Proceedings of the
Eighth Undergraduate Research Symposium
UReS 2021

" Environmental Well-being for Sustainable Food Systems"

Organized by the
Faculty of Livestock, Fisheries & Nutrition
Wayamba University of Sri Lanka

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FOREWORD

I am delighted to write this Foreword to the Proceedings of the 8th Undergraduate Research Symposium of the Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka. The objective of this Proceedings is to disseminate up-to-date, high-quality and original research work done by the undergraduates to the scientific community. This great event will also provide an opportunity for undergraduates to open the path for their future careers and further studies.

This Proceedings consists of 159 abstracts under the theme of "Environmental Well-being for Sustainable Food Systems"from two-degree programmes, Food Science & Nutrition and Food Production & Technology Management. Each abstract provides details of original research studies conducted by the undergraduates of the Wayamba University of Sri Lanka in the field of Human Nutrition, Food Science and Technology, Aquaculture and Fisheries and Livestock and Avian Science. All abstracts were reviewed by internal and external supervisors as well as the members of the editorial committee.

I would like to express my sincere gratitude to Dr. Sanjeewa Bowatte, the Acting Vice-Chancellor of the Wayamba University of Sri Lanka and Prof. C.V.L. Jayasinghe, the Dean of the Faculty of Livestock, Fisheries and Nutrition for the valuable support and guidance given in organizing UReS 2021. Mrs A.M.M.U. Adikari is greatly acknowledged for her utmost contribution as the Coordinator of UReS 2021 to make this event a great success. I congratulate and appreciate all undergraduate researchers who publish their abstracts in this proceedings, with lots of difficulties encountered as a result of the prevailing situation of the Covid pandemic. I convey my thanks to all internal and external supervisors who guided the students for this great achievement. On behalf of the editorial committee, I wish to thank all authors and reviewers for their contribution to this Proceedings. In addition, I express my gratitude to all members of the organizing committee/UReS 2021, all academic and non-academic staff of the faculty who assisted in various ways to publish the Proceedings of the 8th UReS 2021.

Prof. K. D. P. P. Gunathilake
Editor-in-Chief/UReS 2021
Faculty of Livestock, Fisheries & Nutrition
Wayamba University of Sri Lanka

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Message from the Vice-Chancellor

It is my great pleasure to write this message for the Undergraduate Research Symposium (UReS 2021) organized for the eighth consecutive time by the Faculty of Livestock, Fisheries & Nutrition of the Wayamba University of Sri Lanka, with a well-timed theme, "Environmental Well-Being for Sustainable Food Systems".

The world is facing many challenges related to hunger, economic crisis, climate change, environmental degradation and global pandemic. In this backdrop, much attention has been given to the idea of sustainable food systems to face key issues in promoting safe, nutritious and healthy diets. Therefore, it is vital to search for new horizons to develop healthy food systems to ensure food security and establish sustainable food systems for ensuring safe and quality food for everyone while protecting our environment. I wish that these research findings will open up various paths for new research and innovations for many young scientists who are waiting to break the barriers and looking to overcome the challenges of the future. Therefore, I am proud of the highest quality research carried out by the Faculty of Livestock, Fisheries & Nutrition at the Wayamba University of Sri Lanka, encompassing the fields of Food Science, Nutrition, Livestock and Aquaculture. I would like to take this opportunity to appreciate the efforts of the Dean, Heads of the Departments and all the academic and academic support staff and all the non-academic staff and also the UReS organizing committee of the Faculty for their unwavering support and contribution to a fruitful symposium amid these unprecedented times. May this be a great example of how the University, the Faculty and its academic community stand together in unity for the betterment of its undergraduate students.

Permit me to congratulate all the undergraduates who are presenting their research at UReS 2021 and I wish them every success in their future endeavors. I hope they will continue to excel in their respective fields and will be a great strength to our mother country one day.

Vice-Chancellor
Wayamba University of Sri Lanka

Message from the Dean

It is indeed with great pleasure that I issue this message to mark the Undergraduate Research Symposium, 2021 (UReS 2021) of the Faculty of Livestock, Fisheries and Nutrition. This important faculty event is an opportunity for undergraduates to present their research experiences to a larger audience of interest. We strongly believe that research and innovation are integral parts of our academic culture and dissemination of new knowledge is our utmost duty for serving mankind. The Symposium is a forum for students and the faculty to discuss cutting edge research topics and to examine the connection between research and education for the betterment of the wider community.

The academics of the faculty who are creative and innovative in their respective fields have created opportunities for the undergraduates to conduct ethically sound research which is timely relevant and oriented for outputs to address the pressing needs of the food production and nutrition sectors globally. The Symposium includes projects from all disciplines of the faculty that encourage interdisciplinary discourse allowing students to learn from each other about a broad range of exciting research topics. I am very happy to note here that being a leading faculty of the university; we have been successful in delivering numerous innovations and research to the food and nutrition sector in the recent past which has been recognized well and awarded in various national and international forums.

On behalf of the Faculty, I would like to congratulate all the researchers who would present the outcomes of their excellent work in the symposium and those who are awarded for the excellence of the achievements. Further, I would like to extend my gratitude to the supervisors and other collaborators who have immensely contributed to achieving objectives and successful completion of the research. On behalf of the faculty, I would like to acknowledge the organizing committee, UReS 2021, our sponsors and all those who worked hard to make this event a reality. I wish the presenters and the participants a fruitful time at the technical sessions.

Prof. C.V.L.Jayasinghe
Dean, Faculty of Livestock, Fisheries & Nutrition
Wayamba University of Sri Lanka

Message from the Coordinator

On behalf of the organizing committee, it is my pleasure to welcome you all to the Eighth Undergraduate Research Symposium (UReS) 2021: "Environmental Well-being for Sustainable Food Systems" organized by the Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka. Due to COVID-19 pandemic we are organizing the symposium in a virtual environment ensuring health and safety of everyone involved while creating an ideal platform for the final year students of the faculty to present, discuss and debate their research findings in front of a distinguished scientific audience.

On behalf of the organizing committee, I wish to take this opportunity to acknowledge, Dr. Sanjeewa Bowatte, Acting Vice-Chancellor, Wayamba University of Sri Lanka and Prof. CVL Jayasinghe, Dean, Faculty of Livestock, Fisheries & Nutrition, for providing continuous encouragement and timely advice for organizing the event. I extend my sincere gratitude to Prof. Meththika Vithanage, Director, Ecosphere Resilience Research Centre, Faculty of Applied Sciences, University of Sri Jayawardenepura, for accepting our invitation to deliver the keynote speech and inspiring our young scientists. I also congratulate Mr. J.G. Diletha Swahas, for winning the Best School Inventor Award 2020 during UReS 2021.

Amidst the financial difficulties, the generous support extended by our sponsors are gratefully acknowledged and on behalf of the faculty, I convey my heartfelt thanks to them. I express my profound gratitude to Prof. W.J.S.K. Weerakkody, Director, Information & Communication Technology Center, Makandura Premises, Wayamba University of Sri Lanka and his team for the valuable guidance and untiring support extended in launching this virtual symposium. My sincere gratitude also goes to the home crew - the members of the organizing committee - for their hard work, dedication and patience rendered in organizing the symposium. Furthermore, I acknowledge the Assistant Registrar of the faculty, the staff of Deans' office, the technical officers of the media unit and all the nonacademic staff of the faculty for supporting the organizing committee in various ways to make this event a great success.

I wish to thank the academia of the faculty and the external supervisors of these budding young scientists for being patient with them as beginners and creating their interest in research while guiding them to publish the findings. I extend my sincere gratitude to the judges for accepting our invitation to evaluate the research presentations. Finally, I highly appreciate the dedicated work done by the final year students who are disseminating new knowledge and technology generated by their research projects at this symposium.

While congratulating all the presenters, I wish the 8th UReS a great success.

Mrs. A.M.M.U. Adikari
Coordinator
Organizing Committee UReS – 2021
Faculty of Livestock, Fisheries & Nutrition
Wayamba University of Sri Lanka

Keynote Address

Environmental well-being for sustainable food systems

By

Prof. Meththika Vithanage

Director, Ecosphere Resilience Research Centre,
Faculty of Applied Sciences, University of Sri Jayawardenepura

Population growth since the beginning of the industrial revolution has caused serious harm to the environment in various vital ways climate change, resource use and pollution. Waste disposal and wastewater has been polluting the environment ubiquitously. Sustainable food production impacted by the climate change effects such as precipitation and seasonal changes. Discharge of contaminants such as Potentially Toxic Elements (PTEs), pharmaceuticals and personal care products (PPCPs), plastics, plasticizers and plastic additives are considered as pollutants in the recent Anthropocene. Contamination of soil and water impacts the quality of agricultural food products, additives and beverages.

As an example, plastic containers can emit volatile organic compounds (VOCs), plasticizers, and plastic additives into the food and beverages based on the storage conditions. At the same time, compost and sludge from wastewater treatment plants can act as vector for transporting PTEs, PCPs and plastic additives to agricultural fields and ultimately end up in the food web.

Microplastics further can be in food additives like salt whereas fish can be the mostly polluted from micro and nanoplastics. Plastic additives such as Bisphenol A mimics estrogen and may create endocrine issues. Disasters as Xpress Pearl accidents disturb the marine and coastal food web can impact the sustainability of the food system. Further, contamination of fluoride with tea and rice may act as a risk factor for Chronic Kidney Disease of Unknown Etiology. Therefore, for the well-being of humans it is important to reduce the ecological footprint to keep the sustainability in the food system.

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Identification of feeding practices of infants

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The first years of the life of an infant is a period of rapid growth and development. Feeding practices such as breastfeeding and complementary feeding practices during infancy have a direct effect on nutritional status in childhood. The aim of this study was to identify the feeding practices of infants in Sri Lanka. A cross-sectional study was conducted using a sample of 30 children between 1 to 5 years of age. The data was collected through an online questionnaire which was filled by the parents. Basic characteristics of mothers, children and the details about breastfeeding practices and complementary feeding practices were collected using the online questionnaire. The majority of the mothers (n = 23) practiced exclusive breastfeeding for up to 6 months. Some of the infants (n = 7) were not breastfed exclusively for 6 months, thus they were introduced to complementary feed before 6 months of age. None of the infants was given formula feeds before 6 months of age while nine infants (n = 9) were introduced into formula feeding between 6 to 12 months of age. The introduction of fats and animal-based foods were satisfactory as most of the mothers (n = 24) introduced those food at the age of 6-8 months. All of the infants were given well-mashed foods within the first 6-7 months. Chopped foods were given to the majority (n = 16) of the infants within 8-9 months while finger food was introduced to the most of infants (n = 24) within 9-12 months which was the recommended time duration. In conclusion, most of the infants in the sample had proper breastfeeding practices and practices related to the infants feeding were appropriate. Further researches are suggested to conduct recruiting a large representative sample from Sri Lanka to identify the feeding practices during infancy and their association for the growth and development during childhood.

Keywords: Breastfeeding, complementary feeding, infants

Contextualization of primary school child nutrition guidelines in Sri Lanka; situational analysis

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Good nutrition during middle childhood/primary school age (5-10y) is critical in an individual's life. In Sri Lanka, a significant level of middle childhood malnutrition is reported linked to poor dietary habits. This study was aimed to review the current nutritional status of primary school children in Sri Lanka and to investigate mothers' knowledge, attitude and behaviors (KAB) on fulfilling nutrition requirements of primary school children. Existing data sources on middle childhood (age 5-10y) nutrition status and available nutrition guidelines were reviewed. A cross-sectional survey was done to investigate the KAB of mothers fulfilling middle childhood nutrition requirements in Sri Lanka. Almost 70% of the mothers belonged to the age group of 30-39 years. About 47% of mothers were employed and 52% were unemployed. The finding revealed that the levels of knowledge and attitude were high as evaluated based on scores given. Significant effects of attitude towards the behaviors were identified. Though no significant effect of mother's knowledge towards behavior was identified, a significant correlation was observed between mother's knowledge and attitude. Only the mother's age was significantly affected on the correlation between mother's knowledge and behavior. There was no reliable national data source for the nutritional status of each age within 5-10y in Sri Lanka. In conclusion, the majority of mothers had a medium level of general knowledge and positive attitudes on middle childhood nutrition. There were no specific nutrition guidelines focused on middle childhood/primary school children aged between 5-10y. These findings support the development of nutrition guidelines for primary school-age children to improve the nutritional status of this age segment in Sri Lanka.

Keywords: Attitudes, behavior malnutrition, child nutrition guidelines, mothers' knowledge, primary school child nutrition

Primary caregiver perception of factors influencing the food choices of preschool children in middle-income countries: A systematic review

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The double burden of malnutrition has increased globally and is highly prevalent in middle-income countries. Modifying dietary behaviors is necessary to improve the nutritional status of children. Since the primary caregiver is responsible for child food choices, understanding their perspectives on factors influencing children's food choices is vital to promote healthy eating. The current study aimed to systematically review the primary caregiver perception of factors influencing the food choices of preschool-aged children in middle-income countries. Articles were searched using keywords via PubMed, Cochrane Library and Emerald Insight databases published before August 2021. Using PICOS inclusion and exclusion criteria, studies were screened according to the PRISMA guidelines. Studies published in English that involving of a primary caregiver perception or opinions among healthy preschool children aged 2 to 6 years which were published in middle-income countries were included. No period restrictions were considered. General reviews and studies which did not involve primary caregiver perception or opinions were excluded. The quality of the selected studies was determined by a quality criteria checklist. In total 40 studies published between 1988 and 2021 were eligible for inclusion. Thirty-three different factors were identified and categorized into three main categories based on Bronfenbrenner's Ecological System Theory, which were: individual child factors, family and peer factors; and external environmental factors. Family and peer factors were reported mostly (n = 36 studies), followed by individual child factors (n = 9 studies) and external environmental factors (n = 8 studies).The most frequently reported family and peer factors were; nutrition knowledge of the family, family income, maternal education level and maternal employment. Additionally, the food preference of children was also reported frequently. In conclusion, family and peer factors and individual child factors, child's food preferences should be considered when designing interventions to promote healthy food choices in preschool-aged children living in middle-income countries.

Keywords: Factors, food choices, middle income, preschool children, primary caregivers

Impact of physiological and psychological changes on eating behaviors and nutritional status in older adults

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Various physiological and psychological changes that take place during aging may impair the amount and type of food intake, digestion, absorption, and metabolism leads to an increased risk of under-nutrition. Therefore, nutrition and related food behaviors are very important factors for quality life in older adults. The aim of this study was to identify the association between physiological and psychological changes and food behaviors and the nutritional status of older adults in Sri Lanka. A cross-sectional study was conducted recruiting 100 community-dwelling elderly men (n = 39) and women (n = 61) aged 65 years or above. Data on socio-demographic factors, physiological changes, psychological changes, and food behaviors were collected using an online questionnaire. The Mini Nutritional Assessment Short Form (MNA-SF) was used to assess the nutritional status. Food Frequency Questionnaire was used to determine the frequency of weekly consumption of main food groups. The mean age of the total study participants was 72.0 (SD 6.1) years. Three percent (3.0%) of older adults were malnourished while 47.0% of participants were at risk of malnutrition. There were 53.0% of participants at normal nutrition status. There was a high frequency of cereal and starchy food, vegetables, and nuts and oil mean consumption, while fruits, dairy, and meat, fish and egg food groups had lower mean consumption per week. Gastrointestinal problems ($P = 0.035$) and muscle function ($P < 0.0001$) were the physiological changes associated with food behaviors, while poor memory ($P = 0.015$) was the psychological change associated with food behaviors. Changes in the amount of food intake ($P = 0.045$) were significantly associated with nutritional status. None of the physiological and psychological changes was associated with the nutritional status of older adults. In conclusion, the amount of food intake is an important determinant of nutritional status, but physiological and psychological changes during aging are not influenced to nutritional status in older adults.

Keywords: food behaviors, nutritional status, older adults, physiological changes, psychological changes

Adherence to 5-a-day fruit and vegetable recommendations by young adults

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Fruits and vegetables (FVs) are important components of a healthy diet that may reduce the risk of some non-communicable diseases (NCDs) including cardiovascular diseases and certain types of cancer. The WHO/FAO recommends an intake of a minimum of 400 g or five portions (2 portions of fruits + 3 portions of vegetables) of edible FVs per day as a population-wide goal for the prevention of NCDs. This study aimed to explore the adherence to 5-a-day FVs recommendations by young adults. In a cross-sectional study, a total of 180 adults (n = 77 Males and n = 103 Females) in the age range of 20 to 35 years were recruited. A semi-quantitative digital food frequency questionnaire with photographs and portion sizes was used to determine the intake and number of FV portions consumed. The mean (SD) age of the study participants was 24.8 (1.7) years. The mean (SD) intake of FVs was 524.24 (319.0) g. Mean (SD) consumption of fruits, vegetables and FVs together were 4.2 (3.1), 2.4 (1.7)and 6.6 (3.9) portions, respectively. Only 55% of the study participants consumed five or more portions of FVs whereas 45% of them had less than 5 portions of FVs per day. The Residence area (P= 0.037) and ethnicity (P= 0.025) of the participants had only significant associations with FVs consumption. In conclusion, just over half of young adults in the study population adhered to the current WHO/FAO recommendations for daily FVs intake.

Keywords: Fruits, non-communicable diseases, 5-a-day fruit and vegetable, vegetables

Identifying the determinants of food purchasing habits and their association with diet quality of adults' diets

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Since a poor diet quality is directly attributed to the development of diet-related-diseases, people are more concern about their diets. Although food purchasing habits are one of the determinants of quality of the diets limited studies have been conducted to identify determinants of food purchasing habits and diet quality. This cross-sectional study was conducted to fulfill this research gap by identifying the determinants of food purchasing habits and their association with diet quality of adults. Adults who purchased food for House-Holds(HHs) in Kurunegala District were conveniently selected. An interviewer administered lifestyle-questionnaire was used to collect data on socio-demographic factors and food purchasing habits. Dietary information was collected using 3-day diet diary. Diet Quality Index-International(DQI-I), determiner of quality of diet in relation to variety, adequacy, moderation and overall balance of the diet was used to assess the diet quality. Food-Base 2000 software was used to analyze dietary data. DQI-I values that reach towards to 100 considered as quality of diet is good. Statistical analysis was performed using SPSS software. Total of 113 adults' age ranged from 18 to 65 years. Nutrition information, taste, price, expiry date, ingredients of the food, easiness of food preparation and location of food-outlets were most common determinants of purchasing habits of the sample. The mean DQI-I value of the sample was 63.27 ± 10.03 and 87.6% of adults had quality diets in relation to DQI-I values. Results showed that a significant ($P < 0.05$) association between socio-demographic factors of ethnicity, level of education, occupation, and HHs monthly income and food purchasing habits. Further, diet quality and determinants of food purchasing habits including overall quality of food in terms of freshness and storing, keeping conditions of food, nutrition information, price, brand name of the food, easiness of food preparation and location of the food outlets had a significant ($P < 0.05$) association. Awareness on determinants of food purchasing habits for quality diets for adults is needed.

Keywords: Diet quality, DQI-I, Food purchasing habits, House-holds

Study the factors influencing non-communicable disease management during lockdown period

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The patients with non-communicable diseases are showing higher susceptibility to the coronavirus, at risk of developing complications. However, research on the disease management of NCD patients in the context of COVID-19 remains limited. Therefore, the main objective of this study was to identify the factors affecting NCD management during the lockdown period. A cross-sectional survey study design was implemented and an online questionnaire-based convenient study was conducted using 110 participants. The study sample was included with the patients with NCDs from the households of the undergraduates of Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka. A Google form containing the questionnaire was sent to the participants via e-mail. According to the findings of the study, about half of the participants (49.1%) reported issues in getting proper treatments for chronic health conditions during the COVID-19 lockdown period. 26.4% of participants reported issues while seeking regular medical check-ups mainly due to transportation difficulties. 21.8% of participants reported issues in obtaining usual medication during the lockdown period. And, about one-fifth (20.9%) of the participants reported issues in obtaining a quality diet which is consisted of all the essential nutrients in proper amounts and some of the participants (13.6%) reported limitations in engaging in physical exercises to manage disease conditions during the lockdown period. The results of the study showed that the disease management of NCD patients in the context of the COVID-19 pandemic has affected the issues aroused while seeking regular medical check-ups, obtaining usual medication, obtaining a quality diet and engaging in physical activities to manage chronic health conditions. Further extended studies using a representative sample are recommended.

Key words:COVID-19, lockdown, non-communicable diseases

Factors influence on arterial stiffness in adult men

G.N.M. Gunathilaka*, U.L.D.S. Perera, A. Chandrasekara and K.M. Rathnayake

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Cardiovascular diseases (CVD) are the leading cause of death globally. Arterial stiffness (AS) is an independent predictor of CVD events and mortality. AS describes the rigidity of the arterial wall. Measuring AS can help to identify patients with CVD in the early stage. Published data on the factors affecting AS in adult men in Sri Lanka is limited. This study aimed to determine the factors affecting AS in adult men. In a cross-sectional study, a total of 225 healthy adult men aged between 30-60 years (mean age 43.7 $\pm$ 8.1) were recruited. Socio-demographic and information on their usual dietary intake were taken from an interviewer-administered questionnaire and a 3-day diet diary including two weekdays and one weekend day, respectively. The short version of the International Physical Activity Questionnaire was used to assess the physical activity level. Clinical measurements (body weight, height, waist circumference, hip circumference, blood pressure and body composition) were assessed using standard techniques. AS was determined by measuring Pulse wave velocity (PWV) using a pulse wave analyzer. Mean $\pm$ SD of PWV was 6.7 $\pm$ 1.0 m/s. Age (P= 0.001), systolic blood pressure (P = 0.001), diastolic blood pressure (P = 0.001), pulse pressure (P = 0.001), mean arterial pressure (P = 0.001), augmentation index (p = 0.001) and heart rate (P = 0.002) had positive significant correlations with PWV. BMI (P = 0.006) and waist circumference (P = 0.020), percentage of body fat (P = 0.001), fat mass (P = 0.001) and visceral fat level (P= 0.001) had positive significant correlations with PWV. Socio-demographic factors such as education level (P = 0.004) and occupation category (P = 0.002) were associated with PWV. In conclusion, determinants such as age, blood pressure, BMI, waist circumference, visceral fat level and percentage of body fat were positively correlated with AS in adult men.

Keywords: Arterial stiffness, augmentation index, cardiovascular diseases, diastolic blood pressure, pulse wave velocity, systolic blood pressure

Authors would like to acknowledge the Wayamba University Research Grant Scheme (Grant No: SRHDC/RP/04/19-05) for financial assistance.

Influence of dietary, lifestyle and physiological factors on body composition in female adults

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In recent years, obesity has become one of the world's biggest public health concerns. Changes in body composition among adults are mainly the result of physical inactivity and nutrition. This study aimed to assess the influence of dietary, lifestyle and physiological factors on body composition in female adults. In a cross-sectional study, a sample of 210 female adults aged between 30-60 years was recruited. Body composition was studied with anthropometric methods and a body composition analyzer. Lifestyle and socio-demographic information were collected by interview using a self-administrated questionnaire. The short version of the International Physical Activity Questionnaire was used to assess physical activity. A three-day dietary recall was conducted to measure their intake of energy and macronutrients. When anthropometric methods were used, the mean BMI for the study population was 25.32 $\pm$ 4.12 kg/m^2 and 49.8% of the individuals had a body mass index (BMI) > or = 25.0 kg/m^2. Body fat percentage, waist circumference, and W: H ratio in post-menopausal women were higher than in pre-menopausal women($P<0.05$). Body fat percentage, W: H ratio, and waist circumference were positively associated with age. Physical activity was negatively associated with body fat percentage, BMI, and waist circumference ($P<0.05$). There was a significant positive association between BMI and dietary fat intake, while a negative association between BMI and carbohydrate intake was also found ($P<0.05$). There was no association between energy intake and body composition ($P>0.05$).Educational level was negatively associated with body fat percentage, BMI, and waist circumference. Family income and occupation were significantly associated with body composition ($P<0.05$).In conclusion, menopausal status, age, physical activity, education level, occupation, and family income were significantly associated with body composition. Dietary factors also have an influence over body composition; carbohydrate and fat intake are significantly associated with BMI.

Keywords: Body composition, female adults, menopause, nutrition, physical activity

Digital nudging as a trigger for healthy eating among young adults

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Adding more fruits and vegetables to the diet is associated with a myriad of health and nutritional benefits. Although there has been an increase in the use of digital nudging concepts to improve health behaviors in other countries, in Sri Lanka, such research is scanty. This study aimed to evaluate the effectiveness and acceptance of a text and email messaging digital nudging concept named '5-a Day Punch' to improve fruit and vegetable consumption among young adults. Young adults (n = 91), aged from 18 years to 30, were conveniently selected and later randomly divided into two groups as intervention and control, based on equal gender and age distribution. Then a 4-week '5-a Day Punch' with two messages per week was assigned to the int group. The Control group only received a brochure containing the same messages the first week of the study. A pretested computer-based Food Frequency Questionnaire was assigned to both groups before and after the intervention. Before the nudge, participants had consumed a mean 260.2 g and 288.8g of total fruits and vegetables per day in the int group (fruits; 111.2g, vegetables; 149.0g)and control group (fruits; 103.6g, vegetables; 185.2g)respectively, while after the int they were changed as, 382.4g per day and 358.4g per day (intervention group: fruits; 172.5g, vegetables; 209.9g, control group: fruits; 113.6g, vegetables; 244.8g). There is no greater change in mean fruit and vegetable consumption per day ($P = 0.056$) in the intervention group compared with the control group. The nudging resulted in greater fruit consumption ($P = 0.029$) in the int group compared to their counterparts. The majority (int group) 84.4% (38/45) accepted that text and email messaging have prompted them to incorporate more fruits and vegetables into their diet. Therefore, text and email messaging appear to be an acceptable way to promote healthy behaviors among young adults.

Keywords: Digital nudging, fruit and vegetable consumption, Sri Lanka, young adults

Association between dietary fat intake and cardiometabolic risk factors in adult men

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Cardiovascular disease (CVD) is becoming the major cause of morbidity and mortality in Sri Lanka. Diet, in particular dietary fat composition, has been recognized to play an important part in the a etiology of CVD. The effect of dietary fat on cardiometabolic risk is still being doubted in Sri Lanka. Therefore, this study was conducted to explore the association between dietary fat intake and cardiometabolic risk factors in adult men. A cross-sectional study was conducted using a convenient sample of 200 healthy adult men aged 30-60 years (mean age 43.5 $\pm$ 8.0). Dietary fat intake was determined using a 3-day diet diary including two week days and one weekend day, a food frequency questionnaire and a short in-depth questionnaire on dietary fat consumption patterns. Nutrient intake and fatty acid composition were analyzed using Food Base 2000 nutrient analysis software, modified for Sri Lankan foods. A range of clinical (arterial stiffness) and anthropometric (weight, height, and waist circumference-WC) risk markers of cardiometabolic risk were determined using standard procedures. Total daily mean fat intake was 56 g (23.5 % of total Energy) while saturated fatty acid (SFA), polyunsaturated fatty acid (PUFA) and monounsaturated fatty acid (MUFA) intakes were 37.7 g (15.8%), 3.1g (1.3%), and 6.6 g (2.8%), respectively. Partial correlation analyses were performed to test possible associations between dietary fat intake and cardiometabolic risk factors. Total fat (P=0.011) and SFA (P=0.019) intakes had positive associations with WC while there was a positive association between fat from coconut scrapings and waist-to-hip ratio (P=0.009). Significant differences in WC and waist-to-hip ratio were observed when qualities were established for total SFA intake. No association was observed between arterial stiffness and dietary fat intake. In conclusion, total fat and SFA intakes were positively associated with WC while study participants with high WC and waist-to-hip ratio were in the fourth quartile of total SFA intake.

Keywords: Arterial stiffness, cardiometabolic risk, coconut fat, dietary fat

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Influence of dietary and lifestyle factors on body composition in male adults

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The present study aims to investigate the associations between diet, lifestyle factors, socio-demographic factors and body composition by assessing body fat percentage, body fat mass, fat-free mass and muscle mass in a population of adult men. The study population consisted of 230 adults aged between 30- 60 years (median age 43.2 ± 81). Body composition measurements were assessed using a body composition analyzer. Daily food intake was measured using a three-day diet diary. The International Physical Activity Questionnaire was used to assess physical activity. A general questionnaire was used to collect information about lifestyle factors and socio-demographic factors. Spearman's correlation analyses were performed to test the possible associations between diet, lifestyle factors and body composition. Statistical analyses revealed that BMI, body fat percentage and body fat mass has a significant correlation with dietary fat intake ($P < 0.05$). Muscle mass and fat-free mass have an inverse relationship with carbohydrate intake ($P< 0.05$). There is no evidence of any association with the total energy intake, protein intake, dietary diversity score and food variety score with body composition measurements. There was a negative association between physical activity level ($P< 0.05$) and body fat mass. There was no association between smoking and alcohol consumption with the body composition measurements. Occupation and education level were positively associated with body fat percentage ($P< 0.05$). In conclusion, these findings suggest that diet, physical activity and socio-demographic factors influence body composition especially dietary fat intake, carbohydrate intake, physical activity, occupation and education level. These findings support the improvement of the nutrition status of male adults in Sri Lanka

Keywords: Body composition, body fat mass, fat-free mass, dietary diversity score, physical activity level

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Association between socio-demographic and health & nutrition related factors in children less than five years in rural communities in Sri Lanka

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Child undernutrition is still a considerable public health problem, particularly in rural communities in Sri Lanka. Few studies have examined the factors associated with the nutritional status of children in rural communities in Sri Lanka. This study aimed to identify the nutritional status, child feeding practices and factors associated with nutrition status in rural Sri Lankan children under five years. This study was conducted in two phases. Secondary data was analyzed in the first phase and a telephone survey was conducted in the second phase. Secondary data was obtained from a survey conducted by Child Fund Sri Lanka in 2020. A total of 639 parents/caregivers of children 0-5 years were recruited. A subsample (n = 93) from the same study participants was recruited for the 2nd study. The details about socio-demographic, feeding practices, food intake and pre-recorded anthropometric measurements of children were collected. The nutritional status of children was determined by WHO Anthro Plus 3.2.2 Software. Dietary Diversity Score (DDS) was calculated to assess the dietary diversity of children. Of the study sample 2.2% of children were severely underweight, 22% of children were underweight and 10% of children were stunted. About 73% of caregivers did not follow the appropriate complementary feeding practices while 97% of the population follow the recommended breast feeding practices. The mean DDS of the children was 4.6 (SD = 1.5), and the majority (65.0%) fall within the medium DDS category (2.7-5.3). Gestational age ($P = 0.000$), birth weight ($P = 0.000$), DDS ($P = 0.033$) and caregiver's level of education ($p = 0.016$) were significantly associated with underweight while gestational age ($P = 0.004$) and birth weight ($P = 0.000$) were significantly associated with stunting. This study helps to identify the gaps in the existing knowledge among caregivers regarding factors associated with child undernutrition in rural communities in Sri Lanka. It suggests strengthening the current educations programs conducted by MOH clinics emphasizing proper complementary feeding practices.

Keywords: Child under-nutrition, dietary diversity score, Sri Lanka, stunting, underweight

Effect of online diabetes self-management education on glycemic control of type 2 diabetes patients

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Glycaemic control is the central focus of diabetes management. Lifestyle management is an integral part of diabetes management. Diabetes self-management education (DSME) facilitates adherence to proper lifestyle management. As type 2 diabetic patients lost access to regular care at the diabetic clinics during the COVID-19 pandemic, this study was aimed to assess the effect of online DSME intervention on glycaemic control of the individual with type 2 diabetes (T2D). This randomized controlled clinical trial was conducted for fifteen weeks (t = 15 weeks) with 40 (n = 40) T2D individuals aged 18-65 years. T2D individuals were randomly allocated either to receive online DSME intervention (treatment group; n = 20) or general lifestyle management education (control group; n = 20). The online DSME intervention package consisted of short motivational messages, videos on dietary and physical activity modifications, web posters related to lifestyle modification and online structured counseling sessions on diet and physical activity modification by a registered dietitian. Knowledge of DSME, fasting plasma glucose (FPG), body weight, physical activity level (PAL), and dietary intake of both groups were measured at the baseline (t = 0 weeks) and end (t = 15 weeks) of the intervention. After 15 weeks of the intervention, T2D patients showed significant (P < 0.01) reductions in FPG and body weight compared to the control group. There were significant ((P < 0.01) improvements in DSME score, energy from proteins, the quantity of fruits and vegetables and physical activity level of the treatment group compared to the baseline. Further, reductions in the total energy intake, energy from added sugar and fat and carbohydrate intake were observed among the intervention group compared to the baseline. Moreover, significant (P < 0.01) reductions in the FPG and body weight of the treatment group were observed compared to the control group. Therefore, it can be concluded that online DSME intervention was effective in improving the FPG and body weight of T2D.

