth. Both Wangedigala and Paraviyangala forest areas were mostly covered with *Pinus* vegetation. So almost all the lichen samples were collected from bark of the *Pinus* trees and from the rock surfaces. Most of the collected lichen samples were *Parmotrema sp.* and crustose lichens. Oddly color spots, Discolorations of the thallus and gall like structures were helped to identify lichenicolous fungi on the lichens in the field. Potato Dextrose Agar was used as a culture media and direct plate method were used to inoculate the fungi fruiting bodies and fungal hyphae. When using fungal hyphae, sterilized needle was used to inoculate with the help of dissecting microscope. Before using fungal fruiting bodies for inoculation, surface sterilization was done with 70% ethanol solution. Macro morphological characters of the fungal colonies were used for species identification of lichenicolous fungi. Fifteen different species of lichenicolous fungi were identified from the collected lichen samples based on colony characters, indicating they are very successful in Belihuloya area. All species of fungi are slow growers in the culture media and these parasitic fungi has degraded some host lichen species to a level that lichen was unidentifiable.

Keywords: Parasitic Fungi, Potato Dextrose Agar, Host Lichen, Direct Plate Method

Impacts of Clear-cutting in a *Pinus* Plantation Within the Nonpareil Area of Belihuloya, in the Southern Intermediate Zone, Sri Lanka

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Clear-cutting can be recognized as an economical way of timber harvesting in terms of profit and time-saving. Simultaneously, the rapid change within any ecosystem caused by the removal of entire vegetation causes serious environmental problems. Thus, the study was carried out to determine the key consequences of a post-clearcutting scenario (on aspects such as regeneration, soil erosion, and carbon storage). The study area, "Perawaththa Pinus Plantation" underwent a clear-cut during the period from 2014 to 2016. The study area is a sloppy land in the Nonpareil area in Belihuloya within the Mid country Southern Intermediate zone of Sri Lanka. After the clear-cutting, the Forest Department has planted native plant species and together with an exotic *Eucalyptus sp.* with the intention of converting the needle-leaf Pinus plantation forest into a broadleaf forest. However, the study found that natural regeneration of the exotic *Pinus caribaea* (as original stand) outperformed the supported attempt at restoring native broadleaf species, resulting in *P. caribaea* dominating the area (% of regenerating plants) after five years of clear-cutting. The growth rate of *P. caribaea* was calculated as 1.68cm in diameter per year based on the DBH increment. Plot data represents 16 plant species regenerating in the area after the clear-cut belonging to 10 plant families, representing 9 introduced species (incl. *Eucalyptus sp.*) and 7 species that are regenerating naturally (incl. *P. caribaea*). The mean annual soil erosion was calculated by employing the InVEST SDR model, and it has increased from 3.1 tons·ha^{-1}·yr^{-1} to 423.8 tons·ha^{-1}·yr^{-1} in the post clear-cut scenario. The mean value of carbon storage determined using the InVEST carbon model, also changed dramatically from 253.7 tons·ha^{-1} to 27 tons·ha^{-1} respectively, in between the years of 2013 and 2017. The findings of the study provide on the ground impacts of clear-cutting, which should be validated with multiple sampling sites and used for decision and policy-making in plantation forest management.

Keywords: Clear-Cutting, Regeneration, Soil Erosion, InVEST (SDR Model; Carbon Model), Nonpareil

Estimation of Soil Erosion in Samanalawewa Watershed and its Sensitivities to Land Use and Climate Variables

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Soil erosion is one of the most important environmental concerns faced by the world today, and it seriously compromised the fate of human societies and the achievement of sustainable development goals that ensure human and environmental well-being. Numerous factors affect soil erosion, while human-induced changes in climate (rainfall and temperature) and land use land cover (LULC) changes are the most important driving forces. Assessing soil erosion and understanding the impacts of climate variables and LULC changes on soil erosion are crucial for the watershed management. Thus, this study used the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST 3.9.2) Sediment Delivery Ratio (SDR) model which was introduced by the National Capital (NatCap) Project in collaboration with the Stanford University – USA to assess soil erosion in the Samanalawewa watershed (SW), in Sri Lanka and its eight sub-watersheds, over 20 years (2000-2020) with five-year time intervals. Further, the Pearson correlation test was used to establish the relationships between climate variables, LULC changes, and soil erosion of the SW watershed. The estimated mean annual soil erosion rates were 53.2, 52.9, 69.7, 87.7, and 70.2 t ha^{-1}year^{-1} for the years 2000, 2005, 2010, 2015, and 2020 respectively. Estimated soil loss values of the SW are 10 to 18 times greater than the soil erosion tolerance (5 t ha^{-1}year^{-1}) in Sri Lanka. Correlation analysis disclosed that there is a significant correlation ($p < 0.05$) between soil erosion and two driving forces viz. temperature and LULC changes (mean annual temperature and forest cover in the watershed has slightly increased over time). These results would help in formulating watershed management policies and the implementation of proper soil and water conservation measures in the watershed.

Keywords: Climate Change, InVEST-SDR Model, LULC, Samanalawewa Watershed, Soil Erosion

Effects of the Fungicide Tebuconazole on Leaf Litter Decomposition in Agricultural Streams: A Microcosm Study

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Fungicides have the potential to deleteriously affect the non-targeted aquatic microbial communities, macroinvertebrates communities and key ecosystem processes such as litter decomposition, nutrient recycling. Tebuconazole (TBZ) is a commonly used fungicide in agricultural areas in Sri Lanka. Although a few research looked at how other fungicides affected decomposer communities and aquatic ecosystem processes including leaf litter decomposition, there were no studies on Tebuconazole's effects on stream ecosystems. The present study aimed at investigating the effects of TBZ on *Terminalia arjuna* decomposition in tropical streams. A 40-day indoor microcosm study was conducted to evaluate the leaf litter breakdown rate of *Terminalia arjuna* subjected to TBZ concentrations of 0.1mg/L, 1mg/L and control tanks with dechlorinated water. The leaf Decomposition Rates (DR) were analysed using the %Dry weight reduction (%DWR) and %organic matter reduction (%OMR) using ANCOVA keeping time as a covariate in microcosms. Dunnett's post hoc test was used to determine the significant differences among treated and control channels. The results indicated that there was a lower decay coefficient (k) for TBZ treated leaf packs in comparison to control leaf packs (k control: $-0.0104\pm0.0005>$ k 0.1mg/L: $-0.0093\pm0.0007>$ k 1mg/L: -0.0087 ± 0.0002), suggesting a delay in DR when exposed to TBZ contamination. There was a significant reduction of % dry weight in control tanks in comparison to treatment tanks ($p<0.05$) while no significant difference ($p>0.05$) of %OMR among the leaf packs in treated and control tanks. The finding of the study suggests that the fungicide TBZ can harm the non-target aquatic fungi which are not resistant to TBZ contamination thus affecting the leaf litter decomposition process. A high concentration of TBZ exposure suppresses the leaf litter decomposition process.