Keywords: Diabetes, glycaemic control, lifestyle management, self-management education

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Dietary data collection tools for preschool-age children in middle-income countries: A systemic review

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Healthy dietary changes are encouraged to overcome the dual burden of childhood malnutrition, which is an emerging public health threat in middle-income countries. Using a valid, reliable and user-friendly dietary assessment method is necessary to evaluate the impact of dietary behavior change modification. Therefore, the current study aimed to systematically review the existing dietary data collection methods/tools for pre-school-age children in middle-income countries. Articles were searched using keywords via the Sage journal, PubMed, Cochrane Library and emerald insight databases. According to PICOS inclusion and exclusion criteria and PRISMA guidelines, studies were screened for inclusion. Studies included were; (a) published in English, (b) that involving dietary assessment in preschool children (2 to 6 years), and (c) published in middle-income countries. No time period restrictions were considered. Included studies were undergone a quality assessment using the Quality Criteria Checklist for primary research. Key information extracted from the studies included reference of study, study design, a dietary assessment tool used, standard tools used (if the used tool was validated) reliability and validity of the tool, measured outcome of the tool. In total, 63 studies were included. Forty-one of them used 24hr recall and 22 used food frequency questionnaires. FFQs used three-day diet diaries (n = 1 study) and 24hr recalls (n = 21 studies) as standard tools. Fourteen tools were not tested for either reliability and validity. Four of the tools reported both reliability and validity. Only one reported validity and three tools reported reliability. Tools reported both validity and reliability were adapted FFQs not tested for validity and reliability for the adapted versions. Results of this review suggest that further researches are needed to develop more valid and reliable measures to assess pre-school children's dietary intake according to the dietary behavior of the study context.

Keywords: Assessment tools, children, dietary intake, middle income

Assessment of direct and indirect expenditure of type 2 diabetes mellitus management

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Managing type 2 diabetes mellitus and its complications is expensive thus creating a great impact on the economy of the country. Diabetic clinics operated in Government Hospitals of Sri Lanka provide basic facilities for diabetes-related biochemical and clinical investigations and complication management and oral hypoglycaemic agents (OHA) for glycaemic control. However, type 2 diabetics (T2D) have to bear a significant proportion of diabetes management costs. Therefore, the current study was conducted to identify and estimate the direct and indirect expenditure of diabetes management of T2D patients living in a rural setting. Hundred and three (n=103) T2D patients were recruited to the study. Direct and indirect expenditure of the disease management was obtained using telephone and in-person interviews. Out of the 103 patients, 84% of diabetic patients obtained their basic diabetes management facilities from the Government Hospitals. Physician consultation fees, cost of blood and urine tests and cost of medications were identified as the direct cost of diabetes management whereas loss of production due to sick leaves, traveling and transport cost for treatments and consultations were identified as indirect costs. The monthly average direct expenditure per patient of the study sample was thirteen thousand and twenty rupees (Rs. 13,020). Physicians' consultation fee was thousand five hundred and seventy-nine rupees (Rs 1,579) whereas the cost of blood and urine tests per month was eight hundred and twenty rupees (Rs 820). The monthly average expenditure for OHA hypoglycaemic agents was six hundred and twenty rupees (Rs 620). Average traveling and transport cost and cost for loss of production were estimated as hundred and eighty rupees (Rs 180) and four thousand two hundred and twelve rupees (Rs 4,212). In conclusion, the estimated average direct and indirect diabetes management expenditure per person was eighteen thousand four hundred and sixty rupees (Rs 18,460).

Keywords: Diabetes mellitus, direct cost, economic burden, indirect cost

Phenolic content and antioxidant activities of selected commercially available cereal products in Sri Lanka

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Cereals and cereal products are pivotal in the Sri Lankan diet. Ready to serve cereal products are becoming popular among Sri Lankan consumers. Phenolic compounds in cereal products play a considerable role as dietary antioxidants. There are limited studies on the phenolic content and antioxidant activities of commercially available cereal products available in Sri Lanka. Therefore, this study was aimed to determine the phenolic content and antioxidant activities of selected commercially available cereal products. Samples of cereal products namely Kellogg's cornflakes-strawberry, Oateo-instant oats, Maliban Yahaposha Nutri-Fix, Samaposha and Kellogg's cornflakes-original were purchased from the local market in Pannala. Soluble and bound phenolic compounds were extracted from the finely ground cereal samples. The extracts were analyzed for the total phenolic content (TPC), total flavonoid content (TFC) and proanthocyanidin content (PC). TFC and PC were performed for only soluble phenolic extracts of the cereal products. The antioxidant activities of the cereal products were determined using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity (DRSA), reducing power (RP) and ferrous ion chelating activity (FICA). TPC of soluble and bound phenolic extracts ranged from 415.9 ± 57.1-114.7 ± 35.5 and 70.2 ± 7.4-14.9 ± 9.9 μmol FAE/g respectively. TFC and PC of soluble phenolic extracts ranged from 49.8 ± 5.2-8.2 ± 0.5 and 32.3 ± 19.7-5.9 ± 6.6 μmol CE/g respectively. RP of soluble and bound phenolic extracts ranged from 60.9± 0.9-22.5± 1.6 and 9.73± 0.8-3.2± 2.9 mg AAE/g respectively. DRSA of soluble and bound phenolic extracts ranged from 648.9± 65.3-88.0± 58.8 and 320.5± 15.1-268.3± 32.3μmol TE/g respectively. FICA of soluble and bound extracts ranged from 92.2± 3.3-20.1± 11.6 and 26.2± 8.8-13.4± 1.9 μmol EDTA equivalents/g respectively. Selected cereal products were significant sources of phenolic compounds and contribute significant antioxidant potential to the diet.

Keywords: Antioxidant activity, bound phenolic, cereal products, DPPH, soluble phenolic, TPC

Household perception study on immunity-boosting during COVID-19 pandemic

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Since the beginning of the pandemic, the SARS-CoV-2 coronavirus has mutated, resulting in different variants of the virus. Meanwhile, the concept of "immunity-boosting" has become a popular theme. Although a lot of information on immunity-boosting is available from different sources, evidence-based information on individual perceptions is scarce. People engage in wishful thinking which shapes individual perceptions. This study aimed to understand the perception of immunity-boosting mechanisms in the Sri Lankan household during the Covid-19 pandemic. A convenient sample cross-sectional study was conducted. Self-administered and pre-tested questionnaires were administered using the online platform. The study participants included 216 (n = 216) households. A substantial increase (20%) in people using immunity-boosting methods was found after the COVID-19 pandemic. The results of the study showed that a higher number of participants relied on traditional methods like steam inhalation (93%), drinking warm water throughout the day (85%), and drinking coriander (72%). Among the respondents, the majority (99%) perceived that spices and herbs help maintain immunity. The majority of participants (65 %) used dietary supplements and 92 % perceived them as a method of maintaining immunity. The majority (95 %) selected Vitamin C as an immunity-boosting dietary supplement and used (56 %) to maintain immunity. The majority of participants (90%) accepted the vaccination as a true immune booster. But many of them (67%) also perceived that the vaccine has long-term effects. There are no differences between rural and urban about the perception of immune-boosting during the Covid-19 pandemic. Many immunity-boosting methods after the COVID-19 pandemic were observed, mostly in traditional methods. The study confirms the increased consumption of dietary supplements, especially Vitamin C during the pandemic as a method of immunity-boosting. The perceptions on, vaccination showed higher levels. The study recommends further education of the general public on immunity and extended studies with representative samples.

Keywords: COVID-19 vaccines, immunity, natural or traditional immunity-boosting, supplementation.

Effect of providing nutrition information on menus at food outlets on consumer consumption

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People's lifestyles are changed with the busy work schedule and get the trend to eat much more foods away from the home. With the knowledge about nutrition and health, consumers are aware of healthy food. Limited studies were conducted to assess the effect of providing nutrition information of menu items in food outlets on consumer consumption in Sri Lanka. This study aimed to identify the availability of nutrition information on menus in food outlets, to identify the consumers' expectation of nutrition information on menus in food outlets and to determine the effect of nutrition information on menus in food outlets on consumer consumption. A cross-sectional survey was conducted by using two different pretested questionnaires for consumers and food outlets' staff. The study sample was consisted of conveniently selected 203 consumers and 30 food outlets' staff. The study data were collected both online and offline and data analysis was performed by using Microsoft Excel and SPSS 2016. The majority of the consumers (41%) eat from outlets to enjoy the taste. Out of the total, only 17% of food outlets had shown nutrition information on menus and they provided information about carbohydrates, protein, fat and sugar. Out of the total,59% of consumers liked to have nutrition information on menus and 41% of consumers did not consider the nutrition information on menus. Calorie, Fat, Cholesterol, Protein and Sugar content were the major information that consumers expected to know about their meals get food outlets. There was a positive association between age and consumption frequency from outlets (P=0.002).There was a positive association between gender and consumption frequency from outlets (P =0.000). Providing nutrition information of menu items in food outlets positively affects increasing consumer consumption. Further research studies should focus on determining the effectiveness of providing nutrition information on menu items in food outlets in Sri Lanka.

Keywords: Consumer consumption, food outlets, menu, nutritional information

Development of a website on vitamin D nutrition to educate the young population in Sri Lanka

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Acquiring accurate nutrition information is an important factor to promote a healthy nutritional status. The digital platform is a potentially engaging way to support young adults in learning about nutrition. Little emphasis has been given to educating the general public on vitamin D nutrition in Sri Lanka and many countries. Therefore, the present study aimed to identify the knowledge gaps of vitamin D nutrition among young adults and develop a website to educate them on vitamin D. Online questionnaire was used to gather the level of knowledge on vitamin D among young adults in Sri Lanka. A website was developed addressing the basic information on vitamin D nutrition and to address the knowledge gap about vitamin D among young adults. According to the online questionnaire, 50.6% of young adults were unaware of the functions of vitamin D in the body while 40.7% of young adults were unaware about the main sources of vitamin D. In addition, 88.9% of study participants were not knowledgeable on Recommended Dietary Allowances (RDA) of vitamin D. Therefore, a website called NutrivitD has developed a giving emphasis on basic metabolism of vitamin D in the body, sources of vitamin D, functions of vitamin D, RDA of vitamin D, assessment of vitamin D status, vitamin D deficiency (VDD), way of overcoming VDD and FAQs regarding vitamin D nutrition. This website also provides a calculator to predict the vitamin D level in the body by identifying the sun exposure habits. The comments from professionals in the nutrition field will be gathered to improve the content and the appearance of the website. The efficacy of the website in educating young adults will be identified by recruiting a sample of young adults in Sri Lanka. The link for the website will be published on social media to educate the general public.

Keywords: Nutrition education, vitamin D, website, young adults

Psychological distress of undergraduates during COVID-19 pandemic

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Undergraduate students are consistently found to have higher levels of psychological distress compared to the general population. Due to the devastating effects of the COVID-19 pandemic, their distress level would be deteriorated further. Therefore, it is a timely requirement to assess this situation, to take measures against the negative impacts. The aim of this study was to assess the prevalence of psychological distress in undergraduates and to examine possible factors that are associated with it. Depression, Anxiety and Stress Scale-21 was used as an instrument to assess psychological distress in this study. A cross-sectional web-based survey was conducted among undergraduates of Wayamba University of Sri Lanka to collect data using a convenient sampling. Data were collected at a 93% response rate, from the total of 149 respondents (36.2% male and 63.8% female) of mean age of 24.3 years. Approximately 61.7%, 46.3%, and 25.5% of the undergraduates showed risk of depression, anxiety, and stress respectively with the form of mild, moderate, severe and extremely severe. Significant association showed between the year of studying with (P=0.018) the depression. English language proficiency level was associated with both of depression and stress (P =0.038, P =0.024 respectively). Gender (female) was associated with stress (P =0.031). Usage of social media (P =0.017) and online learning (P =0.001) were associated with anxiety. Requirements to engage doing other household works was associated with both of depression and anxiety (P =0.045, 0.017 respectively). This study demonstrates that undergraduates are in risk of higher prevalence of psychological distress and that is associated with factors like gender, year of studying, English language proficiency level, usage of social media, online learning, and requirements to engage extra household works. Further extended study using a larger representative sample is recommended.

Keywords: Covid-19, prevalence, risk factors, undergraduate

Energy balance, hydration status, and knowledge, attitudes, practices of Sri Lankan Air Force athletes

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Sports nutrition is essential for athletes for general health, and better performance. Less number of recent researches are available on energy balance, hydration status, knowledge, attitude, practices regarding nutrition in Air Force athletes in Sri Lanka. The aim of the present study was to identify the energy balance, hydration status, nutrition knowledge, attitudes, practices of Sri Lankan Air Force athletes. Fifty sportsmen and 53 sportswomen aged 20 to 40 years in Sri Lankan Air Force were recruited for present study. A 3-day diet diary was used to identify the energy intake while 3-day physical activity diary was used to assess the energy expenditure. The interviewer administrated questionnaire was used to gather the details on socioeconomic, demographic details and knowledge, attitude, practices related to sport nutrition. Hydration status was identified using urinometer. Mean energy balance of total sample was -293.8 (SD 1222.3) kcal/day. About 61 % of athletes had negative energy balance while39 % of athletes had positive energy balance. Highest negative energy balance was reported among boxing female players. Significant association was observed between sport type ($P=0.016$) and energy balance of athletes. Majority of athletes (64%) were minimally dehydrated while 34 % athletes well hydrated. Percentage of athletes with significantly dehydrated and seriously dehydrated was 1%. Sports type ($p=0.005$) was significantly associated with hydration status. According to the scoring system, mean score of knowledge, attitudes, practices were 42.3 $\pm$ 20.4 %, 68.1 $\pm$ 16.9 % and 65.8 $\pm$ 12.0 %, respectively. Athletes had regular (40-49%) knowledge, good (60-69%) attitudes and good practices (60-69%) regarding sport nutrition. There was a significant association between age ($P=0.040$) and nutritional knowledge of athletes. Similarly, sport type was significantly associated with attitudes and practices related to sport nutrition. As a conclusion, majority of Air Force athletes do not fulfill required energy and fluid intake. Therefore, nutrition education programs should be focused on balance diet to fulfill the energy and fluid requirements of Air Force athletes for better performance.

Keywords: Athletes, energy balance, hydration status, knowledge, attitudes, practices

Dietary intake of preschool-aged children in an estate area in Kalutara District, Sri Lanka

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Preschool age is the most crucial stage of human development as their dietary intake is not only linked to the growth and development but also to the nutrition-related consequences. Despite that Sri Lanka has an impressive health indicator, the country is still being confronted with childhood malnutrition having higher prevalence in estate areas. Since the diet is attributed to malnutrition, current study assessed the dietary diversity and food intake of estate living Sri Lankan preschool children. A cross-sectional study was conducted with parents/caregivers of children aged 2–6 years, from six maternal and child health clinics in Kalutara District, Sri Lanka. Demographic and socio-economic factors, and food intake and dietary diversity score (DDS) (using a food frequency questionnaire) (n = 152) were assessed. Mean daily intake servings of cereals and starchy roots, pulses plus animal sourced foods(chicken, red meat, fish and egg) were in line with the national dietary intake recommendations. About one-fourth and less than 12% of children consumed their daily recommended intake of vegetable (0.98 ± 0.67) and fruit (1.21 ± 0.46) servings respectively. The percentage of children complying with food-based dietary guidelines (FBDG) were ranging from 11.8% to 94.7% for vegetables and pulses plus animal sourced foods. Children had a mean DDS of (4.67 ± 0.72) out of 9, with most in the medium DDS category (DDS of 3.1 – 6.0).More than half consumed salty snacks and sugary snacks and confectionaries twice a week. Around 70% reported watching television while eating. In conclusion, findings highlight inadequate intakes of fruits and vegetables in these children and majority had an unhealthy diet related social behavior, indicates the need for improvement in dietary habits among estate area living Sri Lankan preschool-aged children in order to combat malnutrition.

Keywords: Dietary diversity, dietary intake, estate area, servings, Sri Lanka,

Determine the risk factors of central obesity and the prevalence of central obesity with normal BMI among MI patients

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Myocardial infarction (MI) is a major health problem in Sri Lanka. Central obesity is an independent risk factor and a better predictor of MI than general obesity. Higher mortality rate was found among normal Body Mass Index (BMI) patients with central obesity. This study aimed to identify the risk factors of central obesity of MI patients and determine the prevalence of central obesity among MI patients with normal BMI. 30 adult MI patients (>18 years old) at a private hospital in Colombo was recruited as the study sample. Height, weight measurements and medical information were collected using the assessment forms of the dietitian. Dietary information was collected using an interviewer administered questionnaire. Patients were encouraged to self-measure waist circumference (WC) by providing them a video with instructions. According to WHO cut off values for Asians normal BMI was taken as 18.5-22.9kgm^{-2} and Central obesity was defined as >90cm for male and >80cm for female. 83% of the sample was male patients. The mean age, height, weight, BMI and waist circumference of the sample was 60.03±13.12 years, 163.8 ±8.45cm, 65.2 ±10.59 kg, 24.3±3.53kgm-2 and 89.6 ±10.89cm respectively. Out of the total patients 50% had central obesity. In the study sample 30% had normal BMI, 30% was overweight, 33% percent was obese and 7% percent was underweight. Among the normal BMI patients 44.4% had central obesity. High consumption of starchy food (P=0.009); low consumption of vegetables (P=0.000); high consumption of sugar (P=0.025); low frequency of consuming fish (P=0.009); skipping breakfast (P=0.035) were dietary risk factors for central obesity of the selected study sample. There was an association between alcohol consumption and central obesity. (P=0.035). This study found a higher percentage of central obesity among selected MI patients. Further studies in both private and government hospitals are required to get a clear understanding of central obesity among Sri Lankan MI patients.

Keywords: Central obesity, myocardial infarction, risk factors, Sri Lanka

Development of a digital toolkit for managing gestational diabetes mellitus condition during covid-19 pandemic

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Gestational diabetes mellitus (GDM) is the new diagnosis of glucose intolerance in pregnancy. Although the GDM can aggravate the poor pregnancy outcomes, women with well controlled GDM can have a healthy pregnancy and a healthy offspring. COVID 19 pandemic has challenged the GDM mothers to receive in person self-care and education on GDM management at their regular antenatal clinics. Therefore, the current study was conducted with the objective of developing a digital based solution to provide necessary self-care and management education for GDM mothers during the COVID 19 pandemic. This qualitative study conducted as two phases; content identification and development phases. Components of the digital education toolkit and contents for each tool were identified with the assistance of fifteen ($n=15$) healthcare experts of the GDM management team (dieticians; $n=3$, nutritionists; $n=3$, and midwives; $n=9$) using an online questionnaire and telephone interviews and mothers with GDM ($n=6$). According to the comments and suggestions of the healthcare experts and GDM mothers, an e-booklet, interactive e-diary, and digital diary were developed. Content, visuals, and illustration were designed using MS Word, Excel, and Power Point applications. E-booklet provides the basic information about physiological and biochemical changes of GDM and GDM management. Interactive e-diary and digital diary aids the GDM mothers to record their diet, physical activities, use of insulin and the progress of plasma glucose control. Digital diary offers the GDM mothers to receive customized diets and physical activity guidelines depending on their weight gain and plasma glucose level. Further the developed tools are expected to validate for its contents, readability and comprehension. Therefore, it is expected that developed digital toolkit may assist the GDM mothers to achieve proper glycaemic control and better pregnancy outcomes after validating them.

Keywords: digital toolkit, diet, gestational diabetes mellitus, self-care

Knowledge, attitude and behaviour towards the functional foods and nutraceutical consumption by adults in Sri Lanka

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People are conscious of the role of their foods to prevent non communicable disease (NCDs) conditions and to be healthy. Functional foods and nutraceuticals (FFN) play an important role in adults' health by preventing and reducing the risk of NCDs. This cross sectional study was designed to evaluate knowledge, attitude and behaviour (KAB) towards the consumption of FFN by Sri Lankan adults. The study population consisted of 441 adults above 20 years of age living in Sri Lanka. A pre tested online questionnaire was used for data collection and analysed using SPSS 20 and AMOS software. Majority of participants in the study were (62%) female and 74% of the adults were in the 20 – 29y age category. Significant effect ($p < 0.05$) of behaviour for the FFN consumption were identified, but there were no significant effect of knowledge and attitude. There were significant relationship between knowledge and attitude and knowledge and behaviour, but no significant relationship between attitude and behaviour. Area of residence, education level, income level and current use of medications for NCDs were significantly affect for the knowledge towards the FFN consumption, but they were not significantly affect for the attitude and behaviour. Gender, age and work status were not significantly affect for the KAB towards the FFN consumption. Majority (85%) have a knowledge of health benefits of FFN. About 64% and 51% have positive attitude about the health benefits and the consumption of FFN respectively. As top five daily consuming foods; vegetable curries (93%), black tea (63%), green leaves (54%), dhal (51%) and unpolished rice (44%) were identified. According to this study behaviour affect for the consumption of FFN. Knowledge of FFN affect for the attitude and behaviour towards FFN consumption. Some socio-demographic factors influence for the knowledge towards the FFN consumption. Furthermore people should be aware of the health benefits of FFN and should be encouraged for the consumption.

Keywords: Adults, functional food, nutraceutical, NCDs

Validity and reliability assessment of a food frequency questionnaire for Sri Lankan preschool children

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Dietary behavior change interventions are notable to overcome the double burden of childhood malnutrition, which is growing at an alarming rate in middle income countries, like Sri Lanka. Accurate assessment of children's diet is necessary to identify the current diet and the effectiveness of dietary behavior interventions. To date, there are no valid and reliable dietary assessment tools for preschool age children in Sri Lanka. Therefore, current study was conducted to assess the validity and reliability of an adapted food frequency questionnaire (FFQ). A cross sectional study was conducted using a convenient sample of mothers (n = 92) having a preschool child aged 2 to 5 years, living in Angunukolapelessa District. An adapted FFQ used in a previous Sri Lankan study, comprised of 23 items with food groups were used against a three-day diet diary (3DD). A subsample of participants (n = 31) underwent the reliability assessment four week apart. FFQs (FFQ 1 and FFQ 2) were interviewer administered via telephone calls. Although Spearman's correlations showed lower correlation between FFQ and 3DD for the validation study, cross classification analyses showed satisfactory agreement between the 3DD and FFQ as < 50% of participants were classified as in same or adjacent quartiles for all the selected food group intake servings. Spearman's correlation coefficients showed high correlations between FFQ1 and FFQ2 and Cronbach's alpha values (0.473 to 0.954) while intraclass correlation coefficients (0.310 to 0.912) showed poor to excellent agreement between FFQ1 and FFQ2 for the reliability assessment. In accordance, the FFQ showed acceptable validity and good reliability for selected food group intakes in Sri Lankan preschool children. The validity has to be improved by re testing the FFQ with modified food items in a representative population for future use.

Keywords: Food frequency questionnaire, preschool children, reliability, three-day diet diary, validity

Dietary intake of preschool-aged children in a rural area in Mannar District, Sri Lanka

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Childhood malnutrition is a public health concern in Sri Lanka, which remaining at lower rates in rural areas compared with urban and estate sectors areas. Given that the existing prevalence of childhood malnutrition for several decades in rural areas, understanding the dietary habits of children is necessary to identify the role of diet in childhood malnutrition. This study assessed the dietary diversity and food intake of rural living Sri Lankan preschool children. A cross-sectional study was conducted with 150 parents/caregivers of children aged 2–6 years, from two maternal and child health care centres in a rural area, Mannar District, Sri Lanka. Demographic and socio-economic factors, dietary diversity score (DDS) and food intake in servings (using a food frequency questionnaire) were assessed. Mean daily intakes of cereals and starchy food and pulses plus animal sourced food (chicken, red meat, fish and egg) servings were align with national food based dietary guideline (FBDG) recommendations. Mean daily intakes of fruit (0.57 ± 0.05) and vegetable (1.12 ± 0.32) servings did not align with national FBDG recommendations of 2 servings from these food groups. Most (94%) children met the national recommendations for water intake. Children had a mean DDS of 4.89 ± 0.39 out of 9, with most of them reported the medium DDS category (DDS of 3.1 – 6.0). Intake of salty snacks, sugary snacks and confectionaries were reported in more than two third of children, with a frequency of twice a day consumption. Around 62% of children watched television while eating. In conclusion, rural children's fruits and vegetable intakes are inadequate and majority had an unhealthy diet related social behavior during food intake. This suggests the need for population-based interventions to promote the intake of fruits and vegetables in rural living Sri Lankan children for a healthy future.

Keywords: Child, dietary intake, rural population, serving size, Sri Lanka,

Dietary and socio-demographic factors associated with household food security statues in rural communities during COVID 19 pandemic

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Food security is a major development issue that has been prioritized in the domestic economic policies of Sri Lanka. However, existing data on food security in rural communities are highly outdated and limited. This cross-sectional study aimed to assess rural household food security statues in selected rural areas (Monaragala, Batticaloa) in Sri Lanka. The objectives of the study were to: (i) To identify and characterize food insecure, vulnerable groups and (ii) identify the difference between food intake among food secure and food insecure households. A total of 344 families from the Batticaloa and Monaragala districts were studied. Telephone surveys were conducted to collect data. Food Insecurity Experience Scale (FIES) was used to assess the households' food security status. Dietary Diversity Score (DDS) was used to determine the dietary diversity. Chi-square test, binary logistic regression and Mann Whitney tests were used for the statistical analysis. The percentage of households with food security, moderate food insecurity and severe food insecurity was 50.0%, 36.0% and 14.0%, respectively. Household average income level (OR = 4.597; $P<0.05$) was significantly associated with household food insecurity. Mean Dietary Diversity Score (DDS) was significantly different between food secure and food insecure households ($P<0.05$). The majority of the respondents consumed cereals, vegetables, sugar, and oil. The minority of respondents consumed meat and eggs. Food security and food insecurity households were consumed minimally 4 food groups per day. Energy, protein, fat, carbohydrate, calcium, iron and vitamin C levels showed significant difference between respondents who live in food secure and food insecure households ($P<0.05$).

Keywords: Dietary diversity score, food insecurity experiences scale, food security, rural

Perception and usage of alternatives for sugar by Sri Lankan adults

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Alternatives for sugar) ALS(have continued to be of great interest to achieve sweet taste and other beneficial effects to meet the expectations of health conscious consumers. This study aimed to determine the level of knowledge, attitude and behaviour (KAB) on ALS by Sri Lankan adults. An online survey was conducted through social media platform and was completed by 565 participants aged 18 years or above. Data analysis was done by using IBM SPSS statistics 23 and AMOS graphics and descriptive statistics. The results showed that the level of knowledge and behaviour on ALS were moderate while attitude were at a high level. A significant positive effect (30%) of attitudes was found on usage of ALS ($P \leq 0.05$) whereas knowledge and behaviour were not significantly effect on usage. The sociodemographic factors such as area of residence, age, income level and work status significantly ($P < 0.1$) affected on attitudes and knowledge. The top five ALS consumed by Sri Lankan adults were *Kithul* jaggery, Sugar jaggery, *Kithul* treacle, Bee honey and Coconut treacle. *Kithul* jaggery was used highly in five provinces, namely Southern, Western, Central, Uva and Sabaragamuwa. About 81% had never consumed artificial sweeteners. This study laid a foundation to understand level of KAB on ALS among Sri Lankan adults as the first survey conducted. The level of attitude towards ALS is high whereas level of knowledge and behaviour of ALS are moderate. The level of attitude of Sri Lankan adults influenced the usage of ALS. Further research needs to be conducted with targeted age groups and different socioeconomic groups to find the knowledge gaps and behavioral factors affecting the usage of ALS.

Keywords: Attitude, behaviour, knowledge, socio-demographic factors, usage

Challenges and opportunities for mindful eating during the pandemic

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Mindful eating (ME) is a successful eating approach for a healthy life. COVID-19 pandemic situation may have had a significant effect on the normal routine of people due to the travel restrictions and other safety precautions taken to control the pandemic, ultimately affecting the regular eating behaviors of the population. In this backdrop, this study aimed to assess the ME behaviors and to identify perceived challenges and opportunities for ME during the time of the pandemic. A cross-sectional survey was conducted using a convenient sample of adults aged 18 years and above (n = 117).A pre-validated mindful eating questionnaire was used to assess ME, which consisted of six domains including disinhibition, awareness, emotional response, external cues, distraction, and acceptance. A pretested online questionnaire was used to assess their socio-demography, eating and eating-related behaviors. Participants were mostly women (82%) and had a mean age of 29.81 $\pm$ 7.76 years (ranging from 18 to 60 years). Obese participants have low mindful eating than normal-weight participants ($p = 0.05$). When age increased, mean MEQ score ($r = 0.183$, $p = 0.05$) and, emotional responses ($r = 0.22$, $p = 0.02$) increased significantly. Half of the participants (50%; 59/117) indicated that their eating behaviors have changed positively during the pandemic as the pandemic has opened up new opportunities such as having more free time instead of their usual busy life, staying home and opportunity for frequent family meals. Major challenges for mindful eating were online working schedules, online learning schedules (77%; 90/117), and boredom/ stress or upset (75%; 88/117). Major opportunities for mindful eating were having time to prepare own meals (85%; 100/117) and improved positive relationship with food (83%; 97/117).Future studies should focus on the long-term impact of mindful eating behaviors for health and nutrition, and minimizing the barriers to mindful eating in the post-pandemic new normal context.

Keywords: Cross-sectional online survey, mindful eating questionnaire, pandemic, Sri Lanka

Consumer perception on food consumption and Non-Communicable Diseases

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Non-Communicable Diseases (NCDs) accounted for 71% of all deaths in Sri Lanka, and this mortality rate has been increasing rapidly during past decade. Nutrition related diseases closely correlated with unhealthy eating habits. Individual dietary behavior depends on perceptions they have about food consumption. The present study aimed to identify current consumer understandings on inter-relationship between food consumption and NCDs. A cross-sectional online survey was conducted to collect data from 160 participants of convenient sample of adults above aged 20 years. Self-administrated online questionnaire was the instrument to collect the data. Questionnaire was prepared by modifying the combination of pre-tested and validated questions used in similar previous studies. About 90% of participants perceived those unhealthy dietary patterns led to NCD. According to participants' understanding, 89% of them believed that high fat diet as major risk factor for cardiovascular diseases. However, compared to that low number of participants perceived that low fiber diets (46%) and high carbohydrate diets (58%) may also be risk factor for cardiovascular diseases. Out of total consumers 53% and 51% of participants had positive perception regarding daily servings of fruits and vegetables respectively which as recommended by the WHO. However, close to 50% of consumers didn't have clear understanding regarding recommendations. Most of participants (51%) perceived that all type of margarine and fat spreads are bad for cardiovascular health. Majority of population (80%) perceived those organic foods reduce the risk of cancer and kidney diseases. In conclusion, this study sample of participants perceived that unhealthy eating habits may leading to NCDs and following healthy diet and lifestyle would be effective to reduce the burden. But understanding regarding certain fat types, fruit and vegetables recommendations were still not in the satisfactory level. Participants of this study showed positive perception regarding food consumption and related diseases and healthy eating.

Key words: Consumer perceptions, food types, healthy eating, non-communicable disease

Knowledge, understanding, and comprehension of the use of nutrition labeling

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The nutrition information on food labels is a significant tool for encouraging consumers to make informed healthier food choices. Conversely, to successfully plan nutrition or public health interventions, a better understanding of nutrition label knowledge and comprehension is required. In Sri Lanka, there is little evidence as to how effective the use of nutrition information is on labels by general public. Hence, this study was conducted to apprehend the level of knowledge and to evaluate the understanding and comprehension of the use of various nutrition labeling available in the marketplace by Sri Lankan consumers. An online cross-sectional survey was conducted using a convenient sample of young adults aged 18 years and above(n = 310).The mean age of participants was 28.55 ± 11.47 and 72% of participants were female. Around 56% were unemployed or student and 74% were from middle-income levels. The majority of respondents have satisfactory nutrition knowledge (63%) and satisfactory understanding and comprehension (67%) of the use of nutrition labels. Most people prefer to know what they are buying and consuming (90%) and concerning product prices (79%) are the major prospects for reading labels. However, time constraints (70%) and the lack of nutrition panel details on some products (69%) cause them to fall behind. Results showed nutrition knowledge was significantly associated with self-rated dietary Intake ($P = 0.007$), and label reading frequency was significantly associated with nutrition knowledge ($P = 0.021$).Even though 92% indicated that nutrition labels influence their purchasing decisions, nearly 50% agreed on the reliability of nutrition labels. This study found that though the studied population has satisfactory nutrition knowledge; nutrition information on labels is not as important as price and exp. date. Thus, updating nutrition labels to be more clear, concise, and easily accessible, along with enhancing nutrition literacy, can help consumers adopt healthier dietary behaviors.

Keywords: Knowledge and comprehension, nutrition labeling, purchasing behavior, Sri Lanka

Validation of Malnutrition Screening Tool for Surgical patients

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Malnutrition is prevalent in surgical patients and is associated with a number of adverse outcomes. Identifying the risk of malnutrition and intervening at an early stage will improve patients' overall prognosis. Nutrition Screening identifies individuals who are malnourished or at risk of becoming malnourished. Numerous nutrition screening tools are used in hospitals, but many, if not most, have never been validated for the care setting, patient population, or outcome they strive to identify. The aim of this study was to validate the Malnutrition Screening Tool (MST) for Surgical Patients. The sample population included hundred patients (>18 years old) admitted to a private hospital in Colombo. The malnutrition status of each participant was assessed by using MST and Malnutrition Universal screening Tool (MUST) separately. Nutrition Intake and Medical related information were collected using Interviewer administered questionnaire and Bed Head Ticket (BHT) of the patients. Statistical analysis was carried out using SPSS 16.0 Software to determine the sensitivity, specificity and predictive value of the MST. The mean age of the patients was 56.84 ± 1.4 years According to MUST, 73% of patients were at low risk, 18% were at moderate risk and 9% were at high risk of malnutrition. According to MST, 80% of patients were not at risk and 20% were at risk of malnutrition. The MST had a low sensitivity 48.15% (95% confidence interval [CI] 46% to 34%) and a specificity of 90.41% (CI 81.24%-96.06%) The positive predictive value was 65% (CI 45.34%-80.61%) and the negative predictive value was 82.5% (CI 76.49%-87.23%). Agreement was moderate as represented by Kappa Coefficient of 0.420. Although the MST is simple, quick and easy to use, it isn't a suitable screening tool for detecting risk of malnutrition in surgical patients. The components of the MST haven't acceptable sensitivity for surgical patients, suggesting that further prospective research using the MST is required to confirm its validity as a screening tool in hospitalized surgical settings in Sri Lanka.

Key words: Malnutrition, nutrition screening, surgical patients, Sri Lanka

Evaluation of effectiveness of nutritional counseling on nutritional status of post-operative coronary artery bypass graft surgery patients

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Cardiovascular diseases (CVDs) are the leading causes of deaths in Sri Lanka. Coronary artery bypass graft (CABG) surgery is a common method used to treat CVDs. Proper nutritional status of the patient is important for fast recovery and prevention of complications after the surgery. Nutritional counseling is a strategy that supports to maintain nutritional status of patients. Therefore this study was conducted to evaluate the effectiveness of nutritional counseling on nutritional status of post-operative CABG surgery patients. Thirty post-operative CABG surgical patients of a private hospital in Colombo, >18 years old (Males-20, Females-10) were recruited in the study. Nutritional counseling was received during hospitalization period after the surgery. A structured questionnaire and Food Frequency Questionnaire were used for data collection on patients 'general characteristics, medical information, dietary information and attitude on nutritional counseling through telephone. Nutritional status was evaluated by measuring biochemical parameters at pre-operative, post-operative and 4-6 weeks post-discharge stages of the patient. Food frequency questionnaire measured dietary information after 4-6 weeks post-discharge. The attitude of patients was assessed on Likert five-point scale. Random blood glucose level of 20% of patients was improved from high level to healthy range. Serum albumin level of 16.7% patients was improved from high level to healthy range and 33.3% of patients were improved from low level to healthy range. Length of wound healing period (Mean 3.07 ± 1.2 weeks) was less than two weeks for 36.7% of patients. Majority, 66.7% of subjects belonged to highly effective category. Vegetable consumption of 33.3% of patients was increased from <2 servings to 2-4 servings per day. Generality, 86.7% of patients have changed their usage of coconut milk from first extracted milk to second extracted milk for cooking meals. Therefore based on the obtained data the nutritional counseling was positively effect on nutritional status of post-operative CABG surgical patients.

Keywords: cardiovascular diseases, coronary artery bypass graft surgery, nutritional counseling, nutritional status, post-operative

Validation of a Tool to Measure Food Literacy of Secondary School Children in Sri Lanka

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Food literacy plays a major role in inculcating healthy dietary behaviour since young, which has been considered as a prime solution to the drastic burden of NCDs. Although assessing the food literacy levels of adolescents has been highlighted as important, the absence of a validated and consistent instrument that is specifically designed for the Sri Lankan setting, limited the data on this area. Thus, we developed a food literacy tool that covers minor to broader aspects targeting grade 9 and 10 students. The study consisted of two main phases (1) tool development comprised of identification of the competencies, item generation and an expert study (n = 5 experts) and (2) scale testing included a content validity (n = 11 in-service advisors as a telephone survey), a face validity test (n = 20 pupils, as focus group discussions), a construct validity (n = 282 students) and tests of reliability (internal reliability by Cronbach α and external reliability by intraclass coefficient). Findings showed that the Content Validity Index (CVI) of the tool was at an acceptable level of 0.78. Face validity informed modifications to wording, understanding and formatting. EFA suggested a seven-factor model and the results of model fit indices of CFA confirmed the proposed theoretical model. The intraclass correlation coefficient indicated the high stability of the scale (ICC = 0.75-0.9). The resulting tool consists of 24 items (20 Likert type items and 4 dichotomous type items) which measure food literacy under 7 domains:1) Knowledge, 2)Skills, 3) Food/Health choices, 4) Eating, 5) Emotions, 6) Culture and 7) Food System. The developed tool is a valid scale to measure the food literacy of secondary school children.

Keywords: Development, food literacy, secondary school children, Sri Lanka, tool, validation

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Nutritional behaviours, perceptions and beliefs of high performance athletes in the national pool in Sri Lanka

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Although optimal nutrition is essential for peak performance in sports, little is known about the behaviours, perceptions, and beliefs (BPBs) in related to food and nutrition among athletes in Sri Lanka. This study aimed to determine the key BPBs of high performance athletes in the national pool. The cross-sectional study was conducted among total of 40 athletes. Interviewer administered and previously validated questionnaires were conducted through telephone interviews. Results showed that improving the performance (85%) was the major food choice determinant followed by good quality/price ratio (70%), controlling weight (67%), and brand name (55%). The main belief behind the large quantities of dietary protein consumption is the misconception that the protein is the major source of energy for the exercising muscles (60%). Nearly 80% of them have believed in proper hydration. About 40% of athletes didn't showed the awareness on importance of having pre, during and post event meal whereas supplements subcategory was showed some issues. Nutritional advice was sought by 75% athletes from coaches, 60% from medical doctors (60%) and about 50% from nutritionists. Out of 40 athletes, 35 (93%) used dietary supplements, vitamins (83%), minerals (70%), Branch Chain Amino Acid (68%), whey protein (60%), fish oil supplements (55%) and creatine (53%)were the most prevalent types. About 50% of athletes sleep 7 – 9 hour per day regularly. However majority (58%) were dissatisfied about their sleep. Study identified that improving performance, controlling weight, good quality/ price ratio and brand names were major determinant factors of nutritional behaviour of this group of athletes. Overall nutritional perception and beliefs among athletes was not up to the level of satisfactory and perception regarding supplements is a major concern. The majority were dissatisfied about their habitual sleep. There is a need and space to improve the dissemination of scientifically-based information to the national level sportspeople in Sri Lanka.

Key words: Behaviours, beliefs, optimal nutrition, perceptions, sleeping quality, supplements

Nutritional status and dietary intakes of national level athletes in the national pool in Sri Lanka

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Proper nutrition is one of the significant factors that ensure the peak performance of an athlete. Currently, there is no adequate information related to the nutrition of the national-level athletes in Sri Lanka. Therefore this investigation was conducted as a case series to assess the nutritional status and dietary intakes of high performance national level athletes in the national pool in Sri Lanka. Thirty three elite athletes (Male = 20, Female = 13) from Sri Lankan national pool under 4 sports categories (track and field, para-sports, triathlon, table tennis) were recruited to complete (1) an anthropometric assessment (body weight, body height, skinfold thickness, girth measurements), (2) a body composition assessment (using bioelectrical impedance analyzer), (3) dietary assessment (24-hour diet diary), and (4) physical activity assessment (24-hour physical activity recall). The majority of the athletes had normal BMI (18/33) while 6 athletes were underweight, 2 were overweight and 7 were obese. A major fraction (18/29) of the athletes had a normal fat distribution, while 10 athletes had low and, 1 had increased fat levels. The majority of the athletes had normal body water distribution in the body (25/29), while 4 athletes had a low range of body water. Most of the athletes had "Normal" and "Increased" levels of muscle mass percentage (28/29), only 1 had a low percentage of muscle mass. The majority of the athletes had a negative energy balance (20/33), while 13 athletes had a positive energy balance. In conclusion, although some of the athletes had appropriate body composition match with respective sports, majority of them had a negative energy balance. Individualized dietary counseling and diet plans for the athletes can be suggested in order to meet their proper nutrient requirements to enhance their performance. Follow-up nutritional assessments and further research can be conducted in the future to monitor the nutritional status of the athletes.

Keywords: nutrition status of athletes; dietary intake of athletes; physical activity; sports; body composition; anthropometry; sports nutrition

Generation of food-based recommendations for women and pre-school children using linear programming approach

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Women and pre-school children in Sri Lanka are at high risk for inadequate intakes of multiple micronutrients due to cereal-based monotonous dietary pattern. Therefore, this study aimed to determine the "the problem nutrients" in the diets of women and pre-school children and to formulae realistic sets of food-based recommendations (FBRs) to optimize the nutrient intake using locally available foods. Weekly food consumption patterns were assessed using 24h dietary recalls from a national-level cross-sectional study (2016). Then, FBRs were developed by linear programming analysis using WHO Opti food software. Dietary patterns of women showed that calcium, thiamin, riboflavin, niacin, folate, vitamin B_{12}, vitamin B_6, and iron were "problem nutrients" (could not achieve 100% of RNI even when the diets are optimized). Also, except folate, other seven micronutrients were identified as "problem nutrients" for pre-school children. Dark green leafy vegetables, dairy, fruits, legumes, meat, fish and egg, starchy roots, grains, and vitamin A-rich vegetables were identified as potential nutrient-dense food items that would fill the nutrient gap. Adherence to the best combination set of five food groups and six food subgroups recommendations would ensure the nutrient adequacy (could achieve 65% RNI in the worst-case scenario) of women for protein, fat vitamin c, vitamin B_6, vitamin B_{12}, and zinc and achieve more than 40% of RNI for ten micronutrients except for iron. Also, the best combination set of seven food groups and five food subgroups recommendations would ensure the nutrient adequacy of pre-school children for protein, fat, thiamin, riboflavin, vitamin B6, folate, and vitamin B12 and achieve more than 40% of RNI for ten micronutrients except for vitamin C. However, the promotion of the two formulated sets of FBRs suggests that these would not adequately address micronutrient deficiencies only by consuming locally available foods. Therefore, multiple micronutrient supplementation, food fortification, and provision of nutrition intervention programs should be prioritized.

Keywords: Food-based recommendations, linear programming, Opti food, pre-school children, problem nutrients, women

Dietary intake of adults in rural agricultural communities during Covid-19 pandemic

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The Covid-19 pandemic along with lockdown measures may have an impact on diet quality and food choices, precise information on dietary intake and nutritional adequacy of diets among Sri Lankan adults is scarce. Therefore, the objective of the present study was to (i) assess the current dietary intake (ii) to assess the prevalence of nutritional adequacy, (iii) to assess the diversity of diets consumed by adults in selected rural communities. A cross-sectional survey was conducted in rural agricultural communities in Monaragala, and Batticaloa districts using 221 adults (112 males and 109 females). A telephone-interviewed multiple pass 24 h recall and a structured questionnaire were used to collect dietary intake and socio-demographic data, respectively. Nutrient inadequacy was determined using PC-Side software and percentage of respondents below RNI were calculated for both genders. A majority of the participants of both genders consumed inadequate energy (96.8%), protein (64.7%), total fat (94.6%), carbohydrate (95.0%), niacin (58.8%), folate (99.0%), vitamin A (89.6%), vitamin C (75.6%), calcium (100%), vitamin B12 (50.2%), iron (95.5%) and zinc (64.7%) compared to EAR while majority of the participants of both genders consumed inadequate energy (45.7%), folate (48.4%), vitamin A (44.3%), vitamin C (39.8%), calcium (49.3%), vitamin B6 (43.4%), vitamin B12 (41.1%), iron (46.6%) and zinc (30.7%) compared to RNI. Mean DDS of males and females was 5.6 $\pm$1.2 and 5.3 $\pm$ 1.3 out of 10, respectively and 24.7% of the participants did not achieve minimum dietary diversity score of 5. In conclusion, the study population had low dietary diversity and inadequate intake of several macro and micronutrients.

Keywords: Adults, dietary intake, dietary survey, nutrient adequacy, Sri Lanka

Photo-Based Food Journaling and Self-Reflection on SMART eating in adults

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SMART eating interventions to reduce the consumption of unhealthy food and increase the consumption of healthy food is one of the emerging strategies in the world to combat the spread of non-communicable diseases. Hence, investigating the impact of photo-based food journaling on self-reflection on SMART eating is gaining much attention today. This study aimed to explore the impact of photo-based food journaling on meal tracking experience, self-reflection, and self-assessment on SMART eating along with food choice intention of adults with the use of a meal tracking app developed in the Sri Lankan context named SnaT (Snap & Track). Early adaptable adults (n = 25; Mean age = 24 ± 6.08; Females = 80%; Graduates = 56%) were conveniently selected and assigned to use the SnaT followed by a photo-based food journal for 7 days including the weekend days. Sequential explanatory mixed-method was used with pre and post-semi-structured questionnaires launched as telephone interviews to collect the dietary data. The results indicated an increase in consumption of a variety of healthy food including fruits and vegetables ($P = 0.00$), legumes ($P = 0.001$), fish, meat and poultry ($P = 0.00$), eggs ($P = 0.00$), and milk ($P = 0.001$) while reducing the consumption of unhealthy food such as salt ($P = 0.025$), sugar and sweet foods ($P = 0.00$) which led to self-reflection of the overall food consumption patterns of the majority (82%). The busy lifestyle of the people was identified as the primary challenge for SMART eating. While forgetting to capture photos before eating and the burden of the journaling process has been identified as the main challenges in photo-based food journaling. Therefore, The SnaT was accepted by the majority (84%) as a novel and convenient tool to replace manual photo-based food journaling. Future studies should warrant evaluation of the SnaT on different demographic groups by redesigning the app to include features of digital nutrition education and nudging techniques to prompt and promote healthy eating.

Keywords: Adults, meal tracking app, photo-based food journaling, self-reflection, SMART eating

Perception & behavior on consumption of tuber crops by Sri Lankanyoung adults; online survey

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Tuber crops are second only in importance to cereals as global sources of carbohydrates. They add variety to the diet and provide a number of health and nutritional benefits, including antioxidants, hypoglycemic, hypocholesterolemic, antimicrobial and immunomodulatory activities. A cross-sectional study to evaluate tuber crops related knowledge, attitudes and behavior (KAB) levels of young adults was conducted. Furthermore, the associations between KAB and tuber crop consumption and socio-demographic factors and tuber crop related KAB were determined. The study was conducted among Sri Lankan young adults belonging to the age group of 18-26y who had access to internet facility. A self-administered online questionnaire was developed, pretested, and used for data collection. A number of 432 respondents were selected for the analysis after screening for the completeness of the questionnaire. Data were analysed using SPSS and AMOS. Results indicated that majority of young adults had high level of positive attitudes, medium level of knowledge and behavior on tuber crops consumption. Lack of knowledge on specific health benefits, unavailability, unacceptable organoleptic properties, and longer preparation time similar tastes and recipes, of tuber crops were major barriers regarding consumption. Significant correlations ($P<0.05$) were obtained between behavior and tuber crops consumption and attitudes and tuber crops consumption. The highest education level significantly correlated with knowledge on tuber crops. Monthly income and marital status were significantly correlated with behavior on tuber crops. Attitudes and behavior on tuber crops were significantly correlated with each other. Gender, residential district, working status, ethnicity and family size were not significantly correlated with level of KAB on tuber crops consumption of Sri Lankan young adults. In conclusion, majority of young adults have high level of positive attitudes on tuber crops, but their knowledge and behavior is at a moderate level. There is a need to make people are aware of specific benefits, identification, of tuber crops and their variable usage making diversified products to popularize tuber crops among Sri Lankan young adults.

Keywords: Attitudes, behavior, knowledge, young adults

Effect of online lifestyle management intervention on weight management during COVID19 pandemic

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Prevalence of obesity is increasing throughout the world and in Sri Lanka. During the *COVID-19* pandemic, adults were more prone to experience shifts in their lifestyle patterns leading to excess weight gain. Following a lifestyle modification intervention in managing the weight gain was quite challenging with the lock down and social distancing. Therefore, this study was conducted with the objective of investigating the effect of online lifestyle intervention for weight management during the *COVID-19* pandemic. This randomized controlled study was conducted for fifteen weeks ($t = 15$ weeks) with 40 ($n = 40$) obese adults. Obese individuals were randomly allocated either to receive online lifestyle management intervention (treatment group; $n = 20$) or general lifestyle management education for obesity management (control group; $n = 20$). The online intervention package consisted of short motivational messages, text messages, web posts and blog articles related to diet and physical activity modification and online structured counseling sessions on diet and physical activity modification by a registered dietitian. Body weight, waist and hip circumferences, physical activity level, and dietary intake of both groups were measured at the baseline ($t = 0$ weeks) and end ($t = 15$ weeks) of the intervention. Weight and waist circumference of the treatment group was significantly reduced ($P < 0.05$) at the end compared to the baseline. There were no any significant reductions of weight and waist circumference observed in the control group. Further, obese individuals who received online education intervention showed significant ($P < 0.05$) reductions in their weight and waist circumferences compared to group who received the general lifestyle management education. Total energy intake, energy from carbohydrates and fat were significantly ($P < 0.05$) reduced in the treatment group. Therefore, it can be concluded that the online lifestyle intervention was effective in reducing the weight and waist circumference of the obese individuals and dietary modifications may have contributed to the improvements.

Keywords: Diet, obesity, online intervention, physical activity

Consumer knowledge, perceptions, attitudes and practices on the use of the front of pack (FOP) traffic light labeling (TLL) system

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The traffic light label is one of the most commonly used Front-of- Pack (FOP) labels around the world and has been proposed as a public health intervention to reduce the risk of chronic diseases by guiding consumers towards healthier food choices. The present study aimed to assess the consumer knowledge, perceptions, attitudes and practices regarding the use of the traffic light labeling (TLL) system, focusing on perceived opportunities and barriers for TLL and how consumers use TLL to make informed decisions to self-evaluate the healthfulness of packaged food they purchase. A cross-sectional online survey was employed in this study to collect data from participants (n = 310) using convenient and snowball sampling techniques. The mean age of participants was 28.55 ± 11.47 and 72% of participants were female. Around 60% of participants had a satisfactory level of knowledge regarding TLL and 72% reported using TLL while purchasing food. Yet, only 32% of participants were consistent in their use of TLL. Both consumer knowledge regarding TLL ($P < 0.05$) and the use of TLL ($P < 0.05$) were significantly associated with consumers' nutrition-related knowledge. Age was significantly associated with the use of TLL ($P < 0.05$). TLL was viewed favorably by consumers and seen as simple, easily understood, eye-catching and helpful in making informed dietary choices. However, some consumers had little confidence in the TLL system due to a perceived lack of transparency in the labeling process. This study found that the knowledge regarding TLL in the studied population was satisfactory; however, the reported use of TLL was relatively low. Consumers saw benefits in the TLL system but were unconvinced about its reliability. Transparency about the development and education on the application in the food choice situation may promote consumer practices and positively influence consumer perceptions and attitudes towards the TLL system.

Keywords: Cross-sectional survey, front-of-pack labels, traffic light labeling system, Sri Lanka

The impact of online learning on physical, mental, emotional and social wellbeing of secondary school children during the COVID 19

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The *COVID-19* pandemic created a great impact on lifestyle of school children of Sri Lanka due to recurrent lock down, closure of schools and social distancing. During that time, schools and other educational institutions shifted to online education mode. Impulsive shift in education mode and homebound lifestyle might have altered the mental, physical and social wellbeing of the school children. Therefore, current study was conducted with the objective of assessing the impact of online education on physical, mental, emotional and social health of secondary school children living in Colombo District in the *COVID-19* pandemic. Three hundred and thirty three ($n = 333$) secondary school children from Grade 6 to Grade 11 were recruited to the study. Online and printed questionnaires were used to collect the information from the school children. Majority (64%) of the study participants were males aged between 11-16 years. During the online education period, 68% of the study participants have gained weight and that weight gain was mainly observed among male participants. Changes in dietary pattern and sleeping pattern and loss of play time were the contributory factors of the weight gain. Majority (55%) of the study participants has shown the signs of stress and anxiety. Findings revealed that male gender, digital screening time more than 10 hours, limited time spent with family, loss of playing and chatting time with friends, less than 6 hours of leisure time and loss of sleeping hours than 6 hours were associated with the presence of signs of psychological stress and anxiety. It can be concluded that the secondary school children of this study has gained weight due to the sedentary lifestyle and altered dietary patterns. Study participants experienced the signs of stress and anxiety due to the absence of their leisure time and social interactions during the *COVID-19* pandemic.

Keywords: Anxiety, digital screening time, online education, school children, stress

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Food-mediated exposure of selected Hofmeister ions in chronic kidney disease of unknown etiology-affected regions in Sri Lanka

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Chronic kidney disease (CKD) occurring in the absence of conventional risk factors is called chronic kidney disease of unknown etiology (CKDu). It mainly affects the people who are living in the marginalized agricultural zones of Sri Lanka. Several etiologies for CKDu have been proposed, including chronic exposure to fluoride and other Hofmeister ions due to their Hofmeister-type protein-denaturing mechanism on the kidney membrane. In this study, 30 rice samples from CKDu endemic Dehiyattakandiya and Girandurukotte areas and 15 rice samples from non-CKDu endemic areas were collected to analyze the Hofmeister ion level in the rice samples to understand the exposure via food. Alkali-fused digestion followed by ion chromatography was used to determine the concentration of fluoride and other Hofmeister anions (chloride, phosphate and sulfate). Acid digestion followed by microwave plasma atomic emission spectroscopy was used to determine the concentration of cations (sodium, potassium, magnesium, calcium and zinc). The mean concentrations of fluoride, chloride, sulfate and phosphate in rice were 53.49 ± 10.4, 1520.35 ± 125.02, 2713.9 ± 70.04 and 2808.93 ± 147.17 mg/kg in CKDu endemic area samples and 18.29 ± 2.3, 1156.07 ± 272.41, 2465.32 ± 111.9 and 4804.46 ± 524.44 mg/kg in non-CKDu endemic area samples. The mean concentrations of sodium, potassium, calcium, magnesium and zinc were 30.71 ± 2.18, 1005.59 ± 39.88, 90.38 ± 5.01, 301.76 ± 12.6 and 12.70 ± 0.29 mg/kg in the CKDu endemic area and 37.02 ± 4.78, 1514.66 ± 117.52, 133.42 ± 7.48, 582.72 ± 45.75 and 18.14 ± 0.94 mg/kg in the non-CKDu endemic area, respectively. Although higher levels of fluoride, chloride and sulfate were found in rice samples collected from CKDu areas compared to non-CKDu areas, chloride and sulfate levels in rice samples were not significantly different ($p > 0.05$). Therefore, high exposure to fluoride through food could be a possible risk factor for CKDu.

Keywords: dietary intake, fluoride accumulation, Hofmeister effect, rice

Analysis of the impact of gelatin concentration on shelf life and textural quality of set yoghurt and development of aloe vera incorporated set yoghurt

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Gelatin is a common stabilizer in yoghurt production. It has been proven to provide good stability and desired texture in set yoghurt. During the present study, the impact of gelatin on the shelf life and texture of set yoghurt was investigated. Set yoghurt samples were developed with 0.1, 0.2, 0.3, 0.4, 0.5, and 0.6% gelatin concentrations. Variation in pH, titratable acidity, syneresis, lactic acid bacterial count, sensory characteristics and texture were analyzed. Texture profile analysis revealed that when increasing the amount of gelatin, the hardness, adhesiveness, and springiness of the yoghurt were improved. Yoghurt with 0.1% gelatin demonstrated a rapid decline in pH from 4.68 to 4.10 and increment of titratable from 0.87% to 1.10% while 0.6% gelatin showed a slow decline in pH from 4.73 to 4.45 and minor increment of acidity from 0.81 to 0.89% in yoghurt after 21 days. Further syneresis was increased from 6 to 68.3% in the sample with 0.1% gelatin and 2 to 19.4% in the sample which contained 0.6% gelatin after 21 days. A higher gelatin concentration slowed the acid development, avoided serum separation, improved the texture and extended the shelf life. The shelf life of yoghurt with gelatin concentration of 0.1, 0.2, 0.3, 0.4, 0.5 and 0.6 at 5°C to 7°C was 7, 11, 14, 19, and 21 days, respectively. Gelatin affects shelf-life improvement as it controls pH and titratable acidity. The yoghurt prepared by the addition of 0.4% gelatin had the highest overall sensorial acceptability. Yoghurt with 0.5% gelatin was further developed with the incorporation of aloe vera cubes with the objective of improving the nutritional and functional value of set yoghurt. Yoghurt was made by incorporating 10% of 5×5 mm aloe vera cubes within the acceptable range of sensory properties.

Keywords: aloe vera, set yoghurt, texture

A detailed study of the dairy sector in Badulla District : an approach towards self-sufficiency

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Due to the high population, demand for dairy products increase rapidly. Related to the commencement of open economic policies in 1977, Sri Lanka had been self-sufficient in milking. Imported milk products were induced to be consumed in huge amounts because of their lower pricing. As a result, demand for domestic dairy products was reduced. Due to that condition, the Sri Lankan dairy sector is not self-sufficient now. The purpose of this research is to learn about the difficulties and concerns of dairy farmers in Badulla district and identify their problems and make suggestions towards self-sufficiency. In terms of methodology, the cross-sectional survey was conducted using 102 respondents of dairy farmers. Among the participants 24.51% of responders were female and the other 75.49% were male. According to the demographic characteristics' majority (39.22%) of farmers were included in the 36-45 age category. Farmers with experience years of 33-40 have much experience (41.51%) regarding the dairy sector. According to the survey results, 61.12% of farmers' main income source is dairy farming. The secondary data analysis was done to determine the factors affecting milk production in the Badulla district. There is a relationship between milk yield and other affecting factors such as farmer's gender, education level, income source, the total number of cattle, total cost, feed type, animal rearing system, etc. The main income source was affected 61.12% for main milking yield to dairy farming, intensive cattle rearing system affected 51.87% of dairy milk production. Grass, concentrated feed, and vitamin collaborative feed type are highly affected (47.28%) milk production. Problems faced by dairy farmers were encountered through the study therefore, some suggestions such as providing technical knowledge, and give some benefits for cattle feed, farm machinery and providing quality feeds made to uplift the dairy sector in Badulla district to achieve the goal of self-sufficiency.

Keywords: dairy sector, Milk production, Self-sufficiency

Quality assurance and analytical methods used for evaluation of selected botanical biopesticides

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As an agricultural country from ancient times, in Sri Lanka, the use of pesticides to control the pests in crops is now becoming an essential part of agriculture. But with the aim of 100% organic farming over the country, usage of only organic pesticides is now highly recommended. On that base, replacing synthetic pesticides with biopesticides is now essential. Among three categories of biopesticides (Microbial pesticides, Biochemical pesticides and Plant incorporated protectants), this review is focused on Plant incorporated protectants (Botanical biopesticides). Past researchers have been found various data and information about botanical biopesticides. As botanical biopesticides, over the world, a number of substances are used such as Azadirachtin (Neem seed extract - *Azadirachta indica*), Cinnamaldehyde (Cinnamon oil - *Cinnamomum verum*), Squamosin (Annona seed oil - *Annona squamosa)* and Nicotine (Tobacco extracts - *Nicotiana tabacum*). Among them, neem extracts and tobacco extracts were reviewed as they are much suitable for Sri Lanka. To get the maximum effect from those plant extracts, analyzing the active compound content and assuring their quality of them is highly valuable. With that aim, major extraction & identification techniques of active compounds were discussed deeply. Furthermore, major quality parameters were also reviewed. Overall, this review gives a bird's eye view on quality parameters (pH stability, toxicity, shelf life, effect on humans), target pests, mode of action and natural degradation.

Keywords: Analytical methods, Biopesticide, Neem, Quality assurance, Tobacco

Development of a fermented cooked rice pudding and evaluation of Physico-chemical, sensory and microbial qualities

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Natural fermentation not only preserves the foods but also improves their flavor and palatability. Fermented cooked rice consumes as a traditional breakfast by the people of Sri Lanka as *Diyabath* for past decades and it is reported to have an anti-inflammatory and probiotic effect. Thus, the present study was carried out to develop a pudding which is a value-added rice-based product from fermented rice with functional properties. The pudding was prepared by the natural fermentation of cooked rice with the addition of water (1:3) in an earthenware pot, followed by mixing of other ingredients and refrigerating. The Physico-chemical parameters of puddings which were developed with 39% and 58.5% of fermented cooked rice and control were analyzed. The best organoleptic properties resulted from the inclusion of 58.5% fermented cooked rice. The best formulation was analyzed for proximate composition, storage stability, syneresis, pH and microbial quality against a control without fermentation of cooked rice. The microbial quality of pudding was assessed during the 21-days storage period. The percentages of protein, carbohydrate, fat and fiber were higher in fermented cooked rice pudding than non-fermented cooked rice pudding but the percentage of ash content was showed opposite trends. Fermented cooked rice pudding was contained $43.57 \pm 1.39\%$ moisture, $0.513 \pm 0.31\%$ ash, $8.60 \pm 2.06\%$ crude protein, $2.41 \pm 0.48\%$ crude fat, $0.019 \pm 0.00\%$ crude fiber and $44.58 \pm 2.77\%$ carbohydrate. Fermentation has influenced the physio-chemical and sensory properties of the product. The pH of the pudding was slightly decreased during 21 days of storage. Syneresis was not observed in a pudding made with fermented cooked rice. Findings of this study revealed that 58.5% of fermented cooked rice pudding can be used as a good source of nutrients to improve the health of the consumers and for diversification of rice-based ready-to-serve products.

Keywords: gluten-free, indigenous food, Palatability, Probiotics, Value addition

Consumer perception of dairy and dairy products impacts in nutrition and health during Covid-19 pandemic period in Sri Lanka

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Dairy and dairy products have served as a predominant derivation for human nutrition. The dairy and dairy consumption pattern is limited among Sri Lankans according to the scientific data stream (Required annual per capita consumption of 41.6 L per day and consuming only 19.87 L annual per capita). Due to the Covid-19 pandemic situation consumption has been further limited. The term of dairy its specified cows' milk and products with cows' milk. This study aims to explore the Sri Lankan adults' and young adults perceptions of dairy and dairy products consumption; to identify the consumption pattern during the Covid-19 pandemic period, to find the consumer psychological characteristics, to evaluate consumer experience. This was an online survey which was conducted through Google form with 400 participants and data was statistically analyzed using SPSS software and Ms. excel. The statistical results analysis by Wilcoxon Signed ranks statistical test and results from an express that dairy and dairy products consumption significantly changed with Covid-19 pandemic situation ($p = 0.000$). In statistics, the null hypothesis was no changes in consumption level during and before the Covid-19 pandemic period ($p < 0.05$). The results revealed that full cream milk powder consumption was higher than all daily consumption frequency in all over the dairy and dairy products (51.75%). Most people were speculation dairy and dairy products were healthier (92%). There was a relationship between dairy and dairy products consumption; to monthly income, education level, to psychological characteristics. Investigating the factors that affect the use of dairy and dairy products milk provides insights into the growth of the Sri Lankan dairy sector.