Keywords: Tebuconazole, Litter decomposition, Agricultural Streams, Aquatic Fungi

A Case Study of the Waste Flow Analysis and Resource Optimization strategies in Selected Textile and Apparel Industries in Export Processing Zone - Biyagama, Sri Lanka

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The apparel export sector is a significant contributor to the Sri Lankan economy that accounts for a contribution of 32% of the gross domestic production (GDP) in 2018 and 48% of total exports according to 2022 records. However, Sri Lanka's textile and apparel sector generates waste in large quantities. This study aimed at identifying the main waste streams and their average waste generation in Biyagama Export Processing Zone (BEPZ), Sri Lanka. The study also focused on waste characteristics and waste disposal methods implemented in BEPZ. Three different sub-sectors of the textile and apparel industry were selected for the study, which comprised five fabric mills, five garment washing and dyeing plants, and ten apparel manufacturing plants. Questionnaires, interviews, and field observations were used for the data gathering process. Results revealed that the average total waste generation was 2376.42 t/year in a fabric mill, 745.88 t/year in a garment washing and dyeing plant, and 429.38 t/year in an apparel manufacturing plant. The average hazardous waste generation percentages in a fabric mill and a garment washing and dyeing plant were 48% and 78%, respectively. Effluent treatment plant (ETP) sludge was identified as the most common form of waste type in fabric mills and garment washing and dyeing plants. However, fabric and yarn waste were the most common waste type in apparel manufacturing plants. Ninety percent of ETP sludge was incinerated, with the remaining 10% being disposed of in landfills. Fabric and yarn waste are reused, exported for recycling and landfilling in percentages of 30%, 20%, and 50%, respectively. The study identified waste types that have monetary value, in each sub-sector. It was revealed that there are significant opportunities for waste utilization within circular economy prospects.

Keywords: Circular Economy, Waste Disposal, Waste Characteristics

Exotic and Invasive Alien Species of Plants in the Sabaragamuwa University Nature Reserve

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"Sabaragamuwa University Nature Reserve" (SaUNaR) is an institutionally managed protected area especially for watershed protection, which covers an extent of 13.2 Acres (about 10% of the total area of the university premises). This protected area provides different habitats for the rich native biodiversity it possesses. Exotic and invasive alien species (IAS) of plants marks a rapidly increasing threat to the native biodiversity around the world, in fact the second most serious threat to biodiversity according to the Millennium Ecosystem Assessment. Hence, we conducted an opportunistic survey covering the entire watershed area of the SaUNaR to explore exotic and IAS of plants in it. The survey recorded 15 exotic and 8 IAS of plants representing 17 families altogether. Shanon diversity index for exotic and invasive alien species are 1.68 and 2.24 respectively. Those IAS arranged according to their relative abundance in the study area can be given as; *Leucaena leucocephala* (0.33), *Acacia auriculiformis* (0.32), *Clidemia hirta* (0.11), *Panicum maximum* (0.08), *Austroeupatorium inulifolium* (0.07), *Alstonia macrophylla* (0.04), *Lantana camara* (0.03) and *Sphagneticola trilobata* (0.02). The study identifies the urgent need for implementation of a carefully designed IAS management plan that should include complete removal (eradication) by uprooting, hand pulling, or cutting of all above IAS, as all of them show high growth rates and higher level of impacts to native biota in the site. Exotic species found individually with least impact for native biota such as *Cupressus leylandii, Dracaena fragrans, Ficus benjamina, Citrus sp., Salix sp.* and *Artocarpus altilis* are recommended to be remained under surveillance due to their food and shade value for the habitat and/or medicinal and ornamental values for the humanity.

Keywords: Exotic Pants, Invasive Alien Plants, Management Plan, SaUNaR

Diversity of Fungal Taxa Inhabiting on Ground Litter of *Pinus caribaea* Plantations and Adjacent Vegetation in Selected Locations of Belihuloya, Sri Lanka

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Pinus caribaea has a variety of negative effects on local ecosystems. One of the issues related to *P. caribaea* plantations is the low rate of leaf litter decomposition and suppression of undergrowth regeneration. There are studies carried out to discover the causes for this in many countries. However, the number of studies conducted in Sri Lanka is low. The leaf litter decomposition is governed by different factors including microclimate, litter quality, nutrient availability, soil conditions and decomposer community. This study was designed to identify fungal microbial community inhabiting ground litter in *P. caribaea* plantations and determine the effect on undergrowth by comparison with adjacent native vegetation at two locations in Belihuloya. The methodology followed was dilution series prepared by the collected soil samples. Each solution of different concentrations was cultured in Potato Dextrose Agar media and incubated at 28°C. The resulted fungal species were sub cultured under the same temperature. The diversity of fungal species was determined by macroscopic colony culture characteristics. Overall, 16 different fungal species were isolated and identified based on the macroscopic morphological characteristics. Three species were identified as the most abundant species in both vegetation types in both locations. Four species were common to both *Pinus* plantation and adjacent native vegetation. Three species were exclusively identified in the first *Pinus* plantation and two species in the second *Pinus* plantation. The first adjacent native vegetation recorded two species and five species were observed in the second adjacent vegetation. The measured pH values in two vegetation types were acidic which favor a fungal decomposer community. Similarly, soil temperature of both vegetation types ranged between 22°-25°C exerting a positive impact on fungal inhabitation on ground litter. Overall, a considerable diversity of fungal species was observed during the study.

Keywords: Belihuloya, Fungi, Litter Decomposition, Native Vegetation, *Pinus caribaea*

Isolation of Profenofos Degrading Bacteria from Surface Water in Badulla District, Sri Lanka

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Environmental remediation has been used to solve environmental pollution problems effectively and efficiently. Microorganisms can be used in bioremediation processes to remove residual pesticides from the ecosystems. Pesticides have been widely used in agriculture to produce high-yielding, genetically improved crops, in order to achieve the zero hunger goal. However, pesticides indirectly pollute the natural water bodies due to the presence of pesticide residues, and such contaminated water has resulted in acute and chronic health effects. Therefore, this study aimed to find pesticide bioremediation bacteria that are regionally appropriate. In the study, 23 bacterial isolates (isolate 01 to isolate 23) were isolated from collected surface water samples, after being enriched for five days. The tolerance capacity of profenofos was then examined in all bacterial isolates resulting with optimal levels for four isolates (isolate 01, 03, 13, and 18), which were chosen for further investigation. Their pesticide degradation capability at 5-day intervals was determined using GC-MS, while the pesticide resistivity was determined using, a plate count. The results showed that the tolerance capacity of all isolates are not the same. According to the ANOVA followed by the Post Hoc Test, bacterial isolate 03 had a significantly high ability to break down profenofos (45.40% rate within the first 10 days of the study), while isolates 01, 03, 13, and 18 were able to withstand pesticides for 20 days in M9 minimal salt medium (MSM), isolates 01, 13, and 18 were unable to display a deterioration pattern. According to the results, isolate 03 is capable of decomposing profenofos at a high rate, while other isolates are only resistant to the pesticide.

Keywords: Bacteria in Water, Bioremediation, Gas Chromatography-Mass Spectrometry (GC-MS), Profenofos

Assessment of Water Quality in Marine Bathing Sites in Galle District, Sri Lanka

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The coastal area of the Galle District is facing a serious environmental challenge as a result of unwelcome polluting of its seas by various wastes. The overall objective of this study was to determine the current status of water quality along the coastal line in the Galle District, Sri Lanka. Furthermore, an attempt was made to make recommendations for reducing pollution levels. The study was carried out from December 2021 to February 2022, with monthly sampling taking place in a designated coastal area from Benthota to Ahangama. Temperature, pH, turbidity, conductivity, total dissolved solids (TDS), and salinity were measured in situ, and water samples were analyzed in the laboratory using standard procedures to evaluate Nitrate, Phosphate, Total Coliform, and Fecal Coliform levels. The average salinity level (33.95 ppt), Turbidity (2.5 NTU), TDS (23.71 mg/L), Nitrate level (0.03 mg/L), Phosphate level (0.845 mg/L), Total Coliform (27, MPN Index), Fecal Coliform (8.55, MPN Index) were below the maximum allowable limits of the ANZECC guidelines, according to the findings of the coastal water quality tests. Average pH (8.1±0.08) was within the ideal ranges for above standards and an average value determined for Temperature (29.85±0.06 °C) and Electrical Conductivity (50.055 μS/cm) were much higher than the permissible threshold limits. According to the results, some sampling points were indicating the gross organic and inorganic pollution in selected marine bathing sites in Galle District coast. Furthermore, studies needed to assess heavy metal concentrations and monitor monsoon changes. While the community-based awareness programs should be implemented in the future, water quality data should be shared among relevant agencies for management decision-making. The study also recognized the need of implementing a sound management plan that includes coastal water quality monitoring and proper waste collection service.