Keywords: Adults' and young adults', Availability of dairy products, Dairy and dairy products

Consumer preference towards instant food products and development of a pumpkin and canistel based fortified instant pudding powder mix

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A study was conducted to identify the consumer preference towards instant food products and pumpkin-based food products among working and non-working women in the Ratnapura district. The results of this study revealed that convenience in preparation was the main reason for purchasing instant foods. But many consumers believe that instant foods are not healthy. This study will use the manufacturers of instant foods to understand the preferences of consumers to improve sales. Further, this study revealed that the consumption of pumpkin and availability of pumpkin-based products in the local market are low. The majority of the respondents (64.2%) were aware of the nutritional value of pumpkins. But 64.5% of respondents have stated that they do not like much for the taste of pumpkin. But many respondents (83.9%) preferred to purchase new pumpkin-based food products. Therefore, a pumpkin (*Cucurbita maxima*) and canistel (*Pouteria campechiana*) based instant pudding mix fortified with pumpkin and chia seeds was also developed in this study. This pudding mix was found to be a good source of β-carotene (7.34mg/100g) and fiber (4.89%). Four pudding formulae were produced with different proportions of ingredients. A sensory evaluation was conducted to assess the consumer acceptance for colour, texture, taste, aroma, appearance, overall acceptability and purchasing intention using a nine-point hedonic scale. The sensory attributes of the best treatment were compared with a commercial pudding mix. The formula with 37% pumpkin powder and 25% canistel powder showed the highest mean scores for all sensory attributes and was significantly different from other treatments. Also, there were no significant differences between the new pudding mix and the commercial pudding mix in terms of sensory attributes, except for colour and aroma. The moisture content (5.07-5.27%) and pH (5.21-5.30) were increased slightly during one-month storage at 30 ± 2 ^{0}C.

Keywords: Beta carotene (β-carotene), *Cucurbita maxima*, Instant foods, *Pouteria campechiana*, Sensory attributes

Distribution of trans positional fatty acid isomers in commercially available plant oils/oil-based products in Sri Lanka

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Some unsaturated fatty acids (USFA), which contain in plant oil are converted from their *cis* form to *trans* form and the positional isomers can also be formed during their manufacturing process, in the steps of deodorizing, refining & partial hydrogenation. *Trans* fatty acids particularly some positional isomers cause several adverse health effects, such as CVD & diabetes, *etc*. Though no studies were reported the content of *trans* positional fatty acids isomers in plant oil-based products, this study was carried out to investigate the occurrence and distribution of common *trans* positional fatty acid isomers in commercially available plant oils in Sri Lanka. By conducting a consumer survey and a market survey, commonly consumed plant oil types were selected. Analysis was carried with 7 refined oils and 3 commercial hydrogenated vegetable oils. Lipids were extracted from hydrogenated vegetable oil by using the modified Folch method, followed by the Boron trifluoride (BF3) transmethylation to formulate the Fatty Acid Methyl Esters (FAME). Ag+ Solid Phase Extraction (SPE) was carried out to separate *cis/trans* isomers in the samples. Gas Chromatography (GC) with Flame Ionization Detector (FID) and GC–Mass spectrometry (GC-MS) were used to analyze the total fatty acid composition and the *cis/trans* positional fatty acid isomers of samples, respectively. In analyzed samples, *cis* fatty acids were always prominent than *trans* fatty acids. C18:1 *trans* isomers were prominent (>75%) in all 10 samples except sunflower oil and corn oil. C18:1 *t*9 was the major *trans* positional isomer found in coconut oil (>84%), sesame oil (80%), olive oil (>94%), palm oil (>96%) and a margarine sample (>32%). C18:2TT was the most prominent (>80%) *trans* fatty acid in sunflower oil and corn oil. In conclusion, though the USFA occurred in plant oil/oil-based products containing the same carbon atoms and same double bond/s they can have different positional isomers and geometric isomers.

Keywords: CVD, GC/FID, hydrogenation, Refining, Solid Phase Extraction

Changes in consumer food consumption behaviour during Covid-19 pandemic in Mannar district

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The food industry is highly affected by the covid-19 pandemic therefore people's Food habits and behaviours are changed during this pandemic situation. During the covid-19 pandemic, consumers have changed their behaviours in consuming the foods because of the rules and regulations and health reasons. This study is focused on the changes in food consumption behaviour during the covid-19 situation in Mannar district. For this study cross-sectional survey was conducted online and meeting with the people. 206 individuals from different places in Mannar district participated in this survey. Questions related to the food consumption behaviour (food acquisition, food purchasing quantity, place of purchase and stockpiling behaviours) are asked to the respondents. Results reveal that changes in the modality of acquiring food, consumers reduced the number of shopping trips and bought more on each trip to minimize store visits. According to the analysis of all data about 70% of the people changed their food consumption behaviours during the covid-19 pandemic. 23.19% of people are less visit the store and 9.18% people are visit the food store more often.72% of the consumers buying more food than usual. In this study, the food categories with the highest change in consumption were fruits and vegetables, cereals and healthy foods. People's diet is not changed that much in pandemic situations however 16% of the respondents are stated they ate more healthy foods. Interestingly though this study observed diverging trends in all food categories analyzed, with some people decreasing and others are increasing their consumption frequencies, demonstrating that the pandemic had different impacts on people's lifestyles and food consumption methods. Consumers who bought food from delivery vehicles increased by 12.1% and most of the consumers purchase the food from retail shops but it is less than the usual since the covid-19 pandemic started. In Mannar district consumers stockpiled essential food items like cereals, fruits & vegetables and legumes to avoid shortage and as a measure of rising food prices. The factors include restrictions put in place, changes in households' grocery shopping frequency, individuals' perceived risk of covid-19, income losses due to the pandemic and socio-demographic factors. Interesting differences between the individual were detected in this study. The results are expected to inform current food consumption patterns as well as long-term food-related strategies in Mannar district, especially in pandemic situations.

Keywords; behaviours, delivery, food consumption, pandemic

Aflatoxin effect on few Sri Lankan food items of plant origin and their safer levels-a review

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Aflatoxins are fungal secondary metabolites produced by *Aspergillus* species that frequently contaminate agronomical crops and consequently impose a major challenge for food safety and public health in Sri Lanka. However, the existing information on the natural occurrence of aflatoxin in Sri Lanka is limited in the literature. Therefore, this study was done to identify the important (import/export/domestic) agricultural commodities which have a high risk of aflatoxin contamination in Sri Lanka. This present study reviewed the past incidence of aflatoxin occurrence with prevalence in a few selected plant origin food commodities (coconut oil, rice, peanut, maize and red chili) during the period from 1980 to 2021 in Sri Lanka as a first step in prioritizing aflatoxin problem in Sri Lanka for future research purposes. However, numerous surveys have been reported a high incidence of aflatoxin contamination in Sri Lanka. It was well documented that Aflatoxin B1 (AFB1) is the most toxic compound that leads to the development of hepatocellular carcinoma (HCC) in humans. The high frequency and level of AFB1 in food indicate that exposure of populations to this toxin remains largely uncontrolled. Therefore, this review further focused on the metabolism of AFB1 and its toxicity effect with underlying mechanisms. Furthermore, a summary of physical, chemical, and biological detoxification methods was reviewed. However, combined use of detoxification strategies appears to provide a better prospect than the application of a single treatment. Also, for detection and quantification of aflatoxins, chromatographic, immunochemical, spectroscopic and novel technologies have been systematically reviewed along with their advantages and limitations. A way forward information on regulations and the safer levels of Aflatoxins recommended by the relevant authorities for each selected agricultural food commodity was also reviewed. Overall, the information mentioned here highlights the need for attention towards efficient detoxification methods and new effective interventions to reduce the burden of the aflatoxin effect from Sri Lanka.

Keywords: detection, detoxification, hepatocellular carcinoma

Development of pineapple (*Ananas comosus*) hard cider

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Pineapple, *Ananas comosus* is a tropical fruit crop that is commercially grown in Sri Lanka. It contains vitamins and minerals, as well as a significant number of bioactive compounds, dietary fibre and nutrients that offer numerous health benefits. The present study was carried out to develop a pineapple hard cider as a value addition to the fruit, which investigated the effect of the fermentation period and the effect of initial pre-ferment Brix value, on the pH, acidity, alcohol content, total phenolic content and organoleptic properties of the hard cider. The study was conducted under three fermentation periods and three pre-ferment Brix values including 3, 5, 7 days and 12°, 14°, 16° respectively. In this study, Brix and fermentation time showed a significant effect on Physico-chemical and organoleptic properties. The alcohol content in all samples varied from 2.23-7.86% v/v while pH ranged from 3.53-3.74. The total acidity of all samples showed a range from 0.55-0.88 g citric acid/100 mL. In addition, Total phenolic content ranged from 12.56-15.86 mg GAE/100 mL. Pineapple hard cider with 14 of pre-ferment Brix and 7 days of fermentation was acceptable to consumers and the sample consisted of 6.26 ± 0.09 % v/v alcohol content, 3.64 ± 0.02 pH, 0.8 ± 0.05 g citric acid/100 mL total acidity, 15.86 ± 0.10 mg GAE/100 ml of total phenolic content.

Keywords: Brix, Fermentation, Hard cider, Organoleptic properties, Pineapple.

Development and quality evaluation of a ready to serve beverage with coconut water and *Aloe vera*

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Ready to serve (RTS) beverages are non-fermented drinks prepared by mixing edible portions of fruit, water, sugar and additives for direct consumption. Synthetic, artificial beverages can cause health problems. Consumption of plant-based products has shown to be effective in the prevention of chronic diseases. In recent years, coconut water has become a trendy beverage due to its taste and hydrating effect, micro-nutrients, including minerals that many people don't get enough of. The health and nutritional benefits of *Aloe vera* further impart value to the formulated beverage. This investigation was done to develop a healthy, RTS refreshing beverage with coconut water (*Cocos nucifera*), Pineapple (*Ananas comosus*) and *Aloe vera*. Pineapple was added to mask the lank taste of *Aloe vera*. Coconut water, *Aloe vera,* and pineapple were blended as ratios of 6:3:1(T1), 6:2:2(T2), 5:3:2(T3) and stored for 21 days at room temperature and 28 days at a refrigerated temperature in 200 mL glass bottles. Physico-chemical, sensory, and microbial qualities were evaluated according to AOAC, 2005 method. The titratable acidity, total soluble solids, ascorbic acid contents were increased and pH was decreased (0.219-0.470%, 15.3-18.38˚, 119.44-241.66ppm, and 4.90-4.23) respectively during the storage period due to the addition of citric acid, and pineapple. Sensory qualities were evaluated subjectively by a semi-trained panel using a 9-point hedonic scale and all the samples were given acceptable results. The highest sensory score (8.3) was obtained with the lowest incorporation of coconut water (T3). The best formulation reported considerable anti-inflammatory activity (17.8%), antioxidant capacity (30.6%) and total phenolic content (142μgGAE/mL). Total microbial count and yeast and mold count were less than the critical limit for beverages. The quality parameters were also reported within the SLSI standards. In conclusion, these three combinations can be formulated into good quality RTS beverages and are suitable for consumption up to 28 days at refrigerated temperatures.

Keywords: *aloe vera*, nutritional benefits, physicochemical analysis, pineapple

Developing a simple web application for quick and easy sensory analysis of product development using a nine-point hedonic scale

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Sensory evaluation is a key step of new product development as it decides the qualities of product attributes and the customer acceptability. Interpretation is very important because the final conclusion regarding the product is dependent on the accuracy of this process. In hypothesis testing, many calculations are done either manually or using software like Microsoft Excel and SPSS. Using software involves entering appropriate commands and using the correct which can become practically difficult and for researchers who are not tech-savvy and who need a means of quickly analyzing their data. This project has developed a simple web application as a model for quick and easy sensory analysis of product development using a nine-point hedonic scale. Visual studio code was used as the integrated development environment (IDE) and Github was used for version control. The web application was built using the cascading style sheets (CSS) and HTML programming languages. HTML, CSS, and JavaScript were used for the front-end development. The calculations were implemented using a client-side script created using JavaScript and the styling was done using cascading style sheets (CSS). Once the user enters the sensory evaluation data in the nine-point scale, the program can select the most suitable sample based on calculations of analysis of variance (ANOVA) and Tukey's test, at either 95% or 99% level of confidence. This web application can be used by any person who gets the corresponding link that was created from Github. It will open through the visual studio code and any browser such as Microsoft Edge.

Keywords- Sensory Evaluation, Web application, CSS, HTML, JavaScript

Assessing the impact of COVID-19 pandemic on consumers' food safety perceptions in Gampaha district, Sri Lanka

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Since the outbreak of the COVID-19 pandemic, food safety has been a major concern due to the risk of contracting the COVID-19 virus from foods and packaging. Understanding consumer food safety perceptions is critical for ensuring public food safety and health. Though many countries investigated food safety issues during the pandemic, Sri Lanka has yet to conduct such research. Therefore, this research determines how consumer food safety perceptions have changed during the COVID-19 pandemic in the Gampaha district. The study examines consumer perceptions, trust towards the safety of foods purchased and food delivery services, steps followed to ensure food safety during food purchasing, consumer expectations from food handlers during food purchasing, and trusted sources of food safety information during the pandemic. Respondents completed a 42-item questionnaire during October 2021. Simple random sampling was adopted to select 261 participants. Data were analyzed using descriptive statistics, Chi-square test, and Kruskal-Wallis test (IBM SPSS). Because of safety concerns during the pandemic, the majority have reduced their consumption of fast food (49.5%), bakery foods (77.01%), and dine-in meals (50%). Consumers with non-communicable diseases themselves were very concerned about food safety during the pandemic. Consumers (33.59%) were somewhat confident about the safety of food from food delivery services. Wearing a mask (98.9%) and sanitizing hands (95.0%) were the most common safety steps taken by consumers during grocery shopping. To ensure food safety, customers expect food handlers to wear masks, gloves and maintain physical distance. Television (86.3%) was the most popular means of accessing food safety information, followed by social media (82.10%). There was a relationship between the participants' educational level and the trusted sources of food safety information. Findings suggest that COVID-19-related food safety issues require more attention. Public awareness about food safety will help people avoid unnecessary fears while taking appropriate safety precautions.

Keywords: Food consumption, Food delivery, Food handlers, Food purchasing

Declaration of nutritional information and healthiness of ready-to-eat/cook packaged food products available for children in Sri Lankan supermarkets and parental attitude towards the purchasing.

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In Sri Lanka, it was reported a substantial proportion of school children within the urban area follow an unhealthy dietary pattern and consume excessive sugary snacks and ready-to-eat products, which indicates doubling the prevalence of overweight/obesity among school children during the last decade. When we consider children, parents/guardians are universally accepted to be primarily responsible for children's food procurement and choices. The present study assessed the nutritional information and healthiness of ready-to-eat (RTE) and ready-to-cook (RTC) packaged food products in Sri Lankan supermarkets and parental attitude towards purchasing them. The Nutrient Profile Model (NPM) for Sri Lanka was used to categorize and differentiate foods and non-alcoholic beverages that are more likely to be part of a healthy diet from those that are less likely in a cross-sectional study of packaging analysis of RTE/RTC food products consumed by children. In total, information from 192 products was collected over five broad food categories, but 29 (15.10 %) food products were unable to be examined due to incomplete nutrient labeling. According to the NPM, none of the food products could be recognized as being healthier. Moreover, 26 (13.54%) products carrying health and nutrition-related claims, among them 19 (73.7%) were classified as less healthy while other claimed food items could not be evaluated due to the absence of data. A descriptive research design was used to identify the factors influencing the parent's purchasing behavior towards the RTE/RTC food products in the Western province using an online questionnaire. A multiple regression model analysis results revealed that monthly household income, children's influence/preference, commercial aspects are statistically significant ($p < 0.05$) and positively influence the parent's purchase intentions, while parents' opinion statistically significant ($p < 0.05$) and negatively influences the parent's purchasing behavior of RTE/RTC food products. The findings suggest effective policies should be implemented to increase the relative availability of healthier ready-to-eat packaged foods, as well as to improve the provision of nutrition information on labels in Sri Lanka.

Keywords: multiple regression module, nutrition profiling module, purchase intentions, western province

Improving the post-harvest quality of papaya fruit based on surface disease detection and classification using convolutional neural networks.

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Sri Lanka has 55 different varieties of fruits and papaya has recorded the highest post-harvest loss (45%). Considerable post-harvest losses of fruits occur because of the improper handling and management also due to disease conditions during harvesting, storage & distribution. It is necessary to increase food production & reduce the loss to meet the needs of the growing population. Disease detection and identification are presently done by manual processing depending on the human visual system. Even though it may be sufficient for the home gardener, it is very inefficient for large-scale operations. As a solution for this problem, machine learning (ML) and image analysis techniques based on convolutional neural networks (CNNs) have been developed for fruit disease detection and classification in recent research studies. In this proposed study, a computational application was created for common papaya disease detection. This application is based on a deep learning model created using the Keras software library. By providing the image data of diseased & healthy fruits, the proposed deep CNN model was trained. The model predicts the diseases based on the patterns on the surface of papaya fruits. The proposed CNN model can detect and classify images into six disease classes: anthracnose, black spot, phytophthora, powdery mildew, ringspot, and healthy papaya. Different parameter values for batch size, epochs, learning rate and different configurations of the network were tested to come up with the CNN model with the best performance. The accuracy of the created model was compared with that of transfer learning models created using ResNet 50, VGG 16, and Inception V3. The model yields a prediction accuracy of 94.83%. The proposed model was created as a Graphical User Interface (GUI) using the Tkinter python GUI programming tool to check real-time predictions of the common papaya disease detection and classification.

Keywords: Convolutional Neural Networks, Fruit Disease Recognition, Papaya fruit diseases, Transfer Learning, Graphical User Interface

Indole formation in shrimp and its influence on shrimp market- a review

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Shrimps are in good demand due to their nutritional value and neutral flavor. Along with the increased demand, quality-related issues have also increased. Indole is one of the parameters commonly used to evaluate shrimp quality. However, in certain conditions, when indole is used as a quality index, it has resulted in erroneous conclusions. Therefore, this literature review was conducted to identify the factors affecting indole formation and to determine the suitability of indole as a quality index. Reliable research papers, book chapters, and websites published from 1970 to 2021 were used to collect data. "Google Scholar," "Research Gate," and "Science Direct" were used as the search engines. We conducted two consecutive screening processes to select only the relevant papers, then thoroughly studied those papers, and finally wrote the review. Most studies report indole as a reliable indicator of temperature abuse, putrefactive types of decomposition, and unhygienic processing conditions. However, decomposed shrimp stored at low temperatures may not necessarily contain indole. At any temperature, the FDA defect level (25g/100g) is not an authentic index to detect decomposition, but there is a controversy about using it to validate sensory evaluation. Different methods of processing (*sous vide*, irradiation, freezing, cooking, the addition of preservatives, and beheading) and packaging (modified atmospheric packaging and vacuum packaging) have reduced indole formation. Certain bacterial types (Enterobacteriaceae, mesophiles, and proteolytic bacteria) exhibit a positive relationship with indole levels. Because of the shrimp's size, there is no effect. Certain literature emphasizes the effect of shrimp species and geographic origin on indole production. However, insufficient literature is the barrier to confirming it. There is a controversy over using the FDA defect level of indole to validate sensory evaluation and to identify decomposition. However, using indole in conjunction with other quality indices is more reliable to detect decomposition through temperature abuse.

Keywords: decomposition, indole, quality, shrimps, validation

Changes in fast-food consumption and marketing during COVID-19 pandemic in Kegalle district, Sri Lanka

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The COVID-19 pandemic and lockdown measures adopted to restrict virus transmission have rapidly reshaped food consumption, food marketing across the globe. Limited studies were conducted to determine the effects of COVID-19 on fast-food consumption and marketing in Sri Lanka. Therefore, the present study was conducted to investigate the effect of the COVID-19 pandemic on fast-food consumption and marketing in Kegalle district. To achieve that, descriptive, two studies were performed through a self-administrated online questionnaire for consumers and an interview-administrated questionnaire for fast-food marketers. Results revealed that fast-food consumption has reduced by 59.7% during the pandemic while online ordering and purchasing from mobile deliveries have increased by 14.9% and 35.82% respectively. 19.9% of consumers reported an increase in consumption due to changes in general food consumption patterns (42%) and having the entire family at home (25%). Nearly 90% of the fast-food marketers claimed that fast-food marketing reduced by 89.7%. Both studies showed continuous lockdowns and health concerns as the main reasons for these reductions. To maintain consistent manufacturing and marketing, 62.2% of outlets developed new dishes while efficiently providing takeouts/deliveries (56.8%). Comparisons were revealed that there was a significant decrease between pre and during pandemic for "Consumption frequency" ($p = 0.000$) and "Expenditure for fast-food" ($p = 0.000$) while the significant increase for "Online ordering" (0.000) and "Purchasing from mobile deliveries" ($p = 0.000$) in consumers. "Number of daily customers" ($p = 0.000$) and "Daily revenue" ($p = 0.000$) were shown a significant decrease in marketers respectively. There were positive associations between preferences for online ordering during the COVID-19 period with "Occupation" ($P = 0.000$) and "Monthly income" ($P = 0.009$) of consumers. This study found that fast-food consumption & marketing behavior significantly influenced during COVID-19 pandemic with lockdown situations in kegalle district.

Keywords: Consumption frequency, Fast-food consumption, Fast-food marketing, Lockdown

Comparative studies on nutritional and functional properties of selected traditional rice varieties in Sri Lanka

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Non-communicable diseases are chronic metabolic diseases increasing rapidly around the world. Traditional rice varieties are functional foods currently becoming popular among health-conscious consumers, as they provide a variety of nutrients, bioactive compounds, and phytochemicals. This study aims to evaluate the nutritional and functional properties of selected 20 traditional rice varieties in Sri Lanka. Proximate composition was analyzed for the raw rice samples. Methanolic extracts of rice were analyzed for total phenolic (TPC), flavonoid (TFC), carotenoid (TC), antioxidant, anti-inflammatory, and anti-diabetic properties. *In vitro* gastrointestinal digestion was carried out to assess the bioavailability of bioactive compounds. Rice samples with higher anti-diabetic properties were tested for a postprandial glycemic response using healthy individuals. The results indicate fresh methanolic extracts of *Rath Kadha* have the highest TPC (9.94 ± 0.01mgGAE/g FW) and TC (2.27 ± 0.06 mg/g FW), *Beheth Heenati* have the highest DPPH% inhibition (84.93 ± 0.81%), *Sudu Heenati* has the highest TFC (16.77 ± 0.01mg RE/g FW), anti-diabetic properties (59.54 ± 0.02%) and anti-inflammatory properties (65.85 ± 0.01%). Among the rice varieties subjected to *in vitro* digestion, *Suwadel* showed the highest TPC (0.45 ± 0.02 mgGAE/g FW) and TFC (2.01 ± 0.02 mgRE/g FW), *Ma Vee* showed the highest TC (0.24 ± 0.015 mg/g FW) and *Pachchaperumal* showed the highest DPPH% inhibition (61.77 ± 0.02%) in the gastric phase. In the intestinal Phase *Sudu Heenati* showed the highest TPC (0.99 ± 0.04 mgGAE/g FW), *Ma Vee* showed the highest TFC (0.8 ± 0.01 mgRE/g FW) and TC (3.24 ± 0.04 mg/g FW), *Beheth Heenati* showed the highest DPPH% inhibition (63.98 ± 0.07%). Tested all cooked rice varieties exhibit a lower postprandial glycemic response than glucose. Among the cooked rice varieties *Maa Vee* showed the lowest peak(97mg/dl) with glucose reference. According to glycemic response, values vary significantly with the rice variety. The results highlighted that traditional rice verities are rich with a wide range of functional properties and useful in the management of non-communicable diseases and their complications.

Keywords: Functional properties, Gastrointestinal digestion, Glycemic response, phytochemicals

Physico-chemical changes associated with continuous heating of palm oil and development of a cost-effective method to determine frying oil quality

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Currently, there is a need for a convenient, quick, and affordable method to determine the quality of oil used for frying which can be used to discard oil used for deep frying. Therefore, this study was conducted to assess the variation of the quality of palm oil during deep frying and to develop a quick and affordable method to detect the quality of frying oil. Physico-chemical changes associated with continuous heating of palm oil at $180^{\circ}C \pm 5^{\circ}C$ were measured in samples collected at predetermined time intervals up to 448 hours. Physical parameters such as colour, refractive index, viscosity, density, and changes in dielectric properties (capacitance) were assessed while peroxide value and total polar matter (TPM) and Thiobarbituric acid reactive substances (TBARS) were estimated. Refractive index, viscosity, density, TPM, and TBARS value increased by 0.6, 1079, 5.8, 1605, and 128%, respectively during frying. Plate type, co-centric, and high-frequency dielectric soil moisture capacitive sensors were evaluated and consistent values for the change in the dielectric property of frying oil with heated time were achieved exclusively through the high-frequency soil moisture sensor. Therefore, decimal values of analog voltage-out from the high-frequency soil moisture sensor can be recommended to be used as raw data to derive a mathematical model to relate each Physico-chemical parameter, depending on the requirement. A significant correlation between capacitance and TPM was observed with the relationship of $TMP = 0.270x^2 - 489.7x + 22145$ with an R^2 of 0.98. In conclusion, the designed sensor can be used as a cheap, effective, and simple method to detect frying oil quality.

Keywords: Deep frying, Oxidative products, Thermal degradation, Vegetable oil

Processing and preservation of banana blossom as a dehydrated 'Instant Processed Salad (*Melluma*)'

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Banana blossom is known as a 'Super Food' for humans, due to its nutritional composition, especially with a high amount of crude fibers. As an agricultural byproduct of banana cultivation, there is an enormous postharvest loss in banana blossoms. In that case, this study was conducted to minimize the postharvest losses in banana blossoms by processing the raw material into a nutrient-rich dehydrated food product called 'Instant Processed Salad'. During the processing of fresh banana blossoms into dehydrated forms, enzymatic browning was observed as a major defect. The '*Seeni*' banana blossom variety was chosen over the '*Ambul*' and '*Kolikuttu*' varieties due to its high lightness (L*) value of 51.71 ± 0.29 ($p < 0.10$). The conditions for the effective action of citric acid were evaluated during processing as an effective pretreatment to prevent enzymatic browning. Cleaned, fresh banana blossoms were chopped into 3mm slices and treated with 0.20% citric acid solution at 25°C for 30 min. The drained banana blossom particles were dehydrated at 50°C for 6 hrs. time in an electric dehydrator for $0.305 ms^{-1}$ air circulation with a $2.2 kgm^{-2}$ loading density. Dehydrated banana blossoms had important functional properties, such as anti-inflammatory effects (47.06% ± 5.88), anti-diabetic effects measured as α-amylase enzyme inhibition effects (10.11% ± 0.56) and α-glucosidase enzyme inhibition effects (36.23 % ± 2.42), which may provide significant therapeutic effects on human health. Additionally, its phenolic content (0.180 mg GAE/g ± 0.002) helped improve the antioxidant activity in humans. The dehydrated processed salad scored a higher mean value (4.25/5) for overall acceptability than fresh processed salad (3.95/5) among 20 semi-trained panelists. For the packaging material of dehydrated banana blossom, nylon vacuum packaging was chosen since the aluminum laminated (translucent) vacuum packaging was elevated 5.24% in water activity(a_w) during 37°C storage conditions for two weeks duration. The accelerated shelf life of the final dehydrated product was 3.5 months at 25°C storage. Accordingly, dehydrated 'Instant Processed Salad' of banana blossom would be a solution to reduce postharvest losses, while providing a nutritious product for consumers.

Keywords: anti-diabetic effect, anti-inflammatory effect, dehydration, enzymatic browning,

Effect of different pretreatment methods on the quality, sensory properties, and storability of horse gram incorporated fat spread

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Horse gram is an underutilized legume that has beneficial remedial properties such as anti-diabetic, anti-obesity, anti-helminthic, anti-hypercholesterolemic, etc. The use of horse gram and flours in the food industry is limited due to the presence of certain phytochemicals with antinutrient effects that limit the nutritive value of the horse gram. The knowledge about the underutilized legume-based food products and identifying the preference of horse gram incorporated spread among normal consumers were identified by conducting a survey. This study intended to develop Horse gram flour incorporated spreads from without any treatment (CF), pretreated horse gram seeds using two different methods which are germination (GF) and roasting (RF), and evaluate Physicochemical characteristics, functional, sensory properties, and storability. Results showed that average total phenolic content (TPC), flavonoids were increased by 26%,31% during germination and reduced by 28%,49% during roasting respectively. DPPH radical scavenging activity, water holding, and oil absorption capacities were increased in pretreated horse gram flour. High alpha-amylase inhibitory activity was found in raw and roasted flours compared to germinated flour. The proximate nutrient composition was tested for spreads and the highest TPC, flavonoids were found 2.96 ± 0.25(mg/GAE/g),1.84 ± 0.6(mg/RE/g) in CF spread respectively and the lowest was in GF spread. DPPH radical scavenging activity was high 10.34 ± 4.86 in RF. There was no significant difference in α amylase inhibitory activity and free fatty acid content. The highest Iodine value indicates the degree of unsaturation of fat exhibited in RF spread. *In vitro* digestion assay was conducted comparing three different spread types and the results showed that the highest flavonoids were in RF, alpha-amylase inhibitory activity was increased and TPC reduced in pretreated spreads in all digestive phases. RF spread was the most preferred based on the overall acceptability of the spreads through a trained panel sensory evaluation and shelf life was 13 days at 2℃ refrigerated condition. Roasting is the most suitable pretreatment method from overall evaluation for developing horse gram incorporated fat spread that will result in great antioxidant activity and health benefits.

Keywords: Functional, Germination, Horse gram*, In vitro* digestion, Physicochemical

Recognition of symbols and logos on food packaging using deep learning

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Food packaging is known as the "silent salesmen." It provides all the information necessary for the consumer to make the buying decision directly using one or more common languages or through specific logos or symbols. In this research project, a survey was conducted to study the awareness about major symbols and logos on food packaging/labels in Sri Lanka. For the survey study, 180 participants were selected by convenience sampling technique by sharing a google form with my contacts and acquaintances in such a way that covers the various layers of the general public of Sri Lanka. . The survey revealed that only about 35% of the participants knew the main 15 symbols or logos that are displayed on food packaging. The survey emphasized the importance of developing a mobile app for the real-time recognition of logos and symbols on food packaging or labels. In this project, machine learning was used to develop an image recognition system to identify certain logos and symbols on food packaging/labels. A dataset of 831 color images of standard logos/symbols on food packaging material was used for the research. These images were initially resized to 224×224 pixels. These resized images were used for the development of the convolutional neural network (CNN) model which was used for image classification. The CNN model was built using the teachable machine web-based GUI tool. When building the model 200 epochs, batch size of 16, and 0.0005 learning rate were used. The training was done using 85% of the data set while testing was done using 15% of the data set. The model was built to classify 15 classes of different logos and symbols such as HACCP, ISO, SLS, The universal recycling symbol (Mobius Loop), The green dot, Vegetarian symbol, non-vegetarian symbol, Safe for food use symbols, and seven symbols for seven plastic types. It was able to achieve 97.99% accuracy while training and 84.28% accuracy while testing the module. The output model was converted to TensorFlow Lite format and was used to develop an android app using Android Studio to achieve real-time recognition of symbols and logos on food packaging/labels using mobile phones of consumers.

Keywords: Android studio, Convolutional Neural Network, Food label, Teachable machine

An in-depth study on the effectiveness of local food regulations regarding consumer protection

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In Sri Lanka, Food Act no. 26 of 1980 and 28 current food regulations play a major role in consumer protection related to the food industry. This research examined the level of awareness of food regulations among consumers. The viewpoint of this study was to determine the effectiveness of local food regulations regarding consumer protection. The local food act and Canadian Food and Drug Act were compared. Data were collected through a questionnaire, distributed via an online platform among 250 people in-between 18 to 55 years old in the Western province in Sri Lanka and data were statistically analyzed by using SPSS 16 software. Among 250 participants, 242 answered all questions (96.4%). Most of the respondents (73.97%) were aware of Sri Lankan food regulations and half of the respondents (50.00%) read food labels sometimes. There was a significant association between awareness of local food regulations and frequency of reading food labels among respondents ($p < 0.05$). The mean level of customer satisfaction related to food regulation was $3.72(\pm 0.051)$ which indicates the majority of the respondents were closer to agree. The mean level of willingness to pay for quality foods was 4.06 (± 0.416) which indicates the majority of the respondents were closer to agreeing. Accordingly, the level of awareness among consumers related to food regulations is at an acceptable level but should be improved further. In Comparison between the local Food Act and Canada Food and Drug Act, Similarities under the prohibition in respect of foods, Differences in the administration, powers and duties among authorities, offenses and punishments related to foods. Compared to Canada Food and drug act, the local food act is more generalized. The food regulation authorities also should pay more attention to ensuring consumer protection through improving the effectiveness of the regulations.

Keywords: Awareness, Food act, Food labels, Food regulation authorities, Regulations

Assessing the use of organic fertilizer by paddy farmers in Sevanagala divisional secretariat, Monaragala District, Sri Lanka

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Monaragala district is a major rice production area in Sri Lanka with nearly 82 000 acres of paddy lands. For many years' farmers have used inorganic fertilizer during paddy farming. However, organic fertilizer is getting popular due to the many advantages it has on consumers, soil and the environment. Recent government policy decisions have influenced paddy farmers to quickly divert into organic paddy farming. Therefore, the research was conducted to assess the use of organic fertilizer by paddy farmers in Sevanagala divisional secretariat division, during the *Maha* season, 2021. A cross-sectional survey was conducted with 170 randomly selected farmers from 14 Grama Niladhari divisions. During the season, the majority (70.6%) used complete organic fertilizer, 20.6% used both fertilizer types and 8.82% used only inorganic fertilizer for paddy farming. The main organic fertilizer source was green manure (62%). Farmers received information on organic farming through farmer organization meetings (51%) and television (35%). Considering the farmers' perceptions on complete organic agriculture, nearly 53% believed it is a good initiative while 25% opposed this idea. The main reasons for rejecting total organic farming were the cultivation requirements of new rice varieties (31.6%) and farmers' addiction to inorganic fertilizer use (32%). 65.8% of the farmers have not received any government support for organic farming, while others have received advice from agrarian officers (18.42%) and money for organic fertilizer production (10%). The major problems identified with organic fertilizer use were low plant growth rate (43.2%), low yields (20.7%) and lack of storage space (17.8%). Considering the farmers' expectations on paddy yield, the majority (85%) believed the yields will reduce with complete organic fertilizer application. Nearly 69% believed a combination of organic and inorganic fertilizer will give better yields. Research findings suggest that further studies, government support and farmer awareness are required to increase organic fertilizer usage during paddy farming to ensure food security.

Keywords: Constraints, Expected yield, Government support, Organic fertilizer, Paddy farmers

Causes for the chemical degradation of sucrose during sugarcane processing for raw sugar and remedies by process optimization - A review

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Sugar is a vital commodity for both human use and trade. Sucrose losses upon sugarcane harvest and subsequent milling operations are one of the most critical issues in many sugar processing industries. Acid hydrolysis or inversion reactions are common in sucrose under sugarcane processing conditions. The preliminary analysis and review were conducted to identify the possible causes for sucrose inversion and the effect of pH and temperature for the chemical destruction. Reliable research papers, book chapters, and websites published from 1990 to 2021 were used to collect data. Google Scholar, Research gate and Science direct were used as the search engines. Two consecutive screening processes were done to select the only relevant papers, thoroughly studied, and wrote the review. Sucrose acid hydrolysis is known to be affected by factory operational pH, temperature, Brix, polarization and retention time conditions. When compared to room temperature, it was discovered that increasing the temperature accelerated the sucrose inversion process. As the temperature is raised, this was demonstrated by greater percent reducing sugar values and lower percent polarization values. Because sucrose is most stable at pH 8.3, whereas glucose and fructose are most stable at pH 3-4, sugar technologists face a severe issue in balancing the minimization of both sucrose and invert. At pH 3, the amount of reducing sugar increased while the amount of sucrose declined. These findings suggested that sucrose inversion should take place in more acidic solutions. To reduce total reducing sugar, we found that temperature was the most important factor in controlling sucrose inversion, while the anion (OH - from lime) at higher pH had only a minor impact on the physical and chemical properties of the juice, compared to pure cane sugar's high stability and purity.

Keywords: Cane sugar, pH, process optimization, sucrose inversion

Convolutional Neural Network-based model to identify and classify the millet varieties grown in Sri Lanka

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Millet plays a major role both as a staple food and also as a means of feeding livestock mainly due to its immense capacity for satisfying energy and nutritional needs. There are a number of millet varieties which are difficult to distinguish with a person's naked eye. Classification of grains is important for consumption, exportation, quality production, grain quality control, and impurity identification. Traditional methods for the classification of different varieties are based on features like color, shape, and texture. The accuracy and reliability of traditional manual methods depend on the experience and skills of the evaluator. Generally, visual inspection techniques are tedious and time-consuming. This process of classification can be automated, with reduced human labor and a significant increase in efficiency. In Sri Lanka, millets are cultivated at several locations in different agro-ecological regions. The proso, foxtail, and finger millets are the most common millet types grown in Sri Lanka. This research work involves creating a deep learning model that provides an accurate classification of millet varieties. The model is based on convolutional neural networks (CNNs). It has been created using the Keras software library. The current version of the model can classify millet images with an accuracy exceeding 99%. the model was trained using 840 millet grain images that were obtained from millet grains collected from the Anuradhapura area. Images of grains were captured using a self-designed setup. Furthermore, the proposed model was compared with a state-of-the-art CNN model such as VGG16. The model was deployed to the Heroku cloud service as a web application for ease of accessibility.

Keywords: Deep learning, Machine learning, Millet image classification, Web application

Impact of Color Coding for Fat, Salt & Sugar Labeling on Consumers Purchasing Decisions regarding Selected Dairy Products

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Nutritional information is marked on the front of the packaging in various symbols or styles and is known as Front-of-Package (FOP) systems. This system makes nutritional information visible and appears to impact consumer understanding and reformulation. According to the National Multisectoral Action Plan for the Prevention and Control of Non-Communicable Diseases (NCDs) 2016-2020, Sri Lanka has implemented a traffic light system for fat, salt, and sugar to lower the prevalence of NCDs by reducing excessive consumption of saturated/trans fats, sugar, and salt. This study was carried out to assess the impact of color coding for fat, salt & sugar on consumers purchasing decisions on selected solid & semi-solid dairy products in Western Province – Sri Lanka. Data were collected through an online questionnaire among 300 consumers. A cross-sectional design was used as the experimental design. Data were statistically analyzed by using the chi-squared test and SPSS 16.0 software. As result, there is a significant awareness and perception regarding the existing color-coding system. Identification of the level of sensory perception using the Traffic Light Labeling (TLL) system was mainly based on the sugar values and fat content. Consumers could get a better dietary awareness through both numerical value and color scheme depicted on the TLL system. There is a significant difference ($p < 0.05$) between consumers' noticeability and consumer purchasing decisions with their education levels. Though there is a significant difference between the making of consumer purchasing decisions with household income, no significant difference was shown between consumers' noticeability with household income. Also, no significant difference ($p > 0.05$) between consumers' noticeability and the making of consumer purchasing decisions with their age category. The majority of respondents have agreed to go ahead with the existing TLL system. 75.67% of respondents have recommended the inclusion of total calorie content as an additional component in the existing TLL system.

Keywords: Front of package labeling, Milk products, Non -communicable diseases, Solid and semi-solid, TLL

Impact of COVID-19 on Consumer Food Waste and Self-Grown Food in Kalutara district, Sri Lanka.

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COVID-19 has significantly affected the food supply chain in Sri Lanka. Fears of food shortages have caused panic buying which could give rise to the amount of food waste generation. Amid rising food security concerns, people are motivated to grow their fresh fruits and vegetables. However, there is a lack of academic attention paid to how the amount of food waste and self-grown food has changed during the pandemic situation. Therefore, a survey was conducted in Kaluthara district to assess the impact of COVID-19 on consumer food waste and self-grown food in the area. The survey collected information on demographic data, food waste before and during a pandemic; consumer behavior on food waste, and the extent of self-grown food from 264 respondents. The result showed that the COVID-19 has led to a significant reduction in the amount of food waste ($p < 0.05$). 59.09% of respondents declared the amount of food waste has been reduced. The most wasted food category is vegetables, while other food categories except milk and dairy products, pulses and oilseeds and oil have also shown significant reductions in quantities wasted. Cooking in excess was the major reason for throwing food. Changes in consumer food purchasing and consumption behavior have influenced the amount of food waste. 73.86% of respondents engaged in gardening, among them 33.8% started gardening after the pandemic. The majority of gardeners do gardening to access fresh food. A large majority of home food growers claimed that there was an increase in gardening space, time spent for gardening and the number of varieties grown. All of the findings revealed that there was a positive effect of covid-19 on reducing consumer food waste and increasing self-grown food in the Kaluthara district. Further researches can be done with a large sample to gain insight information.

Keywords: Consumer behavior, Food security, Food category, Gardening

Development of a web-based method for cocoa (*Theobroma cacao*) disease detection using deep learning

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The purpose of this research is to apply machine learning techniques to efficiently identify cocoa tree diseases (*Theobroma cacao* L.) and thereby avoid the loss of cocoa harvest. And also used as a sorting method in the cocoa industry to separate healthy cocoa pods from disease pods. Deep learning has become a widely popular area of interest for researchers in the past few years. Convolutional neural networks (CNNs) are a type of deep learning network that is widely used in image classification. This research involves creating a deep learning model that can identify two main diseases that affect the cocoa fruit: moniliasis disease and Phytophthora diseases. The model has been developed using the Keras software library. Python programming language used for the development of the model. It has been trained using 80 images of healthy, moniliasis affected and phytophthora disease-affected cocoa fruits, respectively. The created model is very lightweight and shows a prediction accuracy exceeding 95%. The model was deployed as a web application to the Heroku cloud for ease of accessibility for worldwide users. Other than identifying the disease, the web application also provides details on how to identify and manage the disease.

Keywords: CNN (Convolutional Neural Networks), Cocoa, Deep learning, Image recognition, Machine Learning,

Development and Quality Evaluation of Ready to eatBreakfast Banana & Oat Meal with Probiotics

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Breakfast is often stated as the most important meal of the day. Recently in Sri Lanka, family structure is changing into nuclear and attempt to balance the demands of work and home, skipping breakfast or consuming a quick unhealthy breakfast. The aim of this study was to introduce a ready-to-eat healthy breakfast product with cereal, milk, and fruits. Market research was done to gather data on preferences of characteristics of the product and to find out the most preferred cereal type, milk type and fruit type among seven commonly eaten fruits, three cereal types and three milk types. Data were gathered randomlyamong a sample of 100 people aged 18 to 60 in Western province. Using the data, raw materials for the product were selected. For the product development from different cereal concentrations (10%, 20%, 30%, and 40%) and fruit pulp concentrations (5%, 10%, and 15%) most preferred cereal concentration and fruit pulp concentration of the selected cereal and fruit were analyzed through sensory analysis. Moreover, proximate analysis, probiotic viability, total phenolic content,antioxidant level, and other physicochemical analysis were analyzed usingSPSS and MS Excel software. Consumers in the Western province were more like to have a semi-solid ready-to-eat Breakfast product with oats as the cereal,kolikuttu banana as the fruit type, and cow milk as the milk type. The incorporation of oats and banana into the product increase the nutritional value, probiotic viability, and sensory attributes of the product. The best formulation of the product was 30% oats slurry, 10% kolikuttu pulp concentration and 60% milk. Ready-to-eat breakfast meals with oats and kolikuttu possess higher nutritional, bioactive compositions, and probiotic viability compared to other processed ready-to-eat breakfast meals in the current market.

Keywords: Breakfast product, oats, kolikuttu, probiotic viability, prebiotics

Dietary intake of fluoride and selected major minerals in tea used in chronic kidney disease of unknown etiology endemic areas in Sri Lanka

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Tea leaves are a rich source of essential dietary micronutrients such as calcium, magnesium, potassium, sodium and fluoride which are considered as Hofmeister ions related to kidney function. Some of these elements are differentially released into tea infusions when tea is brewed. Chronic exposure of the kidney membrane to Hofmeister-active ions can be responsible for chronic kidney disease of unknown etiology (CKDu). Hence the study aimed to determine the fluoride and sodium, potassium, magnesium, calcium content in tea used in CKDu endemic areas in Sri Lanka. Black tea samples (n = 25) were collected from CKDu prevalent areas and control areas (n = 15). Total fluoride levels in alkali-fused digested tea powder samples were determined by using ion chromatography. Fluoride content in tea infusions (1% w/v) was prepared using ultra-pure water and water collected from the CKDu endemic areas was determined using an ion-selective electrode. Microwave plasma atomic emission spectroscopy (MP-AES) determined Hofmeister-active cations content in tea infusions. The mean fluoride concentration was 156.16 ± 54.14 mg/kg in tea powder samples collected from CKDu endemic regions and 100.16 ± 18.91 mg/kg in non-endemic regions. Mean fluoride concentration in tea infusions prepared using tea from CKDu endemic areas and control areas for 5 min brewing time were 1.45 ± 0.43, 1.11 ± 0.06 mg/L and for 120 min brewing time 2.04 ± 0.89, 1.38 ± 0.11 mg/L, respectively. Sodium, magnesium, calcium, and potassium content in tea infusions from CKDu endemic areas were 5.20 ± 1.58, 9.67 ± 0.95, 7.90 ± 1.53, 157.76 ± 12.46 mg/L and control areas were 4.78 ± 1.35, 9.28 ± 0.32, 6.56 ± 1.03, 151.26 ± 5.94 mg/L respectively. The infusions prepared with local groundwater from the CKDu endemic areas showed elevated fluoride and other cations. Results of the present study indicate that the chronic daily intake of fluoride and other Hofmeister ions from tea may induce risk for CKDu.

Keywords: brewing time, dietary exposure, risk assessment, tea infusion.

Development of healthy fiber-rich herbal crackers from whole wheat, finger millet, rice bran and *Gymnema sylvestre* leaves.

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Crackers are considered healthy snacks as it has a low level of salt, sugar, and a moderate level fat. This study aimed to develop healthy fiber-rich herbal crackers from whole wheat, finger millet, rice bran, and *Gymnema sylvestre* leaves. For this study, crackers were made with four different formulations by incorporating *G. sylvestre* leaves at 0%, 1%, 5%, and 8%. In addition to leaves, crackers had whole wheat, finger millet, and rice bran as raw ingredients. Crackers with 0% leave are considered as control. This investigation assesses proximate composition, phenolic, flavonoid, carotenoid content, antioxidant, anti-diabetic, and anti-inflammatory properties of raw ingredients and crackers. Further, sensory profiles, invitro-gastrointestinal digestion, and physical properties of crackers were also analyzed and compared with control. The results showed that among raw ingredients rice bran had a higher amount of fiber (18.74± 0.73%), ash (9.38± 0.01%), and flavonoids content (9.25±0.14 mg RE/g) and *G. sylvestre* leaves had higher phenolic (51.89±0.28 mg GAE/g), carotenoid (0.275±0.004 mg/g), and anti-diabetic properties (70.37±0.68% inhibition). Based on sensory evaluation, it was concluded that *G. sylvestre* leaves can be substituted up to 5% in crackers preparation without adversely affecting quality attributes. When comparing 5% leaf substituted crackers with control, the 5% cracker had a slightly higher percentage of phenolic, flavonoid, carotenoid, antioxidant, anti-diabetic, and anti-inflammatory properties than the control. Accordingly, phenolic, flavonoid, carotenoid, antioxidant, anti-diabetic, and anti-inflammatory property of crackers with 5% *G. sylvestre* leaves are 4.66±0.02 mg GAE/g, 1.4±0.04 mg RE/g, 0.214±0.003 mg/g, 32.77±0.64%, 48.3±0.68%, and 71.42±2.38% respectively. Further, the physical properties of control and crackers with 5% leaves are almost the same. So, these results concluded that *G. sylvestre* leaves can be incorporated up to 5% in crackers preparation along with whole wheat flour, finger millet flour, and rice bran to enhance the functional properties of crackers.

Keywords: Anti-diabetic property, Dietary fiber, Proximate composition.

Evaluation of nutritional and functional properties of mature jackfruit bulb flour in cookies with added value

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Jackfruit is considered a widely consumed fruit that belongs to the genus *Artocarpus*. They can be found across South Asia as well as tropical countries. Jackfruit is considered as a fruit with high nutritional and medicinal value but also an underutilized fruit with significant wastage. The purpose of this study was to develop cookies using jackfruit bulb flour and to evaluate the flour and cookies for various functional, chemical, and physical properties. The best jackfruit type was observed by comparing the nutritional, physical, and functional properties of two jackfruit bulb flour types (soft and firm), both of which are abundant in Sri Lanka. Jackfruit bulbs were turned into flours using standard methods with a few adjustments that are critical in retaining the nutritional and physical properties of flour. The firm kind had a larger quantity of fiber (4.71 ± 0.60 %) and mineral content (4.37 ± 0.03 %) and a lower amount of fat (0.18 ± 0.06 %) and carbohydrate. Firm type also has a greater phenolic content (0.37 ± 0.03mg/g GAE), alpha-amylase (6.66 ± 0.44%), alpha-glucosidase (25.69 ± 0.53%), antioxidant (12.6 ± 0.14%), and anti-inflammatory (57.47 ± 2.63%) inhibitory activities. Varying amounts of jackfruit bulb flour levels (20, 40, 60 and 80 w/w %) were added in making cookies. Based on sensory qualities, the result revealed that the ratio of 40 and 60% were found to be the best for cookies prepared by supplementing wheat flour with jackfruit flour. So 60% of jackfruit bulb flour is used for cookie preparation because of higher health benefits. Jackfruit cookies prepared were assessed for proximate analysis and found to contain moisture (6.99 ± 0.33%), crude protein (7.42 ± 0.21%), crude fat (21.65 ± 0.29%), crude fiber (3.47 ± 0.61%), carbohydrates (57.13 ± 0.86%) and ash (2.55 ± 0.38%) respectively. Therefore, it can be concluded that jackfruit bulbs can be profitability converted into flour for the preparation of good quality and nutritionally enriched processed products like jackfruit cookies.

Keywords: jackfruit, jackfruit cookies, jackfruit bulb flour

A study evaluating the variability in fructan content of selected food sources in Sri Lanka.

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In the last couple of decades, consumers around the globe are increasingly aware of the relationship between a prebiotic-rich diet and gut health. Fructans are non-digestible carbohydrate-based prebiotic and exhibit potentially beneficial effects on human health. There was a lacking database related to the total fructan content of food sources in Sri Lanka and the measurement of fructan contents is a time-consuming and great challenge. Therefore, the objective of this study was to develop a database of the total fructan content of 58 selected food sources and other herbs commonly found in Sri Lanka. The total fructan content of analyzed samples was determined quantitatively and qualitatively using the enzymatic spectrophotometric (ES) method using the K-FRUC kit commercialized by Megazyme International Limited (Bray, Ireland) and thin-layer chromatography (TLC) methods, respectively. The ES results showed that total fructan contents based on fresh weight as highest in *Allium sativum* (19.36 % ± 1.45), followed by *Allium ampeloprasum* (9.57 % ± 0.99), *Abelmoschus esculentus* (8.35% ± 1.13), *Raphanus sativus* (4.29 % ± 0.39), *Maranta arundinacea* (4.01 % ± 0.58), *Glycine max* (4.01 % ± 0.71), *Canna indica* (3.81 % ± 0.52), *Cucurbita pepo* (3.69 % ± 0.21), *Dioscorea esculenta* (3.47% ± 0.27), *Pouteria campechiana* (3.04 % ± 0.09), *Musa acuminata Colla* (2.54 % ± 0.04), *Musa paradisiaca* (2.53 % ± 0.12) and *Brassica oleracea* (2.31 % ± 0.04) respectively. Analyzed leave samples were shown a comparatively low amount of total fructan. *Allium sativum, Allium ampeloprasum, Abelmoschus esculentus, Raphanus sativus, Maranta arundinacea and Glycine max* developed thicker darker blue-green streaks on TLC plates due to their higher fructan concentration, which confirmed the enzymatic spectrophotometric results. Research in this area will be facilitated through the availability of more comprehensive food composition data.

Keywords: enzymatic spectrophotometric, fructan, Megazyme, thin layer chromatography

Potential bioactive properties of *Pterocarpus marsupium* plant extracts and its biofunctionalized chitosan nanoparticles

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Pterocarpus marsupium (PM) is a well-known medicinal plant and its various parts provide numeric health benefits such as antioxidant, anti-inflammatory and anti-diabetic, etc. However, its respective bioactive compounds and their bioactive properties have not been explored systematically. Hence this study aimed to determine the potential bioactive properties and to stabilize those fragile compounds by embedding them in synthesized chitosan nanoparticles (CNPs). Methanolic extracts of different PM plant parts (flower, leaf and stem exudates) were used to evaluate for total phenolic, total flavonoids and total carotene content. The relevant bioactive properties were evaluated by using standard analytical methods. The CNPs were synthesized in the presence of different concentrations of stem exudates extracts and optimized the condition to acquire a stable nanoparticle formation. The entrapment efficiency of CNPs was also determined. The structural properties of PM-CNPs were characterized by X-ray diffraction (XRD), Fourier transforms infrared spectroscopy (FTIR) and Scanning electron microscopy (SEM). The PM-CNPs, α-amylase inhibitory activity, DPPH radical scavenging activity and inhibition of protein denaturation were obtained. The stem exudates have the highest quantity of bioactive compounds and bioactive properties compared to both flowers and leaves. A significant correlation was observed between antioxidant activity and total polyphenolics of the PM. The CNPs formulation with 20 ppm extract has the highest entrapment efficiency (81.62 ± 1.01). The entrapment of PM in CNPs did not lose its bioactivity. The FT-IR results suggested the presence of bioactive compounds such as alkaloids, phenolics, tannins and terpenoids based on the analysis. The PXRD pattern of PM-CNPs shows a semicrystalline nature whereas pure PM extract and pristine are amorphous. The PM- CNPs composite is having a spherical morphology with a porous structure. The particle size was recorded below 100 nm. In conclusion, out of flower, leaf and stem, stem exudates have the highest bioactive properties and PM Stem exudates extract was successfully loaded into the chitosan polymer matrix as PM-CNPs to be used as a potential nutraceutical.

Keywords: Anti-inflammatory, Antioxidant, Entrapment efficiency, Antidiabetic

Current replacement possibilities of natural-phosphate alternatives in meat products

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Food grade phosphates are extensively used in the meat industry to achieve several physicochemical and functional properties. As the role of additive, synthetic phosphates offered a range of possibilities in meat production. Such as adjusting or stabilizing pH values, increasing water retention, improving juiciness and tenderness, improving texture and organoleptic properties, reducing the cooking loss, prolonging shelf life, emulsion stabilization, and maintaining the flavor of processed meat products. However, the adverse health effects arise with added phosphates on humans focused on phosphate-free meat products. High phosphate intake is considered a cardiovascular risk factor in-patient with chronic kidney disease and excess phosphate intake lowers calcium absorption and affects bone formation. While elimination and/or reduction of phosphates affect the final quality of the product, this drives the food scientists to explore phosphate alternatives. Therefore, the main objective of this study was to evaluate the necessity of finding natural phosphate alternatives and based on previous research studies summarize the possible phosphate replacement strategies in meat products. Starch sources, fibers, by-products of the food industry (mango peel, citrus fiber), protein sources, natural calcium powder and some other sources currently examined in some meat products as phosphate alternatives. When these alternatives were added to meat products (alone or combined with multi-components) showed similar characteristics same as synthetic phosphates. In addition, the application of some novel technologies helps in phosphate reduction by altering the structure of meat protein. By looking at the properties of currently examined alternatives, this review proposed some new potential natural-phosphate alternative sources. Such alternatives are jackfruit flour, hydrolyzed potato protein, dried pumpkin pulp and seed, canola protein hydrolysates, soy flour, and soy protein concentration, a polysaccharide from pineapple core. However, natural alternatives have not modified the molecular structure of meat comparable to food-grade phosphates. Therefore, combination treatment of natural sources with novel technologies is required for successful phosphate replacement.

Keywords: Adverse effects, Alternatives, Functional properties, Meat products, Phosphates

Impact assessment on the adoption of new improved technology on loss reduction and profit of stakeholders in the mango supply chain in Sri Lanka

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A study was conducted to evaluate the adoption of newly improved knowledge and technologies introduced by the National Institute of Postharvest Management (NIPHM) for loss reduction and increased profit of stakeholders in mango (*Mangifera indica*) supply chain in Sri Lanka. A total of 30 packhouse owners are located in six districts *viz*. Anuradhapura (n = 7), Kurunegala (n = 5), Gampaha (n = 6), Kandy (n = 4), Ampara (n = 3) and Monaragala (n = 5) were selected based on the judgment sampling technique. A telephone-based survey was conducted using a questionnaire to assess the use of correct harvesting practices, appropriate packages and containers, ripening procedures, branding and dispatching processes. Quantitative & qualitative losses occurred before and after the introduction of new knowledge and technology were compared and costs incurred and profits gained were calculated. It was revealed that all packhouse owners adhered to maturity indices and they use the recommended tool for harvesting of mango which greatly contributes to reducing the losses. The use of plastic crates to transport mangoes has been significantly increased while utilization of bulk transportation, used cartons, wooden boxes, "*Wewal*" boxes and jute sacks have been reduced. There was an improvement in qualitative characteristics such as peel color, flavor, texture, aroma, and pulp color according to the opinion of packhouse owners. A quantitative loss before introducing newly improved technology was 16.30% and after the adoption of new improved technology, it has been reduced up to 4.31%. The mean net profit has been increased by 83.76% after the adoption of new technologies while the mean net profit was increased by 95.03% when selling to supermarkets compared to the normal market. Mechanical damages, stem-end rot, anthracnose and fruit fly were the major factors that caused quantitative losses of mangoes and 73.33% of owners claimed that mechanical damages have been reduced significantly after the adoption of new improved technology. In conclusion, the adoption of newly improved technology has significantly contributed to reducing postharvest losses of mango and increased the profits of the packhouse owners subjected to the study.

Keywords: Mechanical damage, Packhouse owners, Quantitative loss, Qualitative loss.

Development of nutritious healthy cookies using *suwandel* rice, chickpeas and horse-gram for diabetes patients

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Blends of *suwandel* rice flour, chickpea flour horse-gram flour were used for the preparation of nutritious healthy cookies. This study was aimed to determine the proximate composition of raw flours and the swelling power and water holding capacity of raw flours were analyzed. Functional properties of raw materials and cookies were evaluated. Total phenol content (TPC), Total flavonoids content (TFC), Carotene content, (2, 2-diphenyl-1-picrylhydrazyl) DPPH radical scavenging assay, Alpha-amylase inhibition assay and protein denaturation assay were performed for the methanolic extracts of raw flours and formulation of cookies compared with control (only *suwandel* rice flour) cookies. Sensory evaluation and *In-vitro* starch digestion were performed to characterize the formulation of cookies. The *in-vitro* digestion process was carried out to quantify bioaccessible and bioavailable phytochemicals through gastric and intestinal phases analyzed through TPC, TFC, Carotene content, DPPH radical scavenging assay of formulation cookies and control extracts. Comparatively, higher phenolic content was observed in the extract of raw horse-gram flour (2079.50 ± 18.10 μg GAE/g) and higher flavonoids content and carotene content were observed in the extract of raw chickpea flour. Extract of raw horse-gram flour exhibited higher radical scavenging activity ($60.27 \pm 4.11\%$). Extract of raw *suwandel* rice flour expressed a higher percentage of alpha-amylase inhibition ($48.67 \pm 0.31\%$) followed by an extract of raw chickpea flour ($46.89 \pm 3.46\%$). Extract of raw *suwandel* rice and chickpea flour showed higher anti-inflammatory activity ($63.10 \pm 5.05\%$). When comparing the formulation of cookie with control, formulation of cookie has a significantly ($p < 0.05$) difference of TPC, TFC, carotene content, DPPH radical scavenging activity, anti-diabetic and anti-inflammatory properties than the control. Extract of formulation exhibited higher TPC, TFC, carotene content and DPPH radical scavenging activity than control in gastrointestinal phase. These findings support the development of nutritious healthy cookies due to increasing the functional properties of cereal and legumes incorporate formulation.

Keywords: Antioxidant, Diabetes, *In-vitro* starch digestion, Inhibition

Consumer opinion towards the application of synthetic phosphate in meat products and jack-fruit seed starch as an alternative for synthetic phosphate

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Nowadays, people are more inclined to eat clean meat products. The trend is moving towards the selection of meat that is processed using natural ingredients. Phosphates are one of the salts commonly used as sodium triple phosphates (STPP). Excess amounts of phosphate are harmful to people, especially those suffering from renal diseases. Therefore, the study was conducted to analyze consumer preference for consumption of processed meat products going to be prepared using jack-fruit seed starch (JSS) as an alternative to phosphates added in meat processing and to analyze consumer awareness of additives used in the meat industry. The survey was conducted through an online questionnaire with people living in the western province. The questionnaire was randomly sent and 152 responses were collected and applied to the analysis. A cross-section design was used as the experimental design. Statistical analysis was conducted using the chi-square test and the SPSS 16.0 package program. The results of the statistical analysis were as follows: 48.03% of people know that phosphates are added to meat products, but the majority (51.97%) don't know that phosphates are artificially synthesized. In addition, 54.61% of people prefer natural additives. According to the results, 98.03% of people consume jack seeds. Also, among these responses, 84.21% of people consider JSS as a healthy additive. 76.32% of people like to consume Jack seeds. Also, 49.34% of people like to buy JSS-added meat products even though the price is still a little bit higher than the price of processed meat in the market, prepared using artificial phosphates. There is no significant association between consumption of jack fruit seeds and ethnicity, highest education level occupied, monthly household income, or age (P-value > 0.05). Therefore, it can be concluded that people commonly prefer natural ingredients more than artificial ingredients, and there is significant consumer demand for processed meat to be made using JSS as an alternative to synthetic phosphate.

Keywords: Jack-fruit seed starch, natural additives, phosphate, processed meat, Western province

Development of *Psychotria sarmentosa* (Gonika) based herbal tea and assessment of its functional properties

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Gonika is an underutilized green leafy vegetable used as herbal medicine by indigenous healers in Sri Lanka with potent anti-inflammatory activity. *This study aimed to develop a herbal tea with acceptable sensory properties and to* investigate its phytochemicals & functional properties. The proximate composition of *Gonika* tea was determined using AOAC standard methods. Ethanolic extract & hot water infusion of herbal tea were analyzed for anti-inflammatory, total antioxidant activity, anti-diabetic activity, total phenols, flavonoids, tannin and carotenoids, by standard methods. Ginger & cinnamon were added to prepare blends & an acceptance test was conducted to select the best blend. Results revealed that *Gonika* tea contained Moisture content ($14.44 \pm 1.39\%$), ash ($17.6 \pm 2.13\%$), crude fat ($3.2 \pm 0.19\%$), crude fiber ($20.33 \pm 1.07\%$), crude protein ($10.56 \pm 0.45\%$) & total carbohydrate (34.09 ± 1.05 %), respectively. The phytochemicals & functional properties were found to be highest in the ethanolic extract than the aqueous infusion. Ethanolic extract & hot water infusion contained TPC (92.82 ± 2.61, 31.79 ± 0.76 mgGAE/g), flavonoids (14.30 ± 1.71, 5.62 ± 1.37 mgRE/g), tannin (59.38 ± 3.4, 15.50 ± 0.72 mgTAE/g), and carotenoids (950.56 ± 7.08, $291.14 \pm 6.60 \mu$g/g), respectively. The ethanolic extract & aqueous infusion also exhibited IC_{50} values of antioxidant activity (161.39 ± 0.96, 201.06 ± 1.42), inhibition of protein denaturation activity (71.28 ± 1.52, 238.18 ± 1.03), inhibition of hemolysis activity (60.21 ± 0.68, 224.79 ± 2.34) and anti-diabetic activity (74.29 ± 1.23, 615.82 ± 5.18), respectively. The organoleptic evaluation revealed that the blend (*gonika*-70%, ginger-15%, cinnamon-15%) had the highest overall acceptability. Total phenolic & flavonoid content had a strong correlation with antioxidant activity, anti-inflammatory, & anti-diabetic activity. Based on the results of this study, it can be concluded that *Gonika* can be used as an alternative to commercial tea (*Camellia sinensis*) in providing significant anti-inflammatory & antioxidant effects.