Keywords: ANZECC, Coliform, Organic Pollution, Water Quality

Utility of Life Cycle Assessment (LCA) for Sustainable Textile Industry

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The textile industry is one of the most influential industries in the world, but one of the most polluting owing to the significant amount of emissions and effluents resulting from the consumption of energy, water and chemicals in considerable amounts. Therefore, it is important to evaluate the environmental impacts of the products and processes in the textile industry. Life cycle assessment (LCA) is a comprehensive and globally standardized approach for evaluating the environmental implications throughout all phases of a life cycle of a product or a process, as outlined by the ISO 14040 family of standard. It was reviewed how applications of LCA have been used for sustainable environmental performance in the textile industry, a majority of studies representing the system boundaries of "cradle to gate" and "gate to gate". The review included globally available published articles from 1999 to 2020 on LCAs of textile products: natural and synthetic, and textile processes: weaving/knitting and dyeing. The findings showed that LCAs of fabrics enable useful comparison of alternative materials and processing methods, highlight trade-offs between production systems, helps as a decision-making tool and ecolabelling, as well as informed consumer choice. The significant environmental impacts of textile products differ according to the materials of fabric, the technology used, and the geography. Although textile industry worldwide has been progressively using LCA since the year 2000, limited data availability and lack of published literature hinder the true utilities of LCA. A Life cycle assessment study could accurately provide a rationale for sustainable choices of products and processes in the textile industry, in contrast to the myths and general conceptions in the industry, which may or may not be accurate. Environmental Management Systems, Eco innovation, Design for Sustainability, and Circular Economy are some of the present day concepts that have led the textile industry to adopt LCA as a viable technique.

Keywords: LCA, Environmental Impact, Sustainability, Textile Products

Evaluation of Success Rate of Trace DNA in Different Sample Types

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DNA analysis has become a prominent intelligence tool in identifying violent criminals in the criminal justice system. Touch DNA is the type of trace evidence found at crime scenes. The donor causes the transfer of the epithelial skin cells by physical contact with other objects, which leaves a trace amount of DNA on surfaces. In this study, cutting out and swabbing methods for sampling trace DNA evidence have been selected. This study was carried out to (a) determine the most effective and accurate ways for sampling the touch DNA evidence and (b) to analyze the success of DNA profiles of different types of touch evidence. The protocol was followed in two ways; the first way was a statistical evaluation of the success of DNA profiles of different types of criminal touch evidence categories analyzed for 2019, 2020, and 2021 years. The percentage of success of positive DNA profiles obtained for food, garment, cigarette buds, slippers, handles of knives, swabs of nails, and other items, was 60%, 80%, 92.59%, 20%, 53.5%, 33.34%, and 44.45%, respectively. Cigarette/"beedi" buds have represented a higher percentage of success in DNA profiles. The second attempt was to identify a better substrate for obtaining the maximum amount of DNA among selected items such as matches, fabric material, and chewing gums. This study proved that fabric material was the best substrate for obtaining the maximum amount of DNA. Then the researchers tried to select a better sampling method for fabric material to obtain the maximum DNA amount. According to quantification results, the cutting out method was the best sampling method out of the two sampling methods of cutting out and swabbing for fabric material. The study evaluated two different sampling techniques to obtain DNA from touch substrate, proving that the sampling method depends on the types of the substrates of touch evidence.

Keywords: Touch DNA, Sampling Methods, Quantification, DNA Profiles

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Sports Sciences
&
Physical Education

Plenary Speech by Professor M. Elayaraja

Physical activity (PA) is considered to be the best '*Pill*' to enhance an active lifestyle. Researchers globally endeavored to formulate strategies that can curb the increasing problem of overweight and obesity. Physical inactivity (PIA) leads to several non-cardiovascular health risks such as high blood pressure, diabetes, arthritis, and cancer, and so on. Unfortunately, it is prevalent among people of all age groups. Embedding active lifestyle habits during childhood and adolescence periods remains remarkable for a healthy transition to adulthood. The overarching question which arises from the discussion is that - despite numerous rewarding health benefits of physical activity '*why*' we often fail to advocate it adequately. After reviewing a mounting of literature internationally, it appears that the dissemination of physical activity is deterred abundantly because of inadequate guidelines, lack of motivation, inaccessibility of facilities, commuting issues, and so on. This presentation will shed light on the mentioned pertinent aspects leveraging a dialogue to decode the paradoxical existing practice in PA - against what WHO actually recommends on how to emulate it. All of the higher education institutions in the field of sport have been considering the course 'Introduction to research in sport sciences' as highly important.

Prof. M. Elayaraja
Department of Physical Education and Sports
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Physical Education & Sports - I

The Mental and Physical Health of the Sri Lankan Professional Esports players

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Esports are the organized, multi-player video games that can be played individually or as teams and with rapidly growing demand around the world. Professional Esports players spend at least 12-14 hours per day on Esports related games. Sitting in front of a screen for long periods can adversely affect their physical and mental health. Therefore, the purpose of this research was to determine the mental health and physical activity level (PAL) of Sri Lankan professional male Esports players. The cross-sectional study was implemented under the quantitative research method. The WHO self-reporting questionnaire 20 (SRQ-20) and the International Physical Activity Questionnaires (IPAQ) were used to collect the data from 216 professional male Esports players (age: 12 to 45 years). Associations were measured and tested using the chi-squared test, and binary logistic regression with a 95% confidence level was used to identify the risk factor for the Common Mental Disorders (CMD). The game type (Multiplayer online battle arena, fighting, tactical shooting, and sports games; $p=0.001$) and PAL ($p=0.007$) is associated with mental health. In contrast, mental health is not associated with age, higher education qualifications and job status ($p>0.05$). In a tactical shooting, Esports players were 3.82 (95% CI; 0.9118, 16.0230) times more likely to be suspicious for CMD than Esports players who play the sports game. In terms of the PAL, player's likelihood of being suspected for CMD occurrence is 1.63 (95% CI; 0.6793, 3.8976) times higher for the inactive player compared to the minimally active player. Furthermore, with each passing year of playing age, the likelihood of an Esports player being suspected of having CMD increases by 0.89 (95% CI; 0.8304, 0.9535) times. This study concludes that Esports has an impact on the level of mental health and physical activity of the participants. It can be suggested that players can minimize the risk of CMD and improve their lives if they follow a healthy lifestyle and regular exercise.