Keywords: anti-inflammatory activity, antioxidant activity, extraction, infusion, polyphenolics

Histamine-associated fish poisoning – a Review

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Histamine fish poisoning (HFP) is primarily caused by ingestion of fish muscle tissue containing a high concentration of free histidine. It's also known as scombrotoxicosis or scombroid fish poisoning. I did this research because customers are evolving more demands and some cases followed by fish intoxication are now more common and normal in the current society. Also, several viewpoints have been put forward to clarify why the histamine intake in contaminated fish is preferably more toxic than pure histamine, which is consumed orally. Fish species that belong to the Scombridae family that we consume are rich in histamine, which leads to histamine poisoning. Even though it's commonly concerned with the elevated degrees of histamine in spoiled fish by some bacterial species, the pathogenic conditions of histamine food poisoning are not specifically clarified. Therefore, present review was focused to find more details on why histamine poisoning occurs. This study was done by reviewing research papers from 1980–2020. To gather research articles, the databases of Science Direct and Google scholar were used. More than fifty references are included. The results and findings of the review are: Histidine decarboxylase enzyme-producing bacteria synthesize histamine from the naturally occurring histidine in fish that are contaminated. The clinical symptoms of histamine poisoning are quite similar to those of allergic reactions. Therefore, HFP is sometimes misunderstood as having allergic conditions. This led to the later diagnosis of this illness. So, the treatment is delayed. When looking through the epidemiological features, it is clear that Asian countries like Japan are facing histamine poisoning mostly due to the consumption of raw fish. The efficacy of antihistamine therapy, the allergic-like symptomology, and the finding of high levels of histamine in the implicated foods suggest strongly that histamine is the causative agent. Histamine ingested with spoiled fish appears to be much more toxic than histamine ingested in an aqueous solution. The presence of potentiators of histamine toxicity in the spoiled fish may account for this difference in toxicity.

Keywords: Biogenic Amines, Histidine decarboxylase, Scombroid, Toxicology

Evaluation of functional properties in Ready-to-drink beverage formulated with Kalanchoe pinnata (Akkapana) and Aloe vera

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Currently rising of chronic and non-communicable diseases among the population is a burden issue worldwide and the use of functional food have a positive impact to make people healthy. Medicinal plants have a good potency of preventing and curing diseases. This study was done to develop a functional Ready-to-drink beverage from *Kalanchoe pinnata* leaf and *Aloe vera* gel with antiurolithiatic, antioxidant, antidiabetic, and anti-inflammatory properties. *K. pinnata* leaf juice and *A. vera* gel juice were combined in different volume ratios to get different formulations. Sensory evaluation was conducted by adopting 9 points hedonic scale. Among those formulations, the highest sensory scores were obtained for flavor and overall acceptability in 70:30 (v/v %) of *K. pinnata* and *A. vera*. That formulation was selected as the final beverage for further analysis. Proximate composition was evaluated for leaf, gel, and final beverage. Antinutritional factors were quantitatively identified in leaf and gel samples. Physiochemical properties such as pH, TSS, titrable acidity in the final beverage were analyzed. Methanolic extracts of the above plant samples and final beverage were analyzed for evaluating the functional properties such as total phenolic (TPC), total flavonoid (TFC), carotene content (TC), antiurolithiatic, antioxidative, antidiabetic, and anti-inflammatory properties. The presence of tannin, saponin, and alkaloids in *K. pinnata* leaf and only tannin was detectable in low concentration in *A. vera* gel. *K. pinnata* exhibited the highest TPC (1.3141 mg GAE/g dw), TFC (0.7364 mg rutin/g dw) and TC (32.8049 mg/g dw) compared to *A. vera*. The highest DPPH inhibition (80.26%) and α-Amylase inhibition (23.33%) were shown by *K. pinnata* and the highest protein denaturation inhibition (71.43%) was exhibited in *A. vera* compared with other tested samples. Results of *in vitro* antiurolithiatic test in two plant materials and beverage exhibited inhibition action in both nucleation and aggregation assays. This study indicates that *K. pinnata* leaf and *A. vera* gel can be effectively used for developing a functional beverage with antiurolithiatic, antioxidant, antidiabetic, and anti-inflammatory properties.

Keywords: *Aloe vera*, Antidiabetic, Anti-inflammatory, Antiurolithiatic, *Kalanchoe pinnata*

Antioxidant potentials of some selected varieties of banana peels and improve the health benefits of yogurt by fortifying with banana peel extract

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Banana peels are considered waste due to the lack of awareness of health benefits. This study aimed to evaluate the antioxidants properties of peels in three different banana varieties, '*Seeni' (ABB), 'Kolikuttu' (AAB)* and *'Ambul' (AAB)*. Antioxidant activity was assessed with DPPH (2, 2-diphenyl-1-picrylhydrazyl) and $ABTS^+$ (2-2'-Azino-Bis-3-Ethylbenzothiazoline-6-Sulfonic Acid) assays. The DPPH values of '*Ambul'*, '*Kolikuttu'*, and '*Seeni'* were 55.36 ± 0.89%, 56.55 ± 1.86%, 57.77 ± 8.67% and the $ABTS^+$ values were 7.94 ± 1.45%, 59.74 ± 2.31% and 69.8 ± 0.76% respectively. '*Seeni'* had the highest antioxidant activity. The preliminary consumer survey was showed the acceptability for yogurt to incorporate with banana peel extract. *Lactobacillus rhamnosus* was used as the culture for the yogurt. The ethanolic banana peel extract of '*Seeni'* was incorporated with yogurt within the range of 0-1000 μL/100 mL milk. Over 90% of added extract remained in the final yogurts. They exhibited significantly ($p < 0.05$) higher total phenolic content (TPC), DPPH, $ABTS^+$ compared to control yogurts. The extract incorporated up to 800 μL/100g in yogurts received the highest rating in the 9 points hedonic scale in terms of appearance, flavor, consistency, and overall acceptability. It exhibited a higher TPC, DPPH, $ABTS^+$ and lower peroxide value compared to control yogurt after 21 days. At the end of the 7th, 14th and 21st day DPPH values and were changed from 70.67 ± 1.54% to 74.79 ± 2.36%, 71.18 ± 3.21%, 75.30 ± 1.54% and $ABTS^+$ values were changed from 69.31 ± 1.23% to 65.21 ± 0.34%, 62.45 ± 0.63%, 62.47 ± 1.23% respectively. The color, pH, titrable acidity, the microbial count did not show any significant differences at refrigeration storage. The study demonstrated that banana peel extract has the potential to be used as a functional food ingredient for promoting the health of the consumer.

Keywords: Ethanolic, Functional, Phenolic, Waste

Present status of postharvest practices and loss assessment of papaya, potato and cluster onion

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Papaya, potato and cluster onion are three economically important crops giving high income to the cultivators. They are distributed from farmgate to consumers through the supply chain, in which farmers, collectors, transporters, wholesalers, retailers and consumers play a major role. Incorrect postharvest handling practices during the supply chain create a different degree of qualitative and quantitative losses. Therefore, this study was conducted to investigate the present status of postharvest practices and losses of papaya, potato and cluster onion along the supply chain in Jaffna district of Sri Lanka. Based on the extent of cultivation and major marketplaces, a sample of 204 stakeholders namely farmers, collectors, transporters, wholesalers, retailers, and consumers were randomly selected from four divisional secretariats of the district. Results revealed that the postharvest practices performed by the stakeholders significantly affect losses of papaya, potato and cluster onion along the supply chain ($p < 0.05$). Harvesting practices of farmers are more or less similar and all collectors act as transporters as well. The most popular packaging type for papaya, potato and cluster onion by farmers and transporters were plastic crates, sacks and net bags respectively. The common mode of transportation were motorcycles, three-wheelers, open trucks, and lorries. At the wholesaler and retailer level, papaya was displayed in plastic crates while potato and cluster onion were kept on the floor. With the said practices the total postharvest loss of papaya, potato and cluster onion were 46.57%, 20.28%, and 19.15% respectively. A proper marketing practice should be introduced to reduce the postharvest losses of all three crops. It can be concluded that postharvest losses of papaya, potato and cluster onion in the study area were significantly affected by the incorrect harvesting, transportation, marketing practices performed by stakeholders. Awareness creation on correct post-harvest practices can be suggested as one option in reducing the losses.

Keywords: Farmers; Retailers; Supply chain; Transporters; Wholesalers

Symbiotic microencapsulation of corncob xylooligosaccharide and *in vitro* study for bioactivity & stability upon digestion & storage

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Xylooligosaccharides (XOS) are emerging prebiotic that may improve the viability of probiotics and gastrointestinal health. XOS derived from corncob was evaluated for its prebiotic activity with three different probiotic strains and *Lactobacillus rhamnosus* (LGG) showed the highest viability 9.86 ± 0.04 log CFU/mL upon XOS. Three different carrier types were tested as encapsulation materials for XOS and sodium alginate (SA) showed the highest encapsulation efficiency 87.6 ± 0.1%, yield and cost-effectivity among them. Those were incorporated in the formulation of synbiotic microcapsules with XOS. The present study focused on XOS to encapsulate *L. rhamnosus* LGG and explore it's *in vitro* survival & stability upon storage through structural interactive optimization of encapsulation materials. XOS and SA were used for encapsulation of LGG with different formulations, e.g., M_0 (2 % (w/v) SA), M_1 (2% SA + 1% XOS), M_2 (2% SA + 3% XOS), M_3 (2% SA + 5% XOS). The stability of free and encapsulated *L. rhamnosus* LGG was assessed using gastrointestinal conditions. All the treatments provided better encapsulation efficiency > 80 %. M_2 was considered as the best formulation for the survival of *L. rhamnosus* LGG with the highest encapsulation efficiency of 92 ± 1%. It showed maximum viability in simulated gastric juice 8.7 ± 0.1 log CFU/mL and bile solution 8.6 ± 0.2 log CFU/mL, resulting significantly ($p < 0.05$) improved survival when compared with free bacteria. The microcapsules were then incorporated into yoghurt and the results showed that there was an increased survival of probiotics because of the protection of cells by microencapsulation and the promoting effect of XOS on the growth of the probiotics. The XOS extracted from the corncob was successfully incorporated as a prebiotic encapsulation material for the effective delivery of *L. rhamnosus* LGG. The different combinations of wall materials with XOS provided an opportunity to produce beads with better structure and protection.

Keywords: *L. rhamnosus*, Microencapsulation, Sodium alginate, Synbiotic, Xylooligosaccharide

Functional properties of *Moringa oleifera* leaf powder and quality evaluation of tea brewed from different blends of *M. oleifera* leaf powder and black tea (*Camellia sinensis*)

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In the present study, it was investigated nutritional, functional and sensory properties of *M. oleifera* leaf powder and black tea blend after hot brewing as well as the functional properties of methanolic extracts of moringa leaf powder (MLP) at different concentrations. Proximate composition proved that *M. oleifera* leaves are rich in essential nutrients such as fiber, fat, proteins and ashes. As functional properties, this study examined the *in-vitro* antioxidant, antidiabetic and anti-inflammatory properties of different blends of moringa leaf powder and black tea (BT). Hot water extracts of different blends (5%,10%,15%,20%,25% MLP) were analyzed for total phenolic, carotene, flavonoid and tannin content. The results showed that 5% (MLP) tea bags have significant carotenoid, and tannin content and that raising the MLP ratio lowered the contents. Total flavonoid content was significantly increased with the raising of the MLP ratio. There were no statistically significant differences in total phenolic content across the various blends except the 5%(MLP) blend. The results showed that 25% (MLP) tea bags have significant antidiabetic, antioxidant, anti-inflammatory properties and that lowering the MLP ratio lowered the properties. Different concentrations of methanolic extracts of MLP (1000ppm, 2000ppm, 3000ppm, 4000ppm, 5000ppm) were given that there was a significant difference in contents of phenolic, carotene, flavonoid and tannin at different concentrations, and raising the concentration increased the content. The result showed that antidiabetic, antioxidant, anti-inflammatory properties were increased significantly with the different extract concentrations of MLP. There was a good correlation between antioxidant assay and total phenolic contents as well as the protein denaturation assay and their flavonoid contents of the different blends. According to sensory evaluation, the 20% MLP blend has the highest overall acceptability.

Keywords: Antioxidant, Blends, Functional, Phenolic, sensory

Development of instant herbal porridge cubes incorporated with nano-encapsulated *Coccinia grandis* extract

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Diabetes mellitus is a cluster of metabolic diseases characterized by hyperglycemia. Since this epidemic has grown worldwide, the usage of phytotherapeutics to manage diabetes is becoming a trend. *Coccinia grandis* is identified as the most effective herb especially for diabetes and many other disease conditions. This study intended to identify the most effective antioxidant and antidiabetic compounds available in *Coccinia spp*. Therefore, a systematic literature review was conducted to identify the effectiveness of *Coccinia spp*. from articles published in the 2008-2021 period. The results showed that the average total phenolic content (TPC) of *C. grandis and C. indica* were 63.06 and 257.22 mg/g GAE, respectively. Hence, an instant herbal porridge cube incorporating *C. grandis* powder was produced based on the overall acceptability of the recipe selected by sensory evaluation to increase the consumer reachability of these herbs to produce health beneficially supplementary. The developed porridge cube showed TPC of 66.77 ± 0.74 mg/g GAE, DPPH radical scavenging activity of $27.65 \pm 6.79\%$, α-amylase inhibition activity of 5.72% and α-glucosidase inhibition activity of 59.64%. The main nutrient of the porridge was carbohydrates (22.13% wb). Effect for postprandial blood sugar level after consuming the developed porridge was measured and suppression of blood sugar levels was observed. As a further development, *C. grandis* extract was nanoencapsulation with food-grade sodium alginate and incorporated into the same porridge as a safe delivery method. An *in vitro* digestion assay was conducted, and the results showed that TPC and DPPH radical scavenging activities were significantly higher in the non-encapsulated porridge in all digestive phases while alpha-amylase inhibition activity for the gastric phase and alpha-glucosidase inhibition activity for the intestinal phase were significantly higher in the nano encapsulated porridge ($p < 0.05$). Therefore, consuming nanoencapsulated herbal porridges is more beneficial for diabetic patients.

Keywords: antidiabetic, antioxidants, herbal porridge, phytotherapeutics

Department of Aquaculture and Fisheries

Production of a vegan substitute with *Averrhoa bilimbi*, seaweed and oil for Anchovy cured in oil

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Producing sufficient and sustainable vegan food products and enhancing alternative eating habits are essential to meet the food demand of vegetarians and vegans. Anchovy curated in oil is a popular food and a vegan substitute was attempted with bilimbi fruit *(Averrhoa bilimbi)* and seaweed (*Sargassum* spp.) which were bottled in four types of oil (olive, rice bran, coconut, and sunflower). Varying percentages of salt added *A. bilimbi* were sun-dried and powdered. *Sargassum* spp. was combined both during the wet phase and when partially dried. A low salt treatment (2%, 4%, 6%, 10%) was concurrently processed through oven drying. Sensory evaluation was conducted and for the preferred treatments, proximate analysis, total phenolic, flavonoid, and total suspended solid contents and shelf-life were assessed. The most preferred was *A.bilimbi* with 2% *Sargassum* spp. added after partial drying ($p < 0.05$). There was no significant choice difference for the oil. For high and low salt, the preferred choices were 30% and 10% respectively ($p > 0.05$). Proximate analysis indicated 6.62±2.69% protein, 39.56±4.98% ash, 24±2.41% moisture, 0.18±0.116% crude fibre, 35.79±9.93% fat and 9.90±3.56% carbohydrates. A significantly higher concentration of flavonoids (40.60±0.424 g/Rutin 100 g Dry Weight) was recorded in 30% salt and coconut oil treatment. Total phenolic concentration was significantly higher (139.833±1.23 g/GAE 100 DW) in treatment with 30% salt and preserved in olive oil. Total suspended solids were significantly higher in 30% salt in olive (46.50±0.70 °Brix) and rice bran (38.50±2.12 °Brix) oils ($p < 0.05$). pH, water activity and total plate count of the product after three weeks did not significantly differ from first- and second-week values. Mean lightness, redness, and yellowness of the selected treatments were 28.81±7.88, 3.59±1.06, and 11.71±4.04, respectively. This product has the potential to be introduced as a substitute for anchovy in oil due to its similar appearance.

Keywords: anchovy, *Averrhoa bilimbi*, salting, seaweed.

Preliminary study to develop freshwater pearls from *Lamellidens marginalis* to promote the rural income of the fishers in *"Vijaya Katupotha"* tank in Chilaw, Sri Lanka

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Freshwater pearl culture is traditionally practiced in China and Japan. But so far proper pearl production technique has not been developed for Sri Lankan conditions due to poor knowledge and technology. The availability of pearl mussel species: *Lamellidens marginalis* in mass scale, in north-western freshwater bodies in Sri Lanka, shows a greater potential of pearl production. Therefore, to develop pearl production technique, by using locally available low-cost materials, which could be practiced by small-scale fishermen, these culture trials were conducted in the northwest region at *Vijaya Katupotha* tank, from 2014-2015 by using 324 pearl mussels (60 - 80 mm). Three nucleus sources namely, "Mantle tissue", "Plastic balls", "Bivalve shells" (round shape & flat shape) were used for implant purposes. Randomly selected five oysters were opened and observed for pearl formation after 3, 6, 9 and 12-month intervals. A significantly highest survival rate was observed in the individuals implanted with bivalve shells ($P < 0.05$). Moreover, the nuclear rejection rates were significantly higher ($P < 0.05$) in the mussel implanted with the plastic beads. But there was no significant difference in survival rate and nuclear rejection rate among the two shapes of bivalve shells used for implants. Formation of image pearls was observed within 12 months irrespective of the source of nuclease. But pearl formation rates differed with different sources of nuclease. A relatively rounded shape shell nucleus resulted in the highest pearl formation rate but those pearls were not properly attached to the mussel valve. Successful pearl formation was observed with a higher success rate and low mortality percentage after a 6-9 months period. Plastic mesh cages are more effective for artificial pearl culture. By providing drafting and implanting skills together with other knowledge, the livelihoods of the fisher community could be uplifted in establishing a new industry.

Keywords: *Lamellidens marginalis*, nuclear implantations, *Vijaya Katupotha tank*

Stranded sea turtles, dolphins and whales in Sri Lanka in 2021

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Marine animal strandings are a rich source of scientific data. *Sri Lanka* witnessed higher stranding occurrences aftermath Xpress Pearl Ship Disaster from May, during which the need for a protocol for reporting and recording was identified. Accordingly, an online, user restricted, multi-user, mirroring facilitated and data authentication enabled database was developed. All officers of the Department of Wildlife Conservation (DWC) were trained on data collection and reporting. This abstract reports stranding recordings up to 12th December 2021 and necropsy data up to 18th August 202. By 12th December, 402 dead sea turtles (88.5%), 44 dolphins (42 dead, 02 live and later released) (9.3%) and 9 dead whales (2.2%) were stranded. Sea turtle stranding was recorded in 12 coastal districts while dolphins and whales in 11 and 7 districts, respectively. All five species of sea turtles, seven species of dolphins (*Stenella longirostris, S. Coeruleoalba, Lagenodelphis hosei, Tursiops truncatus, Grampus griseus, Delphinus delphis, Sousa* spp,) and four species of whales (*Kogia sima, Feresa attenuata, Pseudorca crassidens, Balaenoptera musculus*) were present amongst standings with an unconfirmed stranding of either *Balaenoptera edeni or B. musculus*. Sea turtle strandings showed a significant increase from the end of May with a peak of 73 in the last week of June. No dolphin strandings were recorded until May and in the 3rd week of June, nine specimens (four *Stenella longirostris* + five data deficient and unidentified) dolphins were recorded. Male to female ratios were 68:206 for all species of turtles. Species-wise, sex ratios were 51:175 (*Lepidochelys olivacea*),15:18 (*Chelonia mydas)*,1:5(*Eretmochelys imbricata)*, and 0:3(*Caretta caretta)*. Mean curved carapace lengths of *L. olivacea*, *C. mydas*, *E. imbricata* and *C. caretta* were 59.65, 61.79, 48.75 and 72.83 cm, respectively. Strandings should be further investigated to ascertain possible links to ship disasters. Also, it is recommended to formally adopt a Standard Operational Procedure for stranding recordings by DWC.

Keywords: marine animal standings, ship wreck.

Exploring citizen science: Nurdle density estimation aftermath *M/V X-Press Pearl* ship disaster in Sri Lanka.

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In May 2021, Singapore registered container ship, *MV X-Press Pearl* caught fire and discharged millions of plastic nurdles into the marine environment amidst COVID, restricting investigations. A citizen science project was therefore launched from June onwards with precise instructions and an online data submission portal. The methodology involved marking three 17cm x 18 cm quadrats using a standard ice cream box lid, photographing the marked areas and submission of photographs with location data. Nurdles in each quadrat were counted and the density of nurdles was calculated. Spatial projections of the density of nurdles were prepared using QGIS and Allen Coral Atlas data were used in identifying the shallow reefs up to 8m and seagrass and seaweed beds within projected densities. A total 73 responses were received from seven districts (*Colombo, Gampaha, Puttalam, Matara, Galle, Kalutara and Hambantota*). A total of 68.5 % of the respondents reported the presence and 31.5% the absence of nurdles in the observed areas. Only 36 responses were used in the final analysis due to technical errors. Point location-wise, the highest average nurdle density was recorded from *Dungalapitiya* in *Gampaha* district (23,459 ±4421m^{-2}) and the lowest average nurdle density was recorded from *Kolaniya* area in *Puttalam* district (33m^{-2}). District-wise, the highest average density was recorded from Colombo (50,789±1139m^{-2}) and the lowest from *Hambantota* (98±65m^{-2}). The average densities of nurdles in the rest of the districts were 48107±3408m^{-2} (*Gampaha*), 33231±689m^{-2} (*Puttalam*), 16068±742m^{-2} (*Matara*), 1307 ±231m^{-2} (*Kalutara*) and 1293m^{-2} (*Galle*). During disaster assessment, high, medium and low impact zones were demarcated by International Tanker Owners Pollution Federation Limited. A significantly higher nurdle density (7063m^{-2}) was recorded in the high impact zone ($p < 0.05$). Results also indicated a decline in the density of nurdles with the distance from the location of the X-Press Pearl disaster and also with time. Spatial distribution maps indicated a total of 4.814 km^2 of shallow reefs and 2.908 km^2 of seagrass and seaweed beds under possible impacts from nurdles. The study revealed that citizen science can be applied for scientific data collection, however, high rates of response discards emphasize that more engagement and instructions are needed. Nurdles densities emphasize the need for systematic cleaning of the coastline and post-monitoring.

Keywords: Citizen Science, MV X-Press Pearl, nurdles.

Convert Duckweeds and fish wastes to organic farming as a liquid fertilizer

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Today, Sri Lankan farmers are facing a problem with chemical fertilizers. An eco-friendly organic liquid fertilizer was produced using duckweeds (*Lemna sp.*) and fish waste as a sustainable solution and Chili (*Capsicum annuum*) plants were used as the experimental plant to determine the effectiveness of prepared organic liquid fertilizer. Two treatments and control(C) were used for this experiment. Treatments were prepared organic liquid fertilizer (T1) and commercially available liquid fertilizer(T2) (Grow More Nitro Plus). Duckweeds, fish wastes, banana peels, compost and fish bone meal were used in the production of organic liquid fertilizer. As a preservative, sanitizer (Evans) 10mL/L was used. Seven replicants were randomly selected for each treatment. Fertilizers were applied 10mL to the relevant pots once per week. Prepared organic liquid fertilizer contained 0.15% total nitrogen, 0.02% available phosphate and 0.02% soluble potash. The initial height of the plants and initial numbers of leaves were recorded. Then, those measurements were taken at weekly intervals. After 33 days, the final height of the plants and the final number of leaves were recorded and the number of spikes that appeared was recorded in each group for 91 days. The average number of spikes in plants (mean $\pm$ SD) were T1- 4.57 ± 1.397, T2- 5.14 ± 1.574 and C- 2.86 ± 1.069. Statistical analysis revealed that treatments groups were significantly ($P < 0.05$) different from the control and there was no significant difference between treatments groups. According to plant height measurements, the average growth rates (mean $\pm$SD) were T1- 0.56 ± 0.13, T2- 0.42 ± 0.15 and C- 0.41 ± 0.10. Statistical analysis revealed that T1 was significantly ($P < 0.05$) different from control and there was no significant difference between treatments groups. During the experiment, the leaf curl virus spread and all plants in T2, 85.71% plants in C and 28.57% plants in T1 were infected. Overall, it can be concluded that newly prepared organic liquid fertilizer has a positive effect on the growth rate, spikes yield and health of chili plants.

Keywords: chili, leaf curl virus, spikes.

Development of liquid organic fertilizer from fish waste and locally available plant ingredients

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Government policy decision on organic agriculture has created an increased demand for effective and innovative organic fertilizers. The present study intended to develop a liquid organic fertilizer (LOF) based on fish offal and plant ingredients (water hyacinth, banana wests, moringa leaves and *Lantana camara*) and poultry manure. Fish offal mixed with sugar was fermented for 14 days while fermenting the mixture of plant and poultry manure for 21 days with sugar. Filtered fermented products were mixed and given a 70ºC heat treatment for 15 minutes and bottled. The product was tested for macronutrients, micronutrients and coliform. The product was diluted 25 (F25), 50(F50), 100(F100), and 200(F200) times with water and tested for tomato plants in a random block design with two commercially available liquid fertilizers C1 (chemical-based) and C2 (seaweed-based). The number of leaves, plant height, stem diameter and the weight of the first harvest was considered as performance indicators. Performances of diluted LOFs were first compared with each other by ANCOVA test in SPSS software. Results of the best performing dilution were again compared with C1 and C2. F100 dilution was given the best performances. Mean Height (1444.70±148.92cm), stem diameter (9.66±0.85cm) and number of leaflets (195.80±29.81) in the F100 dilution treatment were higher than the two commercial fertilizers C1 (1215.80±97.31cm, 9.16±0.85cm and 130.80±19.46) and C2 (1186.90±137.231, 8.87±1.03 and 138.10±16.60) respectively with significant differences. Although there is no significant difference; mean yields of the first harvest in treatments were C1 (196.10±61.87g/plant) > F100 (160.40±32.23g/plant) > C2 (136.70±24.27g/plat). Plant nutrition levels of original LOF was reported as N (0.90%), P (0.613%), K (0.282%), Mg (0.095%), Fe (0.0004%), Cu (.0001%), Zn (0.0008%) and the Coliform test was negative. The results indicated that developed LOF is in favorable condition in enhancing the growth of tomatoes and a further improvement in nutrient content is required to reach the SLS standards.

Keywords: fish waste, liquid organic fertilizer

Effectiveness of *Bacillus* as a potential probiotic in aquaculture: a meta-analysis

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The decline of growth performances and survival of aquatic animals are increasingly recognized as significant constraints to aquaculture production. *Bacillus* probiotics have emerged as promising alternatives for improving survival and stimulating the growth of fish due to their ability to increase disease resistance, enhance immune response, improving feed utilization and growth. Therefore, this study aims to assess the effect of *Bacillus* probiotic addition on the survival and growth performances of fish through a meta-analysis approach. Google Scholar was searched to select appropriate studies (based on Preferred Reporting Items For Systematic Reviews and Meta-Analyses (PRISMA) guidelines) published between 2010 and 2021. Hedges'g effect size calculation was used to quantify the differences in the final weight, specific growth rate (SGR), survival rate (SR) and feed conversion ratio (FCR) of fish treated with *Bacillus* probiotics compared to the control (no addition of *Bacillus* probiotics). In addition, heterogeneity (I^2) and publication bias was estimated. All the analysis were conducted using the metafor package in the statistical software program R. Significantly higher (p-value < 0.0001) final weight (effect size $= 3.0815$), SGR (effect size $= 2.2330$), SR (effect size $= 1.3197$) and significantly lower FCR (effect size $= -2.1136$) was detected in overall analysis (with full list of selected publications) when animals were reared in *Bacillus* probiotic treated aquaculture systems irrespective to the culture species or subgroups (crustaceans, fish species, freshwater fish or marine fish). A significant between-study heterogeneity and publication bias was detected during the overall analysis for each tested variable revealing the need for subgroup and moderator analysis. In conclusion, the outcomes of the present study confirm the consistent efficacy of *Bacillus* probiotics to increase the final weight, SGR and SR and to decrease FCR both in fish and crustaceans.

Keywords: *Bacillus*, feed conversion ratio, probiotics.

Contribution of fish to the daily protein intake among adults in central highlands of Sri Lanka during COVID-19 pandemic

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Fish and fishery products are the most important source of high-quality animal protein in Sri Lankan's diet. Socio-demographic factors, price and market availability of fish, preferred species, distance to market and frequency of purchasing, etc. may influence fish consumption patterns. This study aimed to assess the fish consumption pattern and contribution of fish to the daily protein intake of adults during the COVID-19 pandemic. A total of 100 adults (Males = 59 and Females = 41) were recruited to the study using the purposive sampling technique from Passara Divisional Secretariat, Uva Province. An interviewer administrated pre-tested questionnaire was used to collect the fish consumption pattern and socio-demographics of the study sample. Two non-consecutive 24-hr dietary recalls including one weekend and week-day were obtained to determine daily dietary intake including fish consumption. Protein intake was analyzed using FoodBase 2000 nutrient analysis software, modified for Sri Lankan foods. Out of the various fish species Bigeye scat (25%), Skipjack tuna (16%), Trevallies (10%) and Yellowfin tuna (10%) were the most consumed marine fish species whereas inland fish consumption was quite low while Tilapia (8%) was the most preferable specie. About 80% of study participants stated that their fish consumption was reduced during the COVID-19 pandemic due to low availability and poor access. Total protein intake (Mean ± SD) of male and female participants were 58.9 ± 16.3 and 48.7 ± 12.0 g/day, respectively. Mean (%) contribution of fish & fishery products, meat and meat products and non-animal food to the daily total protein intake was 3.8 ± 3.6g (6.5%), 8.0 ± 8.5g (13.5%) and 47.1 ± 14.3g (80.0%) for males while 2.8 ± 3.9g (5.7%), 5.3 ± 6.2g (10.9%), and 40.6 ± 10.4g (83.4%) for females. In conclusion, the majority (about 81%) of the daily protein requirement of the study participants was fulfilled by the non-animal food sources while fish contributed only about 6%. Fish consumption may be severely affected by the COVID-19 pandemic of the country.

Keywords: protein intake, fish and fishery products, non-animal food, COVID-19

Assessing the efficacy of fish types used in aquaponics systems to enhance crop yield

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An aquaponic system is a productive and sustainable process of growing aquatic organisms and plants symbiotically. There is a number of studies assessing the efficacy of different aquaponic systems however, there is no systematic review conducted to evaluate the use of different fish types in aquaponic systems to increase crop yield. The objective of the study was to compare the effectiveness of different fish types on crop yield. The literature search on aquaponic systems resulted in 164 original research articles published between 2010 - 2021; however, only 63 articles were selected for the analysis after refining through inclusion and exclusion criteria. Data were analyzed and organized into different groups based on fish types and crop types. In the studies, red hybrid tilapia (*Oreochromis* spp.), Nile tilapia (*Oreochromis niloticus*), Rainbow trout (*Oncorhynchus mykiss*), Climbing perch (*Anabas testudineus*), Common carp (*Cyprinus carpio*), Hybrid catfish (*Clarias macrocephalus* × *C. gariepinus*), North African catfish (*Clarias gariepinus*) and shrimps (*Litopenateus vannamei*), (*Litopenaeus setiferus*) were used with various food crops. According to the results, Red Hybrid Tilapia (*Oreochromis spp.*) was the most effective fish type to increase crop yield when they are used at the density of 1625 g/m³. According to the meta-analysis, aquaponics systems have improved crop yield by 24% (Response ratio (LnRR) = 0.2175) compared to control irrespective of the crop type. Tilapia (*Oreochromis niloticus*) and Carp (*Cyprinus carpio*) increased the crop yield by about 1% and 15% compared to control respectively. Crop yields were increased by 102% and 0.4% in bell pepper and Chinese cabbage respectively. However, these results might be different with different fish densities.