Keywords: Binary Logistic Regression, CMD, Esports, Mental Health, PAL

Mental Training Condition of Female School Carrom Players in the Badulla Education Zone

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Player performance in carrom depends mainly on psychological characteristics. The aim of the present study was to identify the mental training condition of female school carrom players in the Badulla education zone, by evaluating their current performance level and by examining their mental skill and mental technique level. An in-depth literature assessment was conducted to expand the theoretical version and formulate the hypotheses of the study. To accomplish this task, a sample consisting of thirty school carrom players (n = 30; female) was selected from the school carrom players in the Badulla education zone, using the overall population sampling method. A quantitative research design was applied to examine the mental training condition. Improved current performance levels through the ten-piece exercise collection according to the. A test was conducted before identifying the current level of the players followed by a six-week training program to identify their weaknesses and apply them. The test was performed under five age groups viz. under 12 (posttest mean=6.50, pretest mean=2.50), under 14 (posttest mean=7.33, pretest mean=4.33), under 16 (posttest mean=7.50, pretest mean =5.33), under 18 (posttest mean=8.33, pretest mean=3.83) and under 20 (posttest mean=7.33, pretest mean=6.83). A questionnaire survey consisting of 20 questions with two subsections on mental skill and mental technique in 5-point Likert scales was collected from the sample. Mental skill levels were grouped into three subsections: foundation skills, performance skills, interpersonal skills and mental techniques were grouped into two subsections: self-talk and mental imagery. Data were analyzed by using SPSS (version 21) statistical software. The median value for mental skill and mental technique was 4. It is in agreement with the mental training condition. A significant mean difference was found between the pre-test and post-test results of the ten-piece pocket exercise test in the under 12 age category (p=0.002). The study resulted in a novel approach towards the measurement of mental skills in the sport.

Keywords: Carrom, Mental Training, Mental Skill, Sports Performance, Sport Psychology

Effect of Selected Yoga Practices on Mental Health Among Mothers in the Third Trimester of Pregnancy

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Yoga is a spiritual and ascetic discipline, a component of which is commonly practiced for health and relaxation, and includes breath control, basic meditation, and the adoption of precise body postures. Excessive stress, anxiety and depression during pregnancy may cause mental disorders in pregnant women and may inhibit fetus growth and also pregnant mothers suffer from fear of childbirth. This study included 180 pregnant women registered at the Medical Officer of Health (MOH) office at Dehiowita from which thirty (n=30) pregnant mothers aged 19–35 years, in the third trimester of pregnancy from week 27 to the end of the pregnancy, were selected for this study under the purposive sampling method. Under the guidance of yoga experts, the researcher provided eight weeks of yoga instructions and yoga practices to the experimental group, three days a week, each session for a duration of 50 min. A post-test was conducted after eight weeks of the yoga training program. Depression, Anxiety, and Stress Scale DASS-21 was used to collect the data. Data were analyzed using the Wilcoxon's test. The results showed that there was a significant difference (p=0.000) in stress levels, anxiety levels and depression levels before and after intervention in the selected sample. The mean values of stress, anxiety and depression were recorded as 23.73 and 14.93, 14.86 and 7.93 and 14.96 and 7.44, before and after treatment respectively. It can be concluded that a reduction in stress, anxiety, and depression levels among pregnant women in their third trimester can be achieved as a result of yoga activities since the pre-test and post- test results of this study show a significant difference.

Keywords: Stress, Anxiety, Depression, Pregnant Women, Yoga Practices

The Impact of Yogic Therapy on Cardiovascular Disease Patients

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Yoga is qualitatively different from any other mode of physical activity in that it consists of a unique combination of muscular contractions, stretching exercises, relaxation techniques, and breathing exercises. Few scientific studies have been conducted about the effect of yoga on biomechanical variables like lipid profile and blood pressure. This study included 100 male patients with cardiovascular disease (hypertensive) who were registered at divisional hospital Pambahinna as a total sample. From that total sample, thirty (N= 30) patients (age group 50-60 years) were selected for this study under the random sampling method. Under the instructions of yoga experts, the researcher gave eight weeks of yoga instruction and yoga practices to the experimental group, three days a week for 50-60 min each session. A post-test was conducted after eight weeks of the yoga training program. Selected variables such as lipid profile and Blood pressure were measured to collect the data. Data were analyzed using the Wilcoxon's test. The results showed that there was a significant difference in lipid profile and blood pressure levels before and after intervention in the selected sample. The results have shown that the mean Total Cholesterol (TC) was 203.13mg/dl and 181.86mg/dl, the mean High density Lipoproteins (HDL) was 40.46mg/dl and 49.53 mg/dl, the mean Low density Lipoproteins (LDL) was 153.86mg/dl and 128.16mg/dl, the mean Triglycerides (TG) was 179.13mg/dl and 148.12mg/dl, the mean of systolic blood pressure and diastolic blood pressure 148.56mm Hg, 136.26mm Hg and 88.76mm Hg and 77.46mm Hg before and after treatment respectively. Finally, it can be concluded that the pre-test and post-test results of this study show a significant difference as well as it has shown a positive impact of yogic therapy on cardiovascular disease patients.

Keywords: Yoga, Blood Pressure, Cardiovascular Disease Patients, Lipid Profile

Impact of Playing Chess on the Development of Cognitive Skills in Schools Students Under the Chess Association of Ampara District

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The primary purpose of this research was to evaluate the impact of playing chess on the development of cognitive skills in school students being trained under the chess association of Ampara district. A quantitative research approach was followed to analyze the cognitive skill of the school students under the chess association of Ampara district and to identify the strategies of the chess players and coaches to improvise the impact of playing chess among the selected school students. The sample consists of 30 male students in each, the Control Group (CG) and the Experimental Group (EG), studying in grades 6-8. All of the students were given an IQ test consisting of 25 questions for the pre-test exam. After that, only the students in the EG students participated in the chess practice program and again both groups were given the same IQ test paper with a changed order of questions compared to the pre-test exam paper. Statistical analysis of data revealed that the students in the control group and the experimental group achieved 50.13 and 51.47 as the average marks respectively, in the pre-test exam. In the post-test exam, students in the control group achieved 51.20 as average marks while the students in the experimental group achieved 64.27 as average marks. Based on the results, there is a significant improvement ($p=0.000$) in the cognitive skills of the experimental group after the chess training and there is no significant improvement ($p=0.174$) in the cognitive skills in the control group. The results indicate the improvement in the cognitive skills of the students who are playing chess compared to the normal school students. Hence, the impact of playing chess on the development of cognitive skills in schools being trained under the chess association of Ampara district can be identified from the study.

Keywords: Chess, Cognitive Skills, School Students

Sport Sciences & Management - I

Relationship Between Selected Anthropometric Parameters and 50m Freestyle Swimming Time in Teenage Swimmers

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Swimming is an Olympic sport which is a very popular endurance development activity around the world. Anthropometry is one of the main factors that influences the swimming performance of teenagers. This study aimed to examine the relationship between selected anthropometric parameters and 50 m freestyle swimming time in teenage swimmers. The sample was thirty (n=30) provincial level male swimmers aged 13-17 years. Their body weight, height and BMI were 35.0 - 96.5 Kg, 136.0 - 181.9 cm and 21.81 Kgm^{-2} respectively. The dependent variable was 50 m freestyle swimming time and the independent variable was anthropometric parameters viz. body weight, height, length measurements (upper arm, lower arm, hand, upper leg, lower leg, foot, arm span), circumference (chest, abdomen) and skinfold measurements (bicep girth, triceps girth). Data were collected from 50 m freestyle swimming race and measuring thirteen anthropometric parameter sites of the body. Stadiometer, digital weighing scale, skinfold caliper, measuring tape and stop watch were used as measuring instruments. Pearson correlation coefficient in SPSS (version 26.0) was applied to determine the relationship between 50 m freestyle swimming time and anthropometric parameters of sample swimmers at 0.05 level of significance. The results revealed that the mean values of swimming time, body weight and height were 39.9±7.30 seconds, 57.65±15.91 Kg and 162.56±9.74 cm respectively. The body weight (r=0.376, p=0.041), height (r=0.375, p=0.041) and hand length (r=0.397, p=0.030) showed a significant positive moderate correlation with 50 m freestyle swimming time. There was no significant relationship between the 50 m freestyle swimming time with upper arm length, lower arm length, upper leg length, lower leg length, foot length, arm span, chest and abdominal circumference, bicep and triceps girth. The study concludes that the anthropometric parameters influence the swimming time of the teenage male swimmers and they have to manage their anthropometric parameters of the body related to the sport for improved performance.

Keywords: Anthropometric, Freestyle, Swimming, Teenage Male Swimmers

Relationship Between Quadriceps Angle, Body Parameters, and Occurrence of Lower Extremity Injuries of Sri Lankan National Level Athletes

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Both intrinsic and extrinsic factors may be the reason for sports injuries. This study aimed to identify the association of some intrinsic factors for injuries by studying the relationship between Quadriceps (Q) angles with body parameters (Gender, height, weight), the occurrence of lower extremity injuries, and contributing factors to the Q angle (femoral anteversion, tibial torsion, and genu valgum) among National level athletes in Sri Lanka. The study was conducted at the Institute of Sports Medicine, Colombo, Sri Lanka. The study sample consisted of national-level male and female athletes with injuries (n=17) and without injuries (n=16) to lower limbs. Athletes who had recent acute lower limb injuries were excluded from the study. Consent was obtained from the study participants by explaining the investigation procedure before conducting the tests and measurements. Body height, body weight, and Q angle of both limbs were measured using a stadiometer, electrical weighing scale, and goniometer respectively. Three clinical tests were done to identify the femoral anteversion, tibial torsion, and genu valgum of both limbs of injured and non-injured athletes. Data were collected from January to February 2022. According to the results, there is no significant difference between the Q angle of injured (Injured limb p=0.776, non-injured limb p=0.739) and non-injured (Right p=0.974, Left p=0.786) athletes' reference to the gender. There is a significant negative correlation between the Q angle and body height of both genders in spite of having injuries. Though there is no significant mean difference of Q angles between injured and non-injured limbs of males (p= 0.171), there is a significant mean difference of Q angle between injured and non-injured limbs of females (p= 0.013). There is a positive significant correlation between Q angle and femoral anteversion, tibial torsion, and genu valgum in both injured and non-injured athletes. It may be concluded that height, femoral anteversion, tibial torsion, and genu valgum had an impact on the magnitude of Q-angle. Females are more prone to have lower limb injury occurrences than males because of their higher Q angles than males.

Keywords: Quadricep Angle, Femoral Anteversion, Tibial Torsion, Genu Valgum

The Effect of Movement Pattern in Flight Phase for Long Jump Performance

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The long jump is an athletic event consisting of four phases viz. approach, take off, flight and landing. Three techniques are mainly used in long jump and they have different air dynamics. The purpose of the study was to find out the body surface area change with the time during the long jump flight phase and how it affects the performance. The data were collected from six national senior male long jumpers in Sri Lanka at the national trials in 2022. Two best performers were selected from each three techniques. Their performances were recorded in the frontal and sagittal planes using two cameras (50Hz). The coordinates of each athlete's center of gravity were analyzed for each frame from start with take-off to landing phase using the Kinovea (version 0.9.3) software and surface area was calculated using Adobe Photoshop (version 2020). Hence, the area of particular position can be calculated using pixel ratio. The space calibration was completed from frontal plane and sagittal planes separately. The Frontal surfaces of jumpers were calculated. The correlations between performance and surface area in the flight phase was analyzed using the Pearson correlation method in SPSS (version 28.0.1.1) statistical software. According to the results, the changes of surface area and the performances of three techniques were significantly different (p<0.05) with a negative correlation. Therefore, surface area of athlete body in flight phase is inversely proportional to the long jump performance for the 21 positions of entire 50 frames of the movement pattern at the points of 0.06T, 0.11T, 0.17T, 0.26T, 0.43T, 0.51T, 0.54T, 0.57T, 0.6T, 0.66T, 0.71T, 0.74T, 0.77T, 0.8T, 0.83T, 0.85T, 0.88T, 0.91T, 0.94T, 0.97T and 0.98T (where, T is the flight time) for each technique. Therefore, the long jumpers have to minimize surface area of the body on frontal plane to optimize their performances.

Keywords: Aerodynamics, Frontal, Surface Area, Long Jump

The Comparison of Different Training Methods to Enhance the Body Composition of Recreationally Trained Male Athletes

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Numerous training methods exist for recreation activities to optimize body composition. The present study aimed to analyze the influence of different training methods to enhance the body composition of recreationally trained athletes. Each group consisted of eight recreational athletes. The pre and post-tests were done within the first and the sixth week of the study period. Blood composition variables viz. High-Density lipoprotein (HDL), Low-Density Lipoprotein (LDL), Very-low-Density Lipoprotein (VLDL), Glucose (G), and Hemoglobin Total Cholesterol (TC), and explosive strength parameters viz. takeoff velocity (V), flight time (FT), force (F), and jump height (JH) were measured by the My jump 2 app during pre and post-test. A two-way mixed analysis of variance with repeated measures and Bonferroni post hoc test were used to investigate the interaction effect and significant differences. Among all blood variables measured only HDL: $F_{(1,14)} = 10.74$, showed a significant difference ($p < 0.05$) between groups and TC: $F_{(1,14)} = 4.31$, $p > 0.05$; HDL: $F_{(1,14)} = 12.996$, $p > 0.05$ and G: $F_{(1,14)} = 5.802$, $p > 0.05$ showed within-group significant differences following HRC. Interestingly, non-significant differences between groups were identified for explosive strength variables, but all variables had significant differences ($p > 0.05$) within-group (pre-post) following both training methods. Overall, these observations imply that enhancing HDL, TC, and G levels in the blood HRC training method is better than PT. On the other hand, each training protocol can induce similar explosive strength adaptations after 6 weeks of HRC and PT training under the different duration of training sessions.

Keywords: Body Composition, Plyometric, High-Intensity Resistance Circuit, Explosive Strength, Blood Composition

Effect of Plyometric Training Volume to Develop the Explosive Power on Horizontal Jump Athletes

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Jumpers must possess a combination of speed and strength as well as a high level of explosive power due to the high-intensity effort of the event. The aim of this study was to evaluate the effect of plyometric training (PT) volume (Low Volume vs High Volume) to develop the explosive power on horizontal jumpers (Long and Triple jump). Twenty male horizontal jumpers were randomly divided into four treatment groups: LJLV- (n=5), LJHV- (n= 5), and TJLV- (n=5), TLHV- (n=5) with age (18.5 $\pm$ 2 years), height (178 $\pm$ 3cm), and bodyweight (64 $\pm$ 5kg). All treatment groups underwent 3 days per week of plyometric training (PT) intervention for a duration of 6 weeks, the volumes were ranging from low to high. The jumping height, flight time, force, and velocity were assessed at the intervals of week number two, four, and six using the MY JUMP 2 (v. 2.2.3) mobile app, and the results were analyzed using a two-way mixed ANOVA with repeated measures. The mean differences were detected from the Bonferroni post hoc (BPH) test. Significant differences ($p<0.05$) were revealed between the groups at each time for all variables, and the main effect of group was significantly different ($p<0.05$) within-group for all variables, and according to the BPH, a significant difference ($p<0.05$) exists between the LJHV - TJHV, and LJLV - TJHV. A non-significant difference ($p>0.05$) was observed between the LJHV - LJLV, TJHV - TJLV, but the mean differentiation LJHV (2.3), and TJHV (5.9) were improved. The main effect of time significant difference, furthermore BPH significant difference ($p<0.05$) between the test at each time for all variable. Except LJLV non-significant difference ($p>0.05$). It can be concluded that the high volume PT more efficiently improved the explosive power when compared to the other volume groups of PT.