Keywords: aquaponics, crop types, fish effectiveness.

Bibliometric analysis of Sri Lankan research on aquatic resources (1950-2020)

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Studies related to the aquatic field have been developing for a long time. Even a considerable number of studies published in this field no study had been carried out to analyze available literature. In this study, a bibliometric analysis was performed to evaluate research trends on aquatic resources research in Sri Lanka from 1950 to 2020. The data were collected from google scholar using keywords only in the title. For that, "Sri Lanka" was used as the primary keyword and "aquatic", "aquaculture", "fishery", "wetlands", "lagoon", "estuarine", "seaweed", "marine", "freshwater" were used as secondary keywords. A total of 776 publications were selected based on the PRISMA framework and various publication characteristics were analyzed. According to the first biotic & abiotic categorization, 619 studies out of total belonged to biotic aspects while 434 studies have been conducted for aquatic fauna among selected studies. The results were indicated an increasing trend of studies with a 2.39 average relative growth rate during the study period except for some slight fluctuations in the 1996 to 2000 period. According to main disciplinary categorization, studies that belong to conservation & ecology, fishery and aquaculture were indicated increasing trends with time. Both quantitative & qualitative studies were indicated an increasing trend during the study period. After 2005, a rapid increase in multiple-authored studies was prominent. During the study period, the contribution of universities was considerably increased with time when compared to the other institutions. Foreign author's collaboration was increased and most international collaborative publications had resulted from Asian and European collaborations. Overall, the findings of this study give a comprehensive trend analysis of disciplines related to the aquatic field and contribute to the future development of research.

Keywords: aquatic resources, bibliometric, research, Sri Lanka

Success of Soybean meal to replace fishmeal in aquaculture feed formulations: a meta-analysis

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Soybean meal (SBM) is emerging as a popular plant-based protein source that has been used to replace fishmeal (FM) in aquaculture feed. With varying degrees of effectiveness, a growing number of studies have been undertaken to investigate the success of SBM as alternatives to various fish species' diets. Therefore, the current study was conducted to quantify the magnitude of final weight (FW) and feed conversion ratio (FCR) in fish when FM is replaced with SBM using a meta-analysis approach. Hedges'g effect size calculation was used to quantify this comparison using data from 17 published papers targeting 16 distinct species (33 and 58 effect size calculations for FW and FCR, respectively). Overall, all fish species fed SBM diets had a negative hedge's g value (-1.7, $P < .0001$) for FW, which is a significant decrement compared to the FW of fish fed diets formulated with FM. Subgroups of freshwater fish (-1.9, $P = 0.002$), marine fish (-0.88, $P = .0008$), omnivores (-1.79, $P = .0042$) and carnivore (-1.77, $P = .0014$) showed a similar pattern to the overall outcome of FW. In the overall analysis of FCR, a significantly high FCR (1.14, $P < .0001$) was noted in the fish-fed SBM diet. In subgroup analysis freshwater fish (1.27, $P < .0001$), brackish water fish (1.81, $P < .0001$), and omnivores (1.50, $P = < .0001$) showed a similar trend while marine fish (0.78, $P = .072$), and carnivores (0.38, $P = .0.98$) had no significant differences in FCR of fish fed two different diets. During the moderator analysis 'Species' was identified as a significant moderator($P < 0.05$) affecting the outcome of freshwater and omnivores fish, whereas 'level of FM replacement' was significant for subgroups of marine and carnivore's species ($P < 0.05$). Higher between-study heterogeneity ($I^{2)}$) was detected throughout the study, which could be due to the variation in nutritional quality, palatability, and digestibility of SBM.

Keywords: aquafeed, feed conversion ratio, soybean meal

Current vegetation and performance of *Rhizophora mucronata* and *Aegiceras corniculatum* under nursery conditions in Anawilundawa mangrove restoration site

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Accelerated Natural Regeneration of Mangroves is scientifically planned restoration, mimicking nature-based solutions. It involves understanding the current vegetation as well as raising identified species *in-situ* to obtain seedlings. These approaches were practiced in *Anavilundawa* mangrove restoration site. The vegetation cover was recorded using 1mx20m belt transects. A sample of 100 hypocotyls from 5000 *Rhizophora mucronata* raised *in-situ* were measured for 8 weeks. *Aegiceras corniculatum* were raised in freshwater, freshwater + curd, brackish water, brackish water + curd, freshwater to brackish water and fresh water to brackish water + curd treatments. Five hypocotyls each in 5 replicates were measured for 5 weeks. Inside the restoration area, 7 true mangrove species, 54 mangrove associates and 6 invasive flora and in the vicinity, 13 true mangrove species, 36 mangrove associates and 3 invasive flora were identified. *Nypa fruticans* and *Scyphiphora hydrophyllacea* were recorded for the first time in the area, expanding the known range of *N. frutucans*. By the 8th week, survival of 95% was achieved for *R. mucronata.* No growth was seen within the first four weeks and after an exposure to floods, seedling growth accelerated. Mean height, mean inter-nodal distance and mean length and width of leaves were 48.9, 4.5, 7.5, 3.9 cm respectively. For *A. corniculatum*, by the 5th week, 100% survival was observed. The germination process started on the 3rd day in all treatments and within the 3rd week, roots were formed in freshwater, brackish water and fresh water to brackish water treatments. No leaves were observed in any treatment. These insights should be used in restoration planning.

Keywords: *Aegiceras, in-situ* nursery, *Rhizophora.*

Estimating gear-wise and species-wise marine fish discards from Sri Lanka during 1950-2018

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Sri Lanka has a long history of reliance on the sea for the nutritional and economic well-being of its people. The report published by Devon et al. in 2011 titled "Reconstruction of Sri Lankan Fisheries catches:1950-2008" has indicated a higher discrepancy between the reconstructed landings, which included commercial and subsistence catches based on national reports, than the total landings reported by Sri Lanka to the FAO. This discrepancy is mainly due to catches from the subsistence sector and discarded bycatch associated with shrimp trawl fisheries. Anyhow, the entire data-set used for the estimations has been provided with the report as a supplementary indicating gear-wise; year-wise catches and discards but the report has estimated the landings only as a whole. Therefore, by using the supplementary data set, this study tried to estimate the gear-wise and species-wise discards that have resulted from the marine fisheries of Sri Lanka during 1950-2008. Further, we try to estimate the nutritional importance of discarded species and how it affects nutritional security. According to data from the FAO, the average annual discarded fish quantity for the period 1950 to 2018 was 2737.56 tonnes. The highest average value of fish discarded was approximately 6765 tonnes while the lowest number of fish discarded was approximately 605 tonnes. The most discarded fish group was *Leiognathidae* which encounters annually 11,610 tonnes while the least discarded fish group was *Elasmobranchii* which encounters only 1.3 tonnes. The shrimp trawl has resulted in most of the discarded fish. Its average quantity was 9120 tonnes. The least number of discarded fish was caught using purse seine which encounters only 0.2952 tonnes. The nutritional value of *Leiognathidae,* especially being a rich source of protein; Ca+2, Thiamin, Niacin and Vit.B 12, could have been created a major impact on the national economy and food security in Sri Lanka.

Keywords – Discarded catches, Economic impacts, National food security, unreported catches

Whether visuals of plastic pollution from the MV X-Press Pearl ship disaster & subsequent social discussions have aroused emotions that will motivate a change in plastic-related consumer behaviour?

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Singapore registered MV X-press pearl ship faced an onboard fire 9.5 nautical miles off the Colombo on 20th May 2021. The billions of plastic pellets coated beaches in the western & Sothern Sri Lanka were the recurring news stories for days. Thousands of posts, articles, and memes on social media, more than 60 TV shows & more than 30 webinars frequently discussed the consequences of this maritime accident and how these plastic nurdles could affect marine life. Therefore, the main objective of this study was to determine whether the visuals of plastic pollution from the MV X-Press Pearl ship disaster & subsequent social discussion have aroused emotions that will motivate a change in plastic-related consumer behaviour. Further, consumer awareness of alternatives for plastic was investigated. A total of 200 individuals in the high education sector as the cross-sectional study were sampled assuming that they have the highest access to the circulated information. Data were collected using a google form through a questionnaire. The results from the study indicated that the visuals of plastic pollution and subsequent discussions after the ship disaster had not been created any emotions to motivate a change in plastic usage. Anyhow, bringing water bottles from home had a significant increase among the educational streams, after the incident, but it is not clear whether it is an environmental or health-related concern. Anyhow, as the same segment shows a significant increase in re-using plastic bags, their concern seems to be more towards the environment. Interestingly no significant difference in the awareness of alternatives for plastic and biodegradable plastics after all awareness through different media. This research can contribute towards developing adequate, appropriate awareness programmes to address the issues of plastic pollution in the marine environment.

Keywords: emotions, plastic pollution, MV X-Press Pearl

Fluctuations in turbidity in response to rainfall and land use associated to river basins experiencing elevated flood levels.

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The contribution of rainfall, land use and flood occurrence to turbidity fluctuations in coastal waters associated with river basins have been least studied in Sri Lanka. Five river basins (*Gin, Kalu, Kelani, Kala Oya, Mundeni Aru*) were selected due to their frequent occurrence of floods. Shallow reefs and seagrass extent up to 10m depth and quarterly turbidity products from October 2019 to June 2021 from Allen Coral Atlas were mapped. Satellite-based precipitation data, the occurrence of flood and land use data were used in describing the landscape and seascape interactions. Of the five river basins, only *Gin* (5.071Km^2) and *Mundeni Aru* (0.086Km^2) had shallow reefs. When adjacent river basins were also incorporated, *Kalu* and *Kala Oya* also had shallow reefs in the vicinity due to the presence of reefs in *Bentota* (5.435Km^2) and *Wilpattu* (0.215Km^2). Two adjacent river basins to *Gin,* namely *Koggala* and *Rathgama*, had 3.178Km^2 and 0.953Km^2 shallow reefs extending the influence zone to 9.202Km^2. Seagrass beds were found only near *Kala Oya* basin (26.870Km^2) and adjacent *Moongil oya* (17.056Km^2) and *Wilpattu* (21.748Km^2). The average turbidity level was 6.9FNU during the study period. The turbidity level of *Mundeni Aru* (4.8FNU) was the lowest and was significantly different from others while *Kelani* river had the highest turbidity level (7.9FNU). *Mundeni Aru* had the highest cover of natural vegetation (54.92%) and the least was in *Kelani* river (18.91%). The land above 500m was considered as hilly terrain, and in *Mundeni Aru*, 83.78% was natural vegetation followed by rocky terrain (16.02). In terms of human-altered land use, paddy (0.11%) was the most prominent. In *Kelani,* 51.30% was natural vegetation and the most prominent human-altered land use type was tea (32.85%). Time series analysis of mean monthly rainfall, flood occurrence and quarterly mean turbidity found no significant relationship. Ground truthing of satellite data and continuous monitoring of turbidity in shallow coastal areas are recommended to ascertain the impacts of landscape changes to turbidity. Also, the incorporation of relevant other variables may explain possible relationships.

Keywords: Allen Coral Atlas, turbidity, river.

Management and control methods of freshwater aquatic plants: A review

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Aquatic plants are critical to the functioning of aquatic ecosystems. However, introduced aquatic plants may threaten ecosystems due to their rapid growth and have both ecological and economic effects. Effective management of aquatic plants in accordance with national or international laws and regulations is required to mitigate these impacts. The most cost-effective management option is to prevent the introduction of aquatic plants. When prevention fails, early detection and rapid response increase the likelihood of invasive aquatic alien plant eradication and can reduce ongoing management costs. A variety of management techniques can be used to effectively control weeds (eradication and/or reduction). The goal or outcome of management interventions may vary depending on the site and the feasibility of achieving the goal with the tools or methods available. Broadly defined management objectives are divided into three categories: containment, reduction or nuisance control, and eradication. Aquatic plant management employs a variety of control methods, either alone or in combination, to achieve a successful outcome. Physical (including mechanical control) biological, and chemical control tools are among the existing management options. The scale of application, costs, and effectiveness of the options vary greatly. Choosing the best management option for different aquatic systems can be difficult. Each option has advantages and disadvantages, and both the species and habitat characteristics, as well as the desired outcome, must be considered. This review provides important information on aquatic plant control and management.

Keywords: aquatic plants, control methods

Characteristics of marine gastropod operculum trade in Sri Lanka

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Evidence of gastropod operculum trade from Sri Lanka dates back to B.C. and to date, the trade continues, now with the permits issued by the Department of Fisheries for collection and export. To ascertain the species under trade, details of the trade and the amounts traded, a study was conducted from secondary data. Trade data from 2015 to 2021 were obtained from the Department of Customs (DoC) and the Department of Fisheries (DoF) of Sri Lanka. Operculum samples weighing nearly 2Kg retained by DoC from shipments were obtained to measure the length, width and weight of opercula. In the DoC data set, opercula that are exported are referred to as *Nakla*. In the DoF data set, permission is given for the export of opercula of *Chicoreus ramosus*. The opercula obtained from DoC were found not to be from *C. ramosus* but appeared to be from *Pleuroploca trapezium*. This observation needs confirmation by obtaining fresh specimens from collectors at the point of landing. From 2015 to 2021, a total of 42,023Kg of opercula have been exported from Sri Lanka earning a revenue of US$ 953,674. The quantity of exports has steadily increased from 2015 (3,250 Kg) to 2020 (10,445Kg), however, in 2021 the amount has decreased (3,998 Kg). Approximately 65% of the opercula were exported to Saudi Arabia followed by India (20%) and UAE (15%). *Gampaha, Puttalam, Mannar, Kilinochchi, Mulathiv, Trincomalee* and *Batticaloa* districts have been permitted by the DoF for collection. Data from 2019 to 2021 revealed that 58% of the opercula were collected from *Mannar* followed by *Puttalam* (20%), *Jaffna* (18%), *Negombo* (2%) and *Mulathive* (2%). Between 2016 to 2021, 57,400Kg of operculum trade has been permitted by the DoF. An over the exportation of 191.16% compared to the permitted in 2016, and in the rest of the years, exportations below the permitted amounts were recorded. The average number of *P. trapezium* per Kg of operculum was 217 ± 9. Accordingly, between 2016 to 2021, an average of 9,118,991 numbers of *P. trapezium* have been harvested (ignoring the discards). The mean length, width and weight of the opercula were 5.27 ± 0.09, 3.14 ± 0.06cm and 4.53 ± 0.25g respectively. Length width and length-weight relationships were both positively correlated. This study established baselines for future monitoring, Study also revealed the correct identity of the species currently under trade.

Keywords: operculum, *Pleuroploca trapezium,* wildlife trade

Alternative feed ingredients to replace fish meal in the diet of Indian major carps under the Sri Lankan context - A review

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Carps are the second most contributory fish in Sri Lankan freshwater production while they contribute 50% to the global aquaculture production. Among them, Indian major carps are the most important in Sri Lanka due to rapid growth, better taste and higher price. Better nutrition plays a major role in aquaculture ensuring enhanced growth, health and economic benefits. Fishmeal is generally considered as the golden standard protein source for many aquaculture species including Indian major carps. Despite its key benefits aquaculture industry is looking for alternative feed ingredients to replace fish meal due to concerns on sustainability. Thus, my review attempted to identify alternative feed ingredients to replace fish meal in Indian major carps' diet and evaluate their suitability for major Indian carp production in Sri Lanka with respect to nutritional profile and cost-effectiveness. A literature survey from 2000-2021 was conducted using science direct and google scholar and after screening, 40-articles relevant to the study were selected. Plant ingredients, terrestrial animal by-products, insect-meal, microbial ingredients and genetically modified plant ingredients were the main categories of alternative feed ingredients for fish meal. In Sri Lanka, soybean meal, rice bran, watermelon seed meal, *Ipomoea aquatica* and *Hydrilla verticillata* have successfully replaced fish meal in the Indian carps' diet. Further, soybean meal, animal by-products, black soldier fly larvae, microalgae and water hyacinth are alternative feed ingredients that have a high potential to replace fish meal due to their nutritional profile which complies with Indian carps' nutritional requirement, availability and cost-effectiveness. On the other hand, advanced technology and high cost are required to replace fish meal with genetically modified ingredients and prawn meal. Moreover, using a combination of feed ingredients and partial replacement of fish meal is recommended to maintain the nutritional quality and other important aspects of feed such as palatability and digestibility.

Keywords: fish meal, Indian major carps, sustainability

Post-Harvest quality losses: The study on Tuna industry at Southern and Western coastal areas of Sri Lanka

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Tuna is the most valuable seafood product in both the export and domestic markets in Sri Lanka. A considerable amount of post-harvest losses has been observed in the tuna industry and it directly affects the quantity that we can export to the foreign markets. The objective of this study was to study post-harvest practices of tuna and multiday boat handling practices. Data were collected from 113 Multiday boats (MDB) that unloaded fish at 5 main fishery harbors. The study employed the stratified random proportionate sampling technique. Data was collected through questionnaires. Evaluated fish quality data were collected from the fish processing factories. Data were statistically analyzed using SPSS, Minitab and Excel. All the studied boats spent more than 20 days for a fishing trip and causes long storage time in boats with 1:3 fish to ice ratio was identified as a major contributor to post-harvest quality loss in the studied multiday boats. In addition, gillnet fishing (50 % of boats used), storage of Tuna, Marlins, Swordfish and other fish species in the same fish hold (93 % of boats), no sanitization step in the cleaning process of the boats, auctions practiced on the floor without ice (Negombo harbor), beating method followed to kill the caught fish (96 % of boats), gaffing through the tuna belly area (86 % of boats), overstocking of fish in fish holds (98% of boats), Inadequate infrastructure facilities to handle fish at the landing site contributed for the post-harvest quality losses of tuna catch in MDBs in Sri Lanka. Overall, this study clearly identified the causes for the post-harvest quality losses in the Sri Lankan tuna industry hence will help necessary authorities to implement preventive or control measures to reduce post-harvest quality losses in the future.

Keywords: multiday, post-harvest loss, tuna,

Phytoremediation of Methylene Blue using *Spirodela polyrhiza* and *Salvinia molesta*

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Present days at the industrial level, azo dyes are released into the water in large quantities. Those azo dyes are sometimes toxic and can lead to carcinogenic effects in both animals and humans. Removal of those azo dye waste can be done by filtration, chemical treatment, or phytoremediation. This study aims to measure the frequency and the ability of *Spirodela polyrhiza* (Great duckweed) and the *Salvinia molesta* phytoremediation process of methylene blue from the water. Both plants were cleaned and kept in clear water for 2 days to remove mud and other surface impurities. From each plant species, 40g were weighted and used for each treatment unit. Treatment combinations were prepared as Salvinia with 10mg/L MB (methylene Blue), Salvinia with 20mg/L, duckweed with 10mg/L, duckweed with 20mg/L. The control was *Salvinia* without dye, duckweed without dye, 10mg/L of MB without plants and 20mg/L of MB without plants. Every treatment unit consists of 3 replicates. Then all the experimental units assign randomly in a place where proper light conditions exist. After 1st day, the 8th day and the 14th day, the absorbance of every experimental unites was measured using a spectrophotometer. Absorbance was converted to concentrations by using dilution series of methylene blue. After 14th days dye remaining concentration in duckweed was 0 mg/L and in *Salvinia* was 0.03397l mg/L in 10mg/L of MB and 0.1944mg/L in 20mg/L sample. At the end of the experiments, plants in each treatment group were added to the clean water for 4 days and a dye-reversing effect was observed. Overall, this study concluded that Great duckweed and *Salvinia* have the potential to remove methylene blue dye from water and removal efficiency is higher in Great duckweeds. Further, following the use of those plants for phytoremediation, safe disposal or conversion methods are necessary to safeguard the aquatic environments.

Keywords: great duckweed, methylene blue, phytoremediation,

Investigating how the MV X – Pres Pearl ship accident impacts the livelihood of the Wennappuwa coastal community; pilot survey

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The incident of MV X – Press Pearl ship sinking was mainly affected the southern part of the Sri Lankan coastal region due to the water current. Even government institutions give priority to investigating adverse impacts on the southern and western part of the coastline with little emphasis on the northwestern region. Therefore, this cross-sectional study aimed to investigate how the MV X – Press Pearl ship sinking incident impact the livelihood of the people who are living in the Wennappuwa coastal area in the northwestern Province. Furthermore, the drop of household financial capital, the approximate harvest loss & the employment shortage were also determined. The study was conducted among fishermen who are living in the Wennappuwa coastal area. A self-administrated livelihood evaluation questionnaire was developed, pretested & used for the data collection. Data (n = 132) were analysed using StataMP – 64 & MS Excel 2016 at 0.05 a significant level & 95% confidential interval. The average monthly payment according to the willingness to pay (WTP) is 231.436 LKR. The total damage per month to the fishermen in the Wennappuwa coastal area is 2,027,387.94 LKR. When it takes as per year it is about 2,432,855.23 LKR. The finding of this study shows there is a significant impact from the incident of MV X – Press Pearl ship sinking to the livelihood of the Wennappuwa coastal community. Therefore, to minimize future damages & to recover the present damage, considerable compensation and a fund should be maintained by the government.

Keywords: compensation, livelihood, sinking, willingness

The use of leech therapy in traditional and Ayurvedic systems of medicine in selected provinces in Sri Lanka.

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The application of medicinal leeches (*Hirudo medicinalis*) for therapeutic purposes is known as leech therapy. They have been used for treating various diseases in Ayurveda and Sri Lankan traditional medicine since ancient times. Over 650 species of leeches have been identified worldwide. These organisms can be found in freshwater, estuarine, marine, and semi-terrestrial environments where the Leech types also differ according to how they feed. Leech saliva contains more than 100 bioactive molecules, more than 20 of which have been identified as having healing properties. It has antithrombin, antiplatelet, analgesic, anti-inflammatory, antimicrobial, vasodilatory, and antimicrobial properties that are important for therapeutic purposes. Therefore, the present comprehensive survey was conducted to investigate the percentage of the population who practice leech therapy in traditional and Ayurvedic systems of medicine in selected provinces in Sri Lanka and identify constraints in leech therapy. The method used was both online and personal interviews, conducted using the google forms and printed questionnaire with randomly selected 80 Ayurveda and traditional physicians in (07) selected provinces in Sri Lanka. Data were collected on leech species, diseases that can be treated, constraints in leech therapy and thought on the future of leech therapy. According to the results, 43.75% of the participants follow leech therapy treatment while 56.25% do not. Also, more participants do not follow the leech therapy in selected provinces in Sri Lanka. Most of the respondents consider the difficulty in finding suitable leeches as the major constraint. The percentage value for this is 58.10%. This study probed the opinions and future of leech therapy and suggestions related to this treatment were also discussed.

Keywords: ayurveda, leech application, leech therapy

Freshwater live feed organisms for Carp fingerlings, their nutritional values and culture methods - A review

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Carps play an important role in world aquaculture contributing 50% to the total aquaculture production. They are exotic yet major contributory species to Sri Lankan freshwater fish production as well. The annual production of carps mainly depends on the fingerlings which are produced mainly under extensive culture practices. Providing well-balanced nutrition is a crucial factor during fingerling production. However, in Sri Lanka live feed organisms used for carps' larval stages and their nutritional profile are not well studied and this knowledge gap needs to be filled to enhance the production through intensive culture practices. Thus, this review attempted to study on potential zooplankton species for Sri Lankan carp aquaculture production and evaluate their suitability with respect to nutritional composition and culture protocols. 41-articles were selected from 356-articles in Google scholar and Science direct and through additional cross-references. Globally, phytoplankton, zooplankton and macroinvertebrates are the most commonly used freshwater live feed organisms while Rotifera*, Cladocera,* and *Copepoda* are the most widely used zooplanktons. 17-genera of potentially cultivable zooplanktons belonging to these 3-groups have been reported from Sri Lanka and they comprise 10-species of Rotifera (2-genera) and 26-species of Cladocera (15-genera). Nevertheless, Sri Lanka lacks information on species-level identification of copepods. Moreover, some of the culture protocols available in literature can be easily adapted to the Sri Lankan context using locally available animal and plant-based materials such as poultry manure, cattle manure, sewage sludge and agro-industrial wastes as culture mediums. The nutritional composition of these zooplankton species mainly depends on the culture medium. However, common microalgae species and *Saccharomyces* along with the nutrient enrichment techniques and different culture protocols can be employed to enhance their nutritional composition. Further, systematic studies on the isolation of potential zooplankton species using *in vitro* and mass culture techniques need to be investigated for commercial application.

Key words: Cladocera, Copepoda, live feed, Rotifera

Antimicrobial use in Asian aquaculture

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Asia is the main aquaculture producer in the world. The application of antibiotics in Asian aquaculture has been reported in the scientific literature for decades and has a severe threat to the environment and human health. As such, this review was focused on the status of antibiotic use and the common aquaculture species susceptible to antibiotic treatments in Asian aquaculture. Furthermore, objectives were extended to study the regulations for antibiotic use in Asian aquaculture. Google scholar and science direct databases were used to search publications and finally, 32 publications were selected using PRISMA method. The main type of antimicrobial treatment is oral ingestion with feed, bath and injections. The first two methods have an extremely high potential for environmental contamination. Main antibiotics used in finfish and shellfish aquaculture in China, Vietnam, India, Bangladesh, and Indonesia in the last 20 years included oxytetracycline, sulphadiazine, and florfenicol, erythromycin, amoxicillin, and enrofloxacin. Catfish, *Tilapia*, shrimps and salmon are the main species susceptible to antimicrobial use in Asia. The main antimicrobials used in catfish farming were oxytetracycline and phenicol. While the use of tetracycline and erythromycin were reported in cultured *Tilapia*. Oxytetracycline and sulphadiazine were the common antibiotics reported in shrimp farming and florfenicol and oxytetracycline were most reported in salmon culture. In Sri Lankan shrimp farming Oxytetracycline was reported as the main antibiotic. Although, the antibiotic residue of tetracycline, ampicillin, amoxicillin, sulfamethoxazole, sulfadiazine and erythromycin were reported from associated water bodies near aquaculture sites proof for using them in aquaculture was no evidence in the literature. The use of large amounts of antibiotics may result in antibiotic residues in fish and fish products. It may cause several negative impacts on human health risks. Most of the regulations in the Asian region have set the maximum residue level at 100 ppb and the majority of the reported residue levels were well below the maximum permissible levels.

Keywords: antibiotic residues, aquaculture, Asia, food fish

How artisanal stake net fishery survived last 300 years and will it be able to survive highly dynamic, social and environmental conditions

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Stake net fishery is an ancient fishing technique existing more than 300 years in the Negombo estuary. This study was conducted to investigate how artisanal stake net fishery has survived the last 300 years and whether the fishery will be able to survive in the present-day competitive environmental conditions. Negombo estuary is one of the most productive and sensitive estuaries in Sri Lanka. Mainly there are 22 stake net fishing stations adjacent to the estuary mouth. The primary data was collected from four rural fishery societies of stake net fishery by using group discussion sessions in the Negombo estuary. In addition to that interview, sessions were conducted with office bearers of stake net fishery associations. Other than that, causal conversations were conducted with knowledgeable, active personnel of the stake net fishing communities. In addition to that relevant literature review articles, journal articles were referred to understand the nature, sustainability and development in this concerned field. Further, specific data were obtained from the logbooks maintained by the auctioneers and some statistical data were obtained from the Annual reports. Limiting of open access nature, facilitate equitable access to the fishing stations by using a complex rotational lottery system, collective social responsibility, socio-cultural homogeneity, sustainable use of fishery resources, a well-defined mechanism for rulemaking and enforcing the rule and proper mechanism for monitoring and conflict resolution are noticeable management practices of this fishery. According to the current situation, some of the threats and challenges such as sedimentation of fishing grounds, the reluctance of youth to engage with the fishery, seem to be adversely affecting the sustenance of the stake net fishery. The stake net fishery management system has been sustained due to the unique characteristics of equitable sharing of the resource. Anyhow, no guarantee that the cumulative experience of society will necessarily fit them to solve new problems and threats.

Keywords: complex rotational system, stake net fishery.

Impact of COVID-19 on inland fisheries and fishermen livelihood: A case study in Mullaitivu District

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The COVID-19 pandemic has affected the fisheries industry worldwide in many different ways. The present study aimed to determine the impact of COVID-19 on inland fisheries and fishermen's livelihood in the Mullaitivu District. Randomly selected 160 fishermen from 18 reservoirs in the Mullaitivu were used for this study. Data were collected through direct interviews and phone conservation. The production data were obtained from National Aquaculture Development Authority and analyzed using Microsoft Excel software and SPSS. The fishermen's average monthly income was decreased from Rs40 000 to Rs 30 000 from 2019 to 2021 because the export of freshwater prawns was blocked. Fishermen's average monthly expenditure was increased from Rs31 000- Rs 39 000 From 2019 to 2021. The total inland production was decreased from 2019-2020 (542,964kg - 481,175kg) due to the imposed curfew by Sri Lanka's government on 20th March 2020 and increased in 2021 (648 478kg) because increased the fingerlings stocking rate and lifted off curfew. 6% of fishermen were found to be infected with COVID-19 and 94% of fishermen were not infected from September to October in 2021. Tilapia (*Oreochromis mossambicus*) is the dominant species culture in Mullaitivu which was 86% from total production followed by Freshwater prawn (5%), Hirrikan (5%), Lula (1%) and other species represent (3%). Peak production occurs in June due to the drought season. Overall, the pandemic period negatively impacted the fishing communities and inland fish production in Mullaitivu district. This study will help the government bodies to take necessary actions to recover the production loss and to increase the fishermen's livelihood in Mullaitivu district.

Keywords: Covid-19, fishermen, fish production, Mullaitivu

Determine the attitudes and perception of marine collagen related products among the university community

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Marine organisms have recently been considered as an alternative source of collagen to bovine, porcine and other sources. To address the growing demand for marine collagen, manufacturers throughout the world are competing to expand their manufacturing capabilities. Because of a lack of knowledge about collagen-based beauty products consumers are having misconceptions. Also, researchers are still investigating the efficiency of collagen as cosmetic and nutraceuticals. Therefore, the aims of this study are two folds, first to find out potential marine collagen sources, extraction methods and major applications based on literature. Secondly to determine the consumer awareness of the information provided with collagen-based products. Therefore158 responses were collected from the University community in Sri Lankan through the virtual interviewing method assuming their awareness of the technical details provided with the collagen products is higher than the layman. Cronbach's Alpha index was used to determine the internal reliability of the instrument and indexed as 0.795 is considered as a valid set of questionnaires. The result of the study shows that participants have moderately good knowledge about collagen. The most preferred collagen source is marine collagen according to gender, religion and ethnicity. Females in the 25 - 34 year age category are using the collagen-based product than others. All product users (100%) recommend marine collagen-based products to others. Major factors that prevent buying a collagen product are lack of faith in marketing companies and lack of standards to define the quality. Knowledge (sources, country of origin) and product quality are the major aspects that influence the purchase decision of consumers. Around 75% of respondents are not sure about the information published regarding collagen. This research shows that more scientific studies need to be carried out to ensure the quality of the collagen-based beauty products in the market and that society is seeking promising collagen-based cosmetic products.