Keywords: Explosive Power, Muscular Adaptation, Plyometric, Horizontal Jump, Training Volume

Physical Education & Sports - II

Development of an Assistive Instrument to Batting Practices and to Improve Hand Eye Coordination in Baseball

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The primary purpose of this study was to develop an assistive instrument to batting practices and to improve hand eye coordination in baseball in order to investigate the subsequent training effect. The balls were pitched one by one from the assistive instrument at a constant speed to enable the practicing of batting skills. A quantitative research approach was followed to analyze the impact of practicing through the assistive instrument and to identify the strategies which baseball players can adopt to improvise the impact of batting skills. The assistive instrument consisted of a 12v wheel motor to feed the ball automatically and two 12V Dc speed motors to pitch the ball to a particular distance. To test the accuracy of the instrument, a training group (n=5), and a control group (n=5) were used by purposive sampling method. The two groups were denoted as Team-A and Team-B. Team-A was allowed to practice 15 hits through the assistive instrument. Each batter of Team-A was allowed to hit 5 balls before and after batting practice to investigate the training effect while the batters in team B were not given any other practices. Paired t-test was used to analyze the data. The results indicate a significantly enhanced batting performance after the practice ($p<0.05$). thus, the study revealed that there is an impact on practicing through the assistive instrument on the performance of baseball players.

Keywords: Baseball, Assistive Instrument, Batting Practices, Hand-Eye Coordination

Contribution of Physical Activities to Health-Related Quality of Life of Stroke Survivors

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Health-related quality of life (HRQoL) post-stroke is an important health issue since functional impairments and socioeconomic inhibitions are associated with stroke affect HRQoL. Participation in physical activity (PA) post-stroke has not been investigated as a possible explanatory variable of HRQoL. Acute stroke survivors are exposed to physical deconditioning and long-term disability, effects that may impact their independence and quality of life. The aim of the present study was to determine the contribution of PA to the HRQoL of individuals with acute stroke. The study was conducted from January 2022 to February 2022, at the out patients' unit of a government hospital, as a quantitative study from a survey. HRQoL was assessed by the physical and mental composite scores of the medical outcomes study short form- 36 (SF- 36) of twenty-four (n=24) adults with acute stroke (mean age= 50.70 years). After four weeks of aerobic, flexibility, strength, neuromuscular exercise intervention program completion, HRQoL was reassessed using SF- 36. T-test and correlation analyses were performed on the data. As assessed, general health (GH), role physical (PR), emotional health (EH), bodily pain (BP), vitality (V), role emotion (ER), social functioning (SF) domains of the SF- 36 questionnaire are significantly impacted ($p < 0.05$) except physical functioning (PF). Even among all the domains, PR and EH were the most positively affected domains. The results suggest that PA intervention for acute stroke survivors is associated with better HRQoL as assessed by the physical and mental composite score of the SF- 36. Also, daily PA with the intervention should be encouraged with the same or similar exercises to potentially increase HRQoL of acute stroke survivors.

Keywords: Acute Stroke Survivors, Health-related Quality of Life, Physical
             Activity, Short Form-36

Comparison of Sri Lankan Traditional Kandyan Dance Leg Exercises and Selected Sport Exercises on Leg Power Development

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Dancing is a part of human culture, and foot drills (Pa sarabha) are exceptional among the dancing skills. This study aimed to determine the best method to improve leg power through traditional Kandyan leg exercises and selected sports exercises. This study is the first endeavour to compare the Kandyan pa sarabha on leg power development. Thirty-six females aged 14 to 15 years who did not train either for dancing or sports had recruited to do the study. The sample was divided into three groups; the dancing group (n=12), the sport group (n=12), and the control group (n=12). Pre and Post experimental research design was used, and the vertical jump test measured the leg power before and after the six weeks of training intervention. Wilcoxon Signed-Rank and the Kruskal-Wallis tests were used to test the significance of the leg power differences and considered significant at a 95% confident interval. The results revealed that there was no significant difference in the initial leg power in dance (15.5 cm), sport (16.5 cm), and control (17.0 cm) groups ($H_{(2)}$=0.27, p=0.875). However, the group differences in final leg power indicated a significant difference in dance (22.0 cm), sport (18.5 cm), and control (17.8 cm) groups($H_{(2)}$=11.29, p=0.004). Dance and sport groups significantly developed their leg power throughout the training (Z= 3.063, p=0.002, and Z=3.105, p=0.002, respectively). The dance and sport groups post-test leg power comparison indicated a significantly higher improvement in the dance group($H_{(1)}$=5.60, p=0.018). Therefore, the findings of the research suggest that Kandyan dance leg exercises more effectively develop leg power than that of the sports exercises.

Keywords: Leg Power, Kandyan Leg exercise, Sport Exercise

Adherence of Physical Activity Recommendations and Socio-Demographic Correlates in Older Adults in Kandy District

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This study aimed to estimate the proportion of the population adhering to the physical activity (PA) recommendation and examine the influence of socio-demographic correlates on reaching the recommendation in older adults. One hundred (n=100) older adults'(Over 65 years) in Kandy district were selected and their PA was measured using the International Physical Activity Questionnaire long-form, and socio-demographic factors were collected through interviews. Physical activity levels (PAL) and significant association between socio-demographic correlates were studied using chi-square and compared with fisher pairwise comparison using mini tab 18 software. Results indicate that 38% of older adults adhered to PA recommendation of the World Health Organization (2020). Gender (r=46.23, p=0.000) and Employment (r=9.158, p=0.002) were significantly correlated with the PAL of the older adults. The one-way ANOVA and fisher pairwise comparison results revealed that moderately active females had significantly higher PA than moderately active males, while low physically active males and females had significantly low PA compared to moderately active males and females (F(3)=87.2, p=0.000). Further, moderately active older adults showed significantly higher PA than employed and unemployed low physically active older adults (F(2)=124, p=0.000). The comparison of PAL with self-perceived health and body mass index (BMI) revealed that the majority of the older adults insufficiently adhered to but had healthy BMI and good self-perceived health (22%). However, most of the older adults (76%) were in a healthy nutritional status, a majority (70%) perceived their health as good or excellent levels.

Keywords: Adherence, Physical Activity Recommendation, Socio-Demographic, Older Adults

A Study of Emotional Intelligence of High-Performance Athletes in Sri Lanka

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Emotional intelligence is a powerful psychological factor of every athlete, and it is considered a determinant of sports performance. Thus, the aim of the present study was to examine the relationship between the emotional intelligence of high-performance athletes on emotional self-awareness, emotional expression, emotional awareness of others, emotional reasoning, emotional self-management, and emotional self-control. A quantitative inquiry method was applied to conduct the study. The field survey of high-performance pool athletes in Sri Lanka generated 45 (n = 45) valid responses (response rate = 75%). Pre-tested two standardized questionnaires captured the responses on a five-point Likert scale. One questionnaire was "Genos Emotional Intelligence Inventory" to measure the emotional intelligence variables, and the other one was the "Schutte Emotional Intelligence Scale" to measure the emotional intelligence of high-performance athletes. Descriptive, correlation, and regression analysis techniques were used to analyze the collected data while hypotheses testing was based on the result of the multiple regression analysis. The gathered data were analyzed by considering a confidence interval of 0.95. The results indicated that emotional intelligence of high-performance athletes has a positive relationship with emotional reasoning (B = 0.318; $p < 0.003$), emotional self-control (B = 0.301; $p < 0.002$), and emotional awareness of others (B = 0.282; $p < 0.003$). The implications of the findings were not addressed by the previous studies. Generally, the findings of the study will be beneficial to all sports organizations and sport-related personalities to identify the importance of improving training and development programs and to update the knowledge and good moral principles which are a good fit for the athletes who want to increase their performance.

Keywords: Emotional Intelligence, Emotional Self-Control, Emotional Reasoning, Emotional Awareness of Others, High-Performance Athletes

A Critical Analysis of Issues and Challenges of Sport and Physical Education in Sri Lanka

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The objective of this research was to elaborate on the contemporary issues and challenges of Sports and Physical Education (PE) in Sri Lanka and by accompanying the current state of problems and to identify the forthcoming issues and challenges. Physical Education is the teaching of all physical activities, starting from the simplest physical skills to the most competitive sports. The teaching strategies and skills learnt in PE are used in the form of practice or competition in sports. In the Sri Lankan context, many issues and challenges related to Sports and PE exist. The key issues are evident in many ways such as, low level of recognition, lack of an effective school curriculum, lack of facilities for athletes, lack of a proper management scheme for differently-abled athletes, limited career opportunities for PE graduates, appointment of non-qualified teachers for the teaching of PE in Schools, negative effects of stereotypical ideas of sports for gender, social class and cultural beliefs. So the research questions was critically discussed and the conclusions were derived by thoroughly analyzing the data from both primary and secondary resources. When the absolute negligence of Sports and PE occurs, no citizen will have either faith or an interest to engage in sports, which may contribute to the degradation of sports. Considering these factors, it is recommended that drastic and rapid developments in the Sport and PE sector are required to elevate Sri Lankan standards to the international level.

Keywords: Sports, Physical Education, Curriculum, Management, Issues and Challenges

The Effect of Endurance Training on the Sri Lankan National Squash Men Players

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The purpose of the present study was to examine the endurance performance of national squash men players in Sri Lanka through an eight-week intervention program. The population of this study comprised 32 men squash players in Sri Lanka, where eight (n=8) players were selected as a sample (mean age = 22.14 years, mean training age 4.1 years, mean height=172.2 cm, mean body mass= 61.4 kg, BMI= 20.8 kg/m^2) through the purposive sampling method. The Pre-test and post-test were conducted before and after the intervention program. The intervention program consisted of continuous run, interval training, beach training, continuous machine workout, and resistant training. Four sessions were conducted per week during the intervention. The study results indicate significant differences between the pre-test and post-test in each variable selected: push-up (p=0.002), sit-up (p=0.00), beep test (p=0.00), and VO$_2$ max (p=0.00). Therefore, the endurance of the selected squash national men's players was significantly improved as a result of the intervention program.

Keywords: Endurance Training, Muscles Adaptation, Squash

The Parents' and Girls' Perceptions of Sports Participation in the Jaffna District

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This study focuses on parents' perception of their girls' participation in different sports in the Jaffna district. The study used a modified questionnaire to use a quantitative inquiry method. The questionnaire consisted of thirty-five of three points Likert scale questions. The study sample of 200 girls and their parents from the two national schools of five zonal (Valikamam, Jaffna, Vadamarachchi, Thenmarachchi, and Delft) in the Jaffna district was chosen by multi-stage sampling method. The collected data were coded and analyzed using the SPSS software version 25. The assumption validation was tested initially and the non-parametric Mann-Whitney U test was conducted since the data did not follow a normal distribution. The results showed that 80% of girls have expressed a desire to participate in sports, but more than 75% of their parents disagreed with their girls for participation. There were significant differences were found between girls' and parents' perceptions about; participating in sports is disgraceful to the culture (μ_G=0.52 & μ_P=1.41, P<0.01), cause serious injuries and that will lead to future difficulties (μ_G=0.96 & μ_P=1.67, P<0.01), and participation in sports is a waste of time and it is a barrier for their studies (μ_G=0.79 & μ_P=1.71, P<0.01). However, girls and parents showed their desire to participate in sports for improving their fitness (μ_G=1.83 & μ_P=1.31, P>0.05), achieve medals (μ_G=1.54 & μ_P=1.48, P>0.05), improve self-esteem and confidence through sports (μ_G=1.89 & μ_P=1.77, P>0.05). The support and encouragement of their parents were the barriers because of cultural perspectives, for girls to participate in sports in the Jaffna district. Moreover, the study concluded that the local government should develop positive advertising campaigns and seminars for girls and parents to minimize misperceptions and to encourage girls' engagement in sports.

Keywords: Perception, Sports Participation, Questionnaire Method, Women Sport

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Sport Sciences & Management - II

The Impact of the Angular Displacements of Torso, Forearm, Arm and Hand on Serving Speed of Wheelchair Tennis Service

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The study aimed to observe the impact of the angular displacements of the torso, forearm, arm, and hand on the serving speed (SS) of the Wheelchair Tennis. Torso angular displacement (TAD), arm angular displacement (AAD), forearm angular displacement (FAD) and hand angular displacement (HAD) were considered as the variables of the model. Six players of the Sri Lanka National Wheelchair Tennis team were selected for the study (above twelve years of training age). The serving phase (102 services) of selected players were observed using three cameras (50 Hz) on three sagittal planes. The contacting height, flight time of the ball, TAD, AAD, FAD and HAD were recorded by using Kinovia (version 0.9.5). Linear motion equations were used to calculate SS. The relationship of selected variables was gained by multiple linear regression (SS = 14.556 + 0.049TAD + 0.818AAD + 0.084FAD + 0.221HAD). TAD (B=0.0489), FAD (B=0.084) and HAD (B=0.2208) and AAD (B=0.818) were positively correlated with SS. The coefficient values of FAD (p=0.049), AAD (p=0.015) and HAD (p=0.00) were significant. Furthermore, the study concludes that AAD is the most important angular displacement for SS of Wheelchair Tennis sport.

Keywords: Arm, Hand, Service, Tennis, Wheelchair

The Relationship Between Body Composition and Strength Parameters of the Sri Lanka Navy Male Wrestling Team

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The body composition and strength parameters are contributory factors for better performance in any kind of game, especially wrestling. Previous studies conducted elsewhere in the world have identified the relationship between body composition parameters and strength capacity of athletes at various sporting events, but this study was focused on local wrestlers given the lack of such studies. In addition, the Navy wrestling team would be a new source of knowledge for the industry. The present study aimed to fill the technical gap in the wrestling sport. Therefore, the purpose of this study was to determine the relationship between body composition and strength parameters of the Sri Lanka Navy wrestling team. A total of twenty-nine (n=29) Navy wrestlers (mean age: ± 29 years, mean body weight: ± 75kg) participated in the cross-sectional study. The "TANITA RD953 body composition monitor" was used to measure body composition (BMI, body fat, muscle mass, muscle quality score, physique rating, bone mass, visceral fat, basal metabolic rating, total body water) and six repetition maximum (6RM) of five exercises (bench press, bicep curl, deadlift, squat, leg press) were applied to measure the strength parameters. The relationships between variables were determined by the Pearson's correlation coefficient. Upper body strength showed a significant positive correlation with BMI, muscle mass, body fat%, bone mass, and basal metabolic rate ($p<0.05$). Lower body strength showed a positive correlation with the above-mentioned body composition parameters which was not statically significant ($p>0.05$). Furthermore, all the strength parameters with physique rating showed a non-significant positive correlation. The water level of the body showed a non-significant negative correlation with strength capacity. Muscle quality showed a positive correlation except for bicep curl and squat. Hence, the wrestlers show an increase in body composition that has a significantly positive correlation with their upper body strength but a non-significant positive correlation with their lower body strength. Considering the body composition, related training period is important, as revealed by the study.

Keywords: Body Composition, Strength, Navy Wrestlers, Upper Body Strength, Lower Body Strength

Comparison between the three phases of Menstrual cycle on the dietary habits and selected Physical Fitness components of National-level Netball players

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Variations in the dietary habits and the training load are noted among female athletes during their menstrual cycle. Thus, the impact of the menstrual cycle on physical fitness and dietary habits is recognized as an important factor to be considered in women's sports. The present study aimed to investigate the influence of the three phases of the Menstrual Cycle (MC.) on food habits and selected physical fitness components of National-level Netball players. The study was conducted by selecting 32 National level Netball players, aged; 32 ± 14 years, height; 167 ± 21 cm, body weight; 67.5 ± 22.5 kg, Body Mass Index (BMI); 22.27 ± 6.13kg/m2, involving a screening test to select subjects who were not using any regulatory drug during the last two months. The regular MC (28-31 days) of selected athletes was divided into three phases. The test was performed 2-3 days before menstruation and two days after the onset of menstruation, and two days after the end of MC. The eating habits of the athletes were evaluated using the modified Food Frequency Questionnaire (FFQ). A vertical jump test and a leg press 45 ° 5RM test were used to measure the muscle power of the lower limbs and strength respectively. The statistical analysis of the data conducted via one-way ANOVA revealed that there is no significant difference between the three phases of the menstrual cycle with lower limb muscle strength ($p < 0.765$) and power ($p < 0.75$). The Chi-square test conducted for the nutritional and food group values obtained from the three phases concluded that only the Rice-based products were significantly different ($p < 0.05$). It was found that there is no relationship between BMI and the variables of power and strength ($p > 0.01$) as well. In conclusion, there is no significant difference in the selected physical fitness components over the menstrual cycle of the selected National Netball players. Therefore, it is suggested that the training load or eating patterns are not essential to be altered during their MC.

Keywords: Menstrual Pases, Netball, Strength, Power, Dietary Habits

Investigation of Bio Motor Abilities and Body Composition of Over 20 Age Female Athletes in Kandy District

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This study aimed to investigate the bio motor abilities and body composition parameters of over 20 aged female athletes in the Kandy district. Fifty (n=50) district-level Football, Netball, Hockey, Volleyball, and Cricket female athletes were randomly selected. The mean training age of the athletes were 10.3 ± 5.96 years. The beep test, 1RM Leg Press, 35m sprint test, sit and reach test, and the alternate-hand wall-toss test was performed to identify the VO2 max, strength, speed, flexibility, and hand-eye coordination, respectively. Bioelectrical Impedance Analysis (BIA) was performed to identify Fat mass (FM), Fat free mass (FFM), and Fat percentage of the athletes. Descriptive statistics and Pearson correlation were used to analyze the data using Minitab 18 software. The mean Vo2Max (30.76 ± 4.73 mL/kg/min) and speed (6.03 ± 0.36 sec) of athletes was at a fair level, while strength (60.1 ± 2.98 kg)was at a poor level, and hand-eye coordination (20 ± 4.95 rep) was at below-average level. However, the mean flexibility (16.78 ± 4.10 cm) was at an excellent level. There were significant high negative correlation between Vo2 Max and fat percentage (r=-0.700, p=0.000), and fat mass (r=-0.733, p=0.000), and low negative correlation with FFM (r=-0.369, p=0.008). Further, There were significant moderate negative correlation between 1RM leg press and Fat percentage (r=-0.611, p=0.000) and (r=-0.575, p=0.000) fat mass. There was moderate positive correlation between speed and fat percentage (r=0.522, p =0.000), and speed and fat mass (r=+0.599, p=0.000). The fisher pairwise comparison revealed significantly higher FFM in Netball and Volleyball athletes (F(4)=5.94, p=0.001) than in other sports. There was significantly low flexibility in Netball and Football athletes (F(4)=4.00, p=0.007), while Netball, Football, and Hockey players' hand-eye coordination were significantly below other sports (F(4)=4.02, p=0.007).

Keywords: Body Composition, Bio Motor Abilities, Female Athletes

Relationship Between Health-Related Physical Fitness and Body Composition of Retired Players of the National Rugby Team, Sri Lanka

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Lack of consideration towards a healthy lifestyle and physical fitness after retirement may lead to issues in the body composition and impact the health-related physical fitness components of rugby players. The objective of this study was to identify the relationship between health-related physical fitness components and the body composition of retired players of the national rugby team. For the present cross sectional study purposive sample method were used and the data were analyzed by the Pearson's coefficient correlation test. The sample group comprised thirty-seven (n=37) players whose body composition variables (body mass index, body fat, muscle mass, visceral fat and physique rating) and fitness variables (cardiorespiratory endurance, upper body muscle endurance and strength, muscular trunk strength, explosive leg power, flexibility) had been measured. A significant strong negative correlation was detected between the visceral fat and muscular trunk strength (p=0.01, R=0.428), flexibility (p=0.01, R=0.610), and explosive leg power (p=0.01, R= 0.536). In addition, body fat and flexibility (p=0.01, R=0.623) revealed a significantly strong negative correlation. Interestingly, significant strong positive correlations were detected between heart rate and body fat (p=0.01, R=0.411) and visceral fat (p=0.01, R=0.409). According to a recent study, the physical fitness of retired rugby players is much lower. Therefore, their body composition has increased significantly.

Keywords: Physical Fitness, Visceral Fat, Former Rugby Players

The Perception of National Athletes on Their Coaches' Behaviour and Skills in Sri Lanka

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This study examined the perception of athletes on their coaches' behavior and skills in terms of knowledge, fairness, and coaches' characteristic features. The motive of the present study is to examine the athletes' perception of their coach's behaviour and skills related to their relevant sport. The research was conducted using a descriptive quantitative research design. The subjects of the study were 100 voluntarily national athletes of which 56 females and 44 males in different sports representing team sports - Football, Volleyball, Basketball, Hockey, and individual sports - Karate, Taekwondo, Wrestling, Judo, and Wushu. Sample were selected according to the random sampling method. The Coaching Behaviour and Skills Scale for Sport (CBS-S) which was developed by Andreas Carlsson and Carolina Lundqvist (2016) was used to assess the study. The reliability of the questionnaire (CBS-S) was examined using Cronbach's alpha coefficient (α=0.954). The scale was composed of 47 questions and divided into six (06) sub dimensions of (Physical Training and Conditioning, Technical Skills, Goal Setting, Mental Preparation, Competition Strategies, Coaches' Interpersonal Behaviour). The data was analyzed by descriptive data analysis to test the effect of sub dimensions for the athletes' perception and the Mann-Whitney U test was used to test the significant difference between each sub dimension. The results of the study reveal that the sub dimension of coaches' technical skills had the highest median average. There was a statistically significant difference between male athletes' and female athletes' perception of coaches' technical skills when it was taken based on the gender and the sport (p=0.04). Nevertheless, type of sport and the athletes' gender had not shown a significant relationship (p=0.05) on athletes' perception of their coaches' and the overall results of the study (median value = 6.0000) showed that the athletes' perception of their coaches' behaviour and skill is at a level of acceptance. Further, it can be recommended to National Federations to increase the recruitment of female coaches and it can be suggested to coaches to pay attention about their technical skills while they presenting it to the athletes.

Keywords: Perception of Athletes, Coaches' Behavior, Knowledge and Skills, Fairness, Coaches' Characteristic

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