Keywords: applications, cosmetic, extraction, sources

A systematic review on heavy metal residues in fish

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Bioaccumulation of heavy metals through food chains has received great concerns in research. Similarly, studies on heavy metals in fish and their impacts on humans through food chains are the popular thematic area in environmental and food safety studies. To identify the types of heavy metal residues in fish and their health impacts with evidence; a systematic literature review on peer-reviewed publications in the last two decades was performed using google scholar and science direct databases. Among the studies subjected to this review, 59.1% and 40.9% were researched on marine and freshwater fish respectively. Fish species reported in the literature were distributed in benthopelagic (27%), demersal 24.3%), reef-associated (20.3%), pelagic (16.2%) and benthic (12.2%) areas. Results showed that 76% of anthropogenic activities added heavy metals to aquatic systems, which can increase the risk of biomagnification. This study revealed high research concerns on heavy metals in Asian aquaculture. Hg, As, Pb, Cd, Cu, Zn, Cr, Ni, Fe, Al and Mn were the reported heavy metals in the literature reviewed in this study. Hg, Pb and Cd were the three commonly reported heavy metals in marine fish, while Zn, Cr and Cd were reported in freshwater fish. Among the different types of body tissues of fish, the liver has the highest level of heavy metals. Cupper, Zn and Fe were higher among benthic fish. Zn, Fe and Al were higher among dermal, benthopelagic and reef-associated fish while Cu, Zn, and As were the highest reported among pelagic fish. Neurological, Cardiovascular, gastrointestinal, reproductive, renal disorders and cancers were possible health impacts identified related to heavy metals, but no direct substantial health risks or deaths were reported due to consumption of fish. Lead, Mercury and Cadmium contents in fish samples in the current literature review were lower than the permissible levels set by Food and Agriculture Organization and European standards.

Keywords: heavy metal residues, biomagnification, cadmium, mercury, led

Contribution of Culture-Based Fisheries for food security and poverty alleviation in Asian developing countries

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Food insecurity and poverty are major causes for the highest absolute number of undernourishment prevalence in Asian developing countries. This literature review intended to identify the role of culture-based fisheries (CBFs) in food security and poverty alleviation in Asian developing countries. About 57 recently published original literature were filtered by PRISMA method from nearly 1000 resulting articles from Google scholar and Science direct databases. In addition, cross-references were performed to fill data gaps for achieving objectives. CBFs fisheries in inland waters are popular in rural areas of developing Asian countries as a fisheries enhancement strategy due to its low inputs requirements, the potential of increasing rural income and food security. The social and economic status of fishers has increased through CBFs in India, Bangladesh, Vietnam and Sri Lanka while increasing rural fish production reducing undernourishment. Fresh water fish availability has increased in Sri Lanka by 64.28% from 2010 to 2019. Inland fish availability for per capita fish consumption in Sri Lanka has been increased from 3.21Kg to 4.14 Kg from 2015 to 2019 by CBFs production. In Sri Lankan context, more than 60% of inland fish production came from CBF. A total number of 247,570 household population is directly benefited through CBFs. Increasing income and revenue generation through CBFs have been evidenced in the literature. The estimated average yearly income for an active fisherman earned from Tilapia and *Macrobrachium rosenbergii* was Rs. million 0.59 and Rs. million 0.16 in 2019. In the year 2020, Indian major carp production was 51.2% out of the total inland fish production in India. It generated Rs. billion 1309 and Rs billion 3213 respectively, for producers and retailers. Mini hatcheries were significantly contributed to livelihood in Sri Lanka and they have generated Rs. million 188.42 in the year 2019. The literature strongly provides evidence to prove the potential of CBFs for poverty elevation and increasing food security in the Asian region.

Keywords: culture-based fisheries, food security, livelihood, inland fisheries

Impacts of Covid-19 Pandemic on Ornamental Fish Industry in Sri Lanka

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The Covid-19 pandemic has generated a serious social and economic crisis in the world. Sri Lankan ornamental fish industry has also experienced disruptions due to the Global COVID-19 pandemic. This study intended to unpack the impacts of COVID-19 on the Sri Lankan ornamental fish industry, identify the major challenges and strategies adopted by the industry. Responses of 60 respondents (25 breeders and out-growers, 15 retailers and 20 exporters) were collected through a pre-tested questionnaire and data were collected through telephone and in-person interviews. The ornamental fish business was the only income for 43% of breeders and out-growers, 73% of retailers and 87% of exporters. Temporary discontinuation of the businesses was reported by 53% of exporters and 100% retailers. Particularly fish breeders and retailers have experienced the increased feed cost (100%), extended holding time (91%) and increased prices of other inputs (87%) during the pandemic. Extended holding time has deteriorated the quality of fish, reduced the market value and production volumes. Disease spread and mortality were other main issues reported by them during the extended holding period. Poor air cargo facilities (93%) and delays in cargo loading (60%), delays of obtaining certificates and licenses (67%), limited importation by main buyers (67%) and issues in local transportation and logistics services (53%) were the main constraints identified by exporters. COVID-19 infection, self-quarantine and mobility restrictions were the main impacts on the labour force. Retaining labours without laying off was reported at 78%, 73% and 64% respectively by breeders and growers, retailers and exporters. Three categories of stakeholders were not happy with the government support to cope up with the Covid-19 pandemic. Reducing labour force and production volumes, shifting to online marketing, avoiding intermediates in market channels, finding new customers and suppliers were the strategies adopted by the industry. This result indicates the need for increased resilience in the ornamental fish industry to face future unexpected global crisis conditions.

Keywords: breeders, production, sales, labour, exporters

Present status of the Tuna fishery in Sri Lanka – A Review

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Tuna fishery gained high attention in Sri Lankan as well as in the global fishing industry due to its significant contribution for the marine capture production. In 2019, Sri Lankan tuna catches exceeded 100,000Mt, contributing 33% for the Sri Lankan marine capture production. Despite its significant contribution, no timely review on Sri Lankan tuna fishery has been conducted to evaluate the present status and future directions of the fishery. Hence, my study aimed to evaluate the present status of Sri Lankan tuna fishery. Data and information were gathered through a literature survey of 60-articles which were filtered from 200 Google scholar, Elsevier and Science Direct results. Sri Lankan fishers target migratory stocks of tuna within the EEZ and offshore fishing grounds located around the country throughout the year by using gillnets, longlines and ring-nets. Yellowfin tuna (*Thunnus albacares*), skipjack tuna (*Katsuwonus pelamis*), big eye tuna (*Thunnus obsesus*), kawakawa (*Euthynnus affinis*), frigate tuna (*Auxis thazard*) and bullet tuna (*Auxis rochei*) are major contributory species to tuna fishery while skipjack tuna is the most dominant species followed by yellowfin tuna. More or less similar fluctuation pattern is evident for skipjack tuna, yellowfin tuna and other tuna like species catches from 2000-2019 while total tuna production fluctuate between 120,000 and 170,000Mt. However, CPUE data need to be analyzed to make decisions on management of these stocks. Log sheet data collection and vessel monitoring systems (VMS) in vessels >10.3m and pilot projects on observer scheme and electronic monitoring system (EMS) for vessels <24m are being used for fishery data collection. Despite of these data collection systems and various authorities in fisheries management, unreported small scale artisanal tuna fisheries still exist in Sri Lanka. Hence, further studies on these unreported fisheries are necessary to ensure the sustainability of Sri Lankan tuna fishery.

Keywords: EEZ, fishing gears, fishing vessels, tuna

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Biosynthesis of Phosphate Nanoparticles using a Biological Approach

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Eppawala rock phosphate (ERP) is a locally available natural resource in Sri Lanka containing about (28% to 42%) of P_2O_5. The low solubility of Eppawala rock phosphate makes it unsuitable for direct application as a fertilizer for annual crops. The objective of this study was to the biosynthesis of phosphate nanoparticles using a biological approach. Purified ERP and High Graded ERP were used as sole phosphate sources to synthesize of Nanoparticles. The treatment was provided for 10 days for obtaining readings after 2, 4, 6, 8, and 10 days. The biosynthesized phosphate particles were analyzed by using a particle size analyzer and X-ray powder diffraction (XRD). According to the results, phosphate particles were not within the Nano range, but in the micro range under the provided conditions. The lowest particle size recorded was 12.12 μm. The formation of the Nano phosphate particles needs to be further studied by optimizing the conditions.

Keywords: Eppawala rock phosphate, Phosphate nanoparticles, Biological approach

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Effect of an AI Heifer Calf Rearing Project on the Sustainable Dairy Development in Bulathsinhala Veterinary Surgeon's Division of Sri Lanka

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Improving heifer performance will assist dairy farmers in the long run by increasing milk yield and total profit. There was a lack of understanding about the recent performance of the AI heifer project conducted in the rural dairy industry of Sri Lanka. The present study was carried out to assess the progress of the Heifer Calf Rearing (HCR) project in smallholder dairy farms in Bulathsinhala, Western Province of Sri Lanka. About 50 farmers were interviewed and the effect of feed ration on heifer growth was evaluated using the recorded data that were collected monthly by weighing 48 calves with two-way ANCOVA test. The scheme effect for the heifer performance was compared using one-way ANOVA test with farmers who did not participate in the scheme. Data were analysed using the SPSS 16 statistical software. Calf mortality was lower ($4.78 \pm 0.92\%$) in the scheme with the availability of calf housing than in non-scheme ($4.84 \pm 0.99\%$). When compared to the non-scheme, there was a significant positive effect on calf growth by feed ration provided by the HCR scheme. Friesian breed indicated the highest average daily weight gain (0.306 ± 0.019) followed by Jersey (0.271 ± 0.010) and Friesian, Sahiwal crossbreed (0.257 ± 0.021) under the influence of the HCR scheme. Farmers in the scheme were more motivated than non-scheme in practicing deworming and deticking. Scheme heifers significantly differ by age at first calving and calved earlier (28.71 ± 0.98 months) than non-scheme heifers (29.88 ± 1.89 months). Early calving scheme heifers acquired a relatively higher milk yield (2411.80 ± 344.89L), benefiting higher profit compared to non-scheme (1900.00 ± 416.33L). Even though the cost of rearing was higher in the scheme. These results suggest that a well-organised HCR project has a significant potential to develop village-level dairy farming by producing high-yielding replacement heifers.

Keywords: Calf management, dairy heifers, HCR project, smallholder dairy farmers

Probability of Male versus Female Calving in Artificial Insemination and Fate of Male Calves after Weaning

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The sex ratio among offspring born by artificial insemination can be calculated by checking the artificial insemination records from the previous years. Averaged over many births, the odds are bull or heifer calves was 1:1. The purpose of this quantitative study was conducted to determine the probability of male versus female calving (sex ratio) of cattle and buffalo in artificial insemination in the southern province and the fate of male calves after weaning in artificial insemination in the Hambantota district. Totally 5 years' data were collected from 42 veterinary offices in Galle, Matara, Hambantota districts in the southern province. The data were analyzed using t-test in SAS system and outliers of the data were excluded. Randomly selected 100 farmers were interviewed using a structured questionnaire in the Hambantota district. Year-wise, the highest sex ratio of cattle was found in 2018 (1.3098 ± 0.4634). The lowest sex ratio of buffalo was found in 2018 (0.9494 ± 0.3512) district-wise, the highest sex ratio was found for cattle in Galle district (1.2796 ± 0.3218) the lowest sex ratio was found for both cattle and buffalo in Hambantota district(0.9438 ± 0.4016). This result showed that the sex ratio of cattle was significantly ($P < 0.05$) affected in 2018, 2019, 2020 years. There was no significant ($P > 0.05$) difference between the sex ratio of buffalo in 2018, 2019, 2020 years. There was no significant ($P > 0.05$) difference between the sex ratio of both buffalo and cattle in 2016 and significantly ($P < 0.05$) affected in 2017. The fate of artificial insemination male calves (purpose) were agricultural 37 (28%), meat 47 (36%), breeding 43(33%), other 4 (3%) responses. Preference of beef production among farmers was reported to be liked 30%, disliked 51% and no idea 19%. The study revealed that artificial insemination had significantly affected the sex ratio.

Keywords: Artificial insemination, breeding, calving, cattle

Consumer preferences for the milk and milk products consumption in Gampaha District

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The availability of data about consumers' purchasing habits, preferences, and demand for dairy products is seen to be one of the most important factors of the dairy industry's efficiency. Having a thorough analysis and accurate predictions of demand for dairy products aids in the forecasting of the dairy sector's future development in Sri Lanka. The overall objective of this study was to identify the factors that influence consumer preferences and attributes towards dairy products consumption in the Gampaha district. Specific objectives of the study were to study the socio-economic condition of consumers towards dairy products and identify factors considered by dairy products consumers when selecting a product. Residents of the Gampaha district (n = 385) were selected using the purposive sampling technique. The data were analyzed by Kruskal Wallis test and Chi-square test of association using SPSS 16.0 software. Dairy products were chosen by people due to health benefits, as dessert, palatability, freshness, affordability and ease of availability. When consumers purchase milk products, the brand name (Mean rank = 12), taste (Mean rank = 11), nutritional value (Mean rank = 10), local milk product brands (Mean rank = 9) and ingredients (Mean rank = 8) were considered by the majority of them. Yoghurt (71.17%), ice cream (65.71%), and cheese (62.86%) were selected by a majority of the participants. Fresh milk (51.43%) while only 36.36% selected fresh milk. The majority of females (32.73%), unmarried people (40%) and students (29.35%) selected chocolate ice cream. A significant association was observed between the female participants and a fairly satisfying level for available dairy products in Sri Lanka ($p < 0.05$). The study findings indicate that the consumers' consumption behaviour can be applied to dairy products' production, marketing, and promotion strategies in Sri Lanka. Further, highlight the opportunity for introducing new local products to the market.

Keywords: Dairy products, fresh milk, Ice- cream, local products

Awareness and Acceptance related to Functional Dairy Products among Adults in Gampaha District of Sri Lanka

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There has been a rising interest in functional foods, which are widely recognized as having benefits such as health promotion, wellbeing maintenance and disease prevention other than nutritional functions. In the present functional food market, dairy foods have a prominent position. However, there is a lack of awareness of functional dairy products among Sri Lankans. Comparatively, Sri Lanka has a small market share for Functional Dairy Products. Therefore, this study was conducted to evaluate the awareness and acceptance of functional dairy products among consumers in the Gampaha District of Sri Lanka. The study was conducted using a pre-tested questionnaire from September to November 2021; convenience sampling technique was applied to select 385 participants. Information on consumers' knowledge and awareness, acceptance and future prospects related to Functional Dairy Products. The data were analyzed using the Chi-squared test by IBM® SPSS statistical software 28. Although consumers consumed functional dairy products, the majority of the consumers (62%) did not know the meaning of the term 'Functional Dairy Products'. Only 38% of consumers had knowledge and awareness about functional dairy products. However, the level of education and gender (female) of the respondents showed a significant positive association with the knowledge and awareness, acceptance and consumption of functional dairy products. The majority (71.7%) of the consumers did not satisfy with the existing availability of varieties of functional dairy food. According to consumer response, the highest demand was for yoghurt, followed by powdered milk and butter, respectively. Participants stated that proper awareness is needed regarding the benefits of functional dairy products for a healthy life and requested more variety of functional dairy products. The study showed a good potential to increase availability and introduce novel functional dairy products to the Sri Lankan market.

Keywords: Acceptance, consumer awareness, functional dairy products, health benefits

Production performance of Ayrshire dairy cattle breed and Ayrshire x Friesian crossbreed in the upcountry of Sri Lanka during 2016 to 2020

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The dairy industry plays an important role in the Sri Lankan animal husbandry sector. European dairy cattle breeds contribute highly to the dairy sector. However, insufficient attention has been given to the Ayrshire breed and Ayrshire x Friesian crossbreed in Sri Lanka, as they are limited to a few farms. The objectives of this study were to assess the production performance of the Ayrshire breed and the Ayrshire x Friesian crossbreed and also to identify the effects of environmental factors on milk fat content. Twenty animals were selected from each Ayrshire cattle herd and Ayrshire x Friesian cross herd. Data were taken from birth registers, individual cow record cards and climatic records of the last decade. According to the multiple linear regression, higher Birth Weight (BW) of 32.65 kg was reported in the Ayrshire x Friesian crossbreed, which was significantly ($P < 0.05$) higher than the pure Ayrshire breed (31.75 kg). The average age at First Service (AFS) of Ayrshire was 681 days and it was higher than the average AFS of Ayrshire x Friesian crossbreed (664 days). Age at First Calving (AFC) was reported as 991 days in the Ayrshire breed which was significantly ($P < 0.05$) higher than Ayrshire x Friesian crossbreed (983 days). Calving to Service Period (CSP), Calving Interval (CI) and Lactation Length (LL) of Ayrshire breed were 118 days, 421 days and 342 days, respectively. CSP, CI and LL of the Ayrshire x Friesian crossbreed were 125 days, 426 days and 352 days, respectively. The mean Total Milk Yield (TMY) per lactation of Ayrshire x Friesian crossbreed was (7741 L) higher than that of Ayrshire breed (6730 L). The breed, AFS, and LL had a significant ($P < 0.05$) effect on mean TMY. Results indicated that the temperature had a significant ($P < 0.05$) effect on cow milk fat. It could be concluded that the production performance of Ayrshire x Friesian crossbreed was better than Ayrshire breed. Introducing low temperature conditions for those two breeds may lead to increase cow milk fat content.

Keywords: Ayrshire, age at first calving, age at first service, calving intervals, Ayrshire x Friesian cross

The consumption patterns & perception of processed dairy products (PDPs) in a young adult population in Sri Lanka

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Processed Dairy Products (PDPs) represent one of the most elemental foods due to their multicomponent nutrient blends. Thus, young adults are strongly encouraged to consume dairy products to meet their nutritional requirements. The purpose of this study was to investigate Sri Lankan young adults' (aged between 18 and 29) dairy consumption patterns under the key determinants of food-related internal factors (FIF), food-related external factors (FEF), individual features (IF) and socioeconomic factors (SF) and their perception towards PDPs. The convenience non-probability sampling method was used to select the sample among the target population ($n = 384$). The outcome of this study was obtained through an exclusive survey using a pre-tested questionnaire, which was analyzed employing descriptive statistics and explanatory factor analysis. The explanatory factor analysis revealed that the consumption patterns significantly varied with the key determinants. FEF was found to be the most significant determinant followed by FIF, IF and SF. Most young adults consumed yoghurt (22.1%) followed by ice cream (20.2%) and curd (14.0%). The dairy product consumption was not significant ($p > 0.05$) on ethnicity, income, and gender. Conversely, perception towards PDPs was significantly related to these factors ($p < 0.05$). The results showed the shelf life, designated by the manufacturer's date and the expiry date was the most important packaging information on the label (95.8%), followed by the brand name (74.3%), packaging material (47.6%) and ingredient composition (39.8%). In conclusion, this study emphasized that there is a direct relationship with food-related factors (FEF, FIF, IF and SF) and consumption patterns of PDPs while the perception of PDPs widely varied with demographic data and several food choices of young adults. These results will positively support the industry to understand the consumer definition to successfully position and market the PDPs.

Keywords: Consumption patterns, perception, processed dairy products, young adults

Development and Evaluation of set type yoghurt incorporated with *Annona muricata*

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Yoghurt is the most suitable probiotic carrier which has a high potential to be supplemented with fruits. This study was designed to develop a set type yoghurt incorporated with Soursop (*Annona muricata)*. Soursop was processed into a pasteurized pulp concentrate and incorporated into yoghurt at the rates of 7.5% (w/v) and 12.5% (w/v). Set yoghurt without fruit was considered as the controller (CY). Three different yoghurts were evaluated on their proximate composition, physiochemical, microbiological and sensory quality over the 14 days of storage at 4℃. The addition of fruit pulp significantly affected the pH of each yoghurt, while the pH of fruit yoghurt with 12.5% soursop level (FY2) was significantly lower than the control (p value < 0.05). The 7.5% soursop yoghurt (FY1) showed the highest titrable acidity throughout the storage time. There was no significant increase in syneresis of all yoghurt formulations during 1st 7 days of storage and a significant increase was observed at 14 days of storage. Higher incorporation level of fruit affected higher syneresis in yoghurt. Higher *Lactobacillus bulgaricus* counts were observed in FY1 formulation. Higher levels of fruit incorporation had decreased the *Lactobacillus* sp. count significantly over the storage time than the control yoghurt (p value < 0.05). Sensory results showed that there was a significant difference among all yoghurt formulations. The yoghurt containing 12.5% incorporation level had the highest taste, after taste and overall acceptability score compared to the 7.5% fruit level. The overall acceptability score for 12.5% fruit incorporated yoghurt was not significantly different from the control yoghurt (p value < 0.05). Overall, it can be concluded that soursop incorporated yoghurts have shown desirable physiochemical properties and microbiological quality; hence has a high potential to develop further.

Keywords: *Annona muricata*, functional yoghurt, microbiology, sensory quality

Effect of replacing Guinea Grass (*Megathyrsus Maximus*) by Gliricidia (*Gliricidia sepium*) leaf meal in dairy cattle diet: Feed intake, Lactation Performance, and Milk Composition

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Gliricidia is a fodder legume that can be used as a nitrogen supplement to various forage-based ruminant diets. The objective of the current study was to investigate the effect of supplementing Gliricidia leaf meal on feed intake, milk yield, and milk composition of lactating dairy cows. Nine lactating dairy cows belonging to the same crossbreed (Jersey × Sahiwal) at their mid-lactation were assigned into three groups in a completely randomized design. The three groups were fed separately with guinea grass-based diets supplementing three levels of gliricidia inclusion (12%, 15% and 30%). The animals were fed *ad libitum* and feeding was done twice daily over 36 days. The daily milk yield of each animal, feed intake, water intake, and the proximate compositions of milk were recorded daily. Feeding behaviour and clinical signs of the animals were observed twice a week. The proximate compositions of the gliricidia leaf meal and the three experimental diets were also determined. The average daily milk yield of the cows increased proportionately to the level of gliricidia supplemented in the basal diet. Thirty percent (30%) supplementation of gliricidia results in the highest increase (28%) in the average daily milk production. Supplementation of 15% and 12% gliricidia diets resulted in approximately 9% and 12% increase in milk yield. Feeding 30% gliricidia significantly increased milk fat content compared to 15% and 12% gliricidia fed groups. However, the level of gliricidia supplementation did not significantly affect the protein and solid non-fat (SNF) contents in milk. Gliricidia supplementation did not affect the feed intake and feeding behaviour of the animals. Any signs of bloating and differences in pulse rate and rumination were also not observed. Results conclude that 30% inclusion of gliricidia into guinea grass basal diet significantly increases the milk yield of lactating dairy cattle without any negative effects on feed intake.

Keywords: Dairy cattle, feed intake, forage, gliricidia, milk composition

Perception and consumption of quail eggs among consumers in Rathnapura District

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Quail eggs are being used as an alternative to other prevalent types of eggs in many parts of the world due to changing lifestyles and eating preferences. Quail eggs are more nutritious than chicken eggs, and eating them reduces the risk of many diseases. However, quail farming is limited in Sri Lanka. Hence, there is a low demand for quail eggs in the country. This study was conducted to investigate consumption and perceptions about quail eggs among consumers in the Rathnapura district. A pre-tested questionnaire was administered to 385 respondents from 18-60 years old in Rathnapura district and convenience sampling was used to select the respondents. The questionnaire consisted of main sections such as demographic data, consumption patterns, consumer perception, and purchasing behaviour of quail eggs. Close to 34% of the respondents were quail egg consumers, while nearly 66% of the respondents avoided consumption of quail eggs. Some of their demographic indices significantly ($p > 0.05$) influenced egg consumption, except for gender, religion and education level. Most consumers (86.05%) eat quail eggs due to their nutritive value. However, data revealed that quail eggs are not a regular food item for consumers. It was also found that boiling (82.95%) was the most preferred cooking method and most of them boiled quail eggs for 10 minutes (67.44%). All of the respondents usually consumed less than 4 quail eggs per day. Moreover, most consumers store quail eggs for 1-2 weeks (46.51%) and refrigeration (55.56%) was the most utilized storage method. However, knowledge of the nutritional and health benefits of quail eggs among consumers was low. This study illustrates the need for the dissemination of accurate nutritional information and health benefits of quail eggs based on sound scientific evidence to popularize quail egg consumption among consumers.

Keywords: Consumption patterns, consumer perception, quail eggs

Consumers' knowledge on nutritional characteristics and quality parameters of fresh cow milk in Western Province, Sri Lanka

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The current study was designed to examine the consumer's awareness on fresh cow milk quality and nutritional characteristics in Western Province. The data were collected through pretested questionnaire from 384 participants who were selected randomly from the study area. Chi-square test of independence and descriptive statistics were used to examine the collected data. The results of the chi-square test of independence revealed that there is a significant relationship ($P<0.05$) between gender, age group and educational level with overall knowledge about fresh cow milk nutritive and quality characters. Descriptive analysis of the collected data indicated 41.93% and 70.57% of participants were aware of the vitamin profile and major nutrients of fresh cow milk. A scaling system was used to categorize the knowledge level of people. Individuals with a score of more than 60% were recognized to have a good knowledge level, those with a score of 30% to 60% were recognized to have a moderate knowledge level, and those with a score of less than 30% were considered to have a low knowledge level. As per the scaling, around 62.50% of respondents were with moderate knowledge level regarding the nutritive characters on fresh cow milk, while 31.25% and 6.25% were with low and good knowledge respectively. There were 57.55% of respondents who have shown a good knowledge level on fresh milk quality parameters. Among the participants, 35.94% and 6.51% had moderate and low knowledge on fresh milk quality respectively. In conclusion, consumers' knowledge level of quality parameters (57.55%) on fresh milk was much better than the knowledge on nutritional characters (6.25%). Considering these findings, it is necessary to develop effective strategies to create awareness about the nutritional profile of fresh cow milk to increase good quality fresh milk intake.

Keywords: Consumer awareness, fresh cow milk, knowledge level, nutritive characters, quality parameters

Performance of the artificial insemination in Kurunegala district, Sri Lanka

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Artificial insemination (AI) is the modern and primary breeding tool in the genetic upgrading program of cattle in Sri Lanka and this method is being used island-wide. AI is a method of deliberate introduction of sperms into a female's reproductive tract for the purpose of achieving a pregnancy by means other than natural mating. Though scientific studies have been conducted to assess its performance in the country. Only a limited number of studies were about in the Kurunegala which is located in the North-Western province. Performance of AI in Kurunegala district mainly found by data obtained from Department of animal production and health's annual records and questionnaire-based survey conducted from randomly selected 60 farmers in Kurunegala district from 2015 to 2020. According to the result, 68.3% of farmers in Kurunegala district used the AI technique. The annual average of AI done in Kurunegala district was 42000 of that 16772 (40%) AIs were a successful average annual number of male animals born were 8380 (50%) and female animals born were 8370 (50%). Most of the farmers were selling male animals after birth within one month and some of the farmers were selling male animals after birth within one month, some of the farmers were keeping for drought propose.

Keywords: Artificial insemination, genetic upgrading, heat detection, Sri Lanka

Trends in Sri Lanka's dairy industry; In large scale modern confinement feeding and management intensive grazing

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Smallholder subsistence farmers dominate the dairy farming sector in Sri Lanka. There are approximately 400,000 smallholder cattle and buffalo farmers in the country and 75% of local milk production comes from smallholder farmers in Sri Lanka. The contribution of large-scale farms to local milk production is significantly low. The feeding system plays a vital role in production performance. The present study was conducted to characterize and evaluate the contribution of feeding methods towards the production performance in large-scale farms. In this analysis, 36 large scale farms in Sri Lanka, both government and private sector were investigated, to compare the aspects regarding the dairy sector for four distinct production systems; Large scale modern confinement feeding (LMC), management intensive grazing (MIG), semi-intensive rotational grazing (SIRG) and intensive management (INM). A questionnaire was used to collect data from farms and the most common breed type was the Jersey*Friesian cross breed, which accounted for 74% of all cows within the survey. Of all responses, the average herd size was 216 cows, whereas the mode was 60 cows and the range was 25 to 1250 cows. Results showed a significant relationship between the production system and milk yield ($F = 8.442$, $P = 0.0001$), whereas SIRG farms had the highest mean milk yield of 14.95 ($SD \pm 8.98$) liters per cow. The mean land area ($F = 6.314$, $P = 0.002$) was highest in MIG farms (1562 acres) and lowest in LMC farms (81 acres). There were significant differences in feed cost ($F = 5.932$, $P = 0.004$) and labour cost ($F = 7.397$, $P = 0.001$) in terms of production systems. These production systems conveyed many significant differences in land area and utilisation, farm and farmer characteristics, as well as technology and management practices. The survey results highlighted the potentials and constraints and provided suggestions for reasonable performance in the future dairy industry.

Keywords: Confinement feeding, management intensive grazing, production performance, semi-intensive rotational grazing

A systematic review on characteristics of buffalo milk production in Sri Lanka

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Buffalo milk which is known for its highly nutritious and creamier nature, has lower production in Sri Lanka in comparison to cow's milk. In the current study, a systematic review was conducted to evaluate buffalo milk production characteristics and its use with evidence using literature published within the last 60 years in Sri Lanka. This study found that studies investigating buffalo milk production characteristics in Sri Lanka were limited. In particular, there was little research on the composition and characteristics of buffalo milk, buffalo milk production characteristics, and comparative studies. There were no studies to explore on average buffalo milk consumption in Sri Lanka. The results also found that there was a trend of a rapid increase in publications on buffalo milk production in the past 13 years. The research interest in studies was focused mainly on the characteristics of buffalo milk products and their improvements in aspects of sensory, textural, nutritional, microbial and compositional properties. Buffalo milk yield varied with agro-climatic zone, breed, nutritional and managerial factors. Dry zone and intermediate zone were the suitable environments for buffalo milk production. There was a high potential to improve milk yields of buffalo breeds. Though products manufactured from buffalo milk were much similar to cow's milk products, the manufacture of diversified products from buffalo milk was not commonly practiced in buffalo milk-producing farms. This review showed that average buffalo milk consumption, characteristics of buffalo milk, buffalo milk production characteristics and comparative studies of buffalo milk were under-researched and more research is needed to explore buffalo milk production characteristics in Sri Lanka explicitly.

Keywords: Buffalo, lactation, milk, milk composition, Sri Lanka

Physicochemical and textural properties of fermented dairy products fortified with natural additives: A review

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Consumer interest in health-promoting natural products is a major driving force for the increasing global demand for functional dairy foods. Fortification of fermented dairy products with natural additives such as herbs, fruits, vegetables and cereals in different forms such as; juice, puree, powder, pulps is a popularly accepted process for enhancing food functionality. This study reviewed the effect of some plant-based additives on the physicochemical and textural properties of fermented dairy products, including yoghurt, cheese and butter. The physicochemical properties: pH, titratable acidity, syneresis, total solids, ash, colour, protein and fat content of fermented dairy products were affected with the addition of natural additives. The review suggests that desirable pH and acidity can be approached through enrichment of fermented dairy products by adding vegetables, fruits, herbs, and cereals. The addition of herbs and vegetables reduced the moisture content of cheese varieties. Incorporation of fruits and herbs in high level to fermented dairy products were optimized in developing the interconnections between milk proteins by reducing syneresis and increasing water holding capacity. Tea extracts and fruits (date palm pollen, apple pomace) have contributed to improving firmness. The cohesiveness of dairy products has increased by adding fruits, vegetables, and herbs while they reduced the adhesiveness when compared to the control. Vegetables and fruits could help increase the springiness, gumminess and chewiness of cheese products. Adding fruits, vegetables, and herbs increases the viscosity of yoghurt. In conclusion, enrichment of fermented dairy products with natural additives has intensified the desirable physicochemical and textural properties while more studies are needed to comprehensively support the importance of these properties to the overall quality improvement of fermented dairy products.

Keywords: Fermented dairy products, physicochemical properties, plant-based additives, textural properties

Availability and usage of Maize (*Zea mays* L.) as animal feed in Sri Lanka

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The livestock sector of Sri Lanka has tremendous potential in the economy of the country. The demand for maize as a feed ingredient has increased substantially due to the rapid increment in the livestock sector in the recent past. This investigation was carried out to assess the proportion of maize grain used in animal feed from local production and to project the maize grain requirement for the poultry sector. Time series data on the quantity of total maize production and total import volume were analyzed to identify the percentage of the proportion of maize grain used for the livestock industry. Growth of poultry production was projected up to the year 2030 to estimate maize requirements for the commercial poultry industry. Time series data on human population, per capita consumption of chicken and eggs, were used to demand projection. Present status, constraints for maize production and selling were evaluated by personal interview through randomly selected 50 maize farmers in Kahatagasdigiliya, Anuradhapura district. According to the result, the percentage of maize used from local production for a feed from 2009 to 2018 were 41, 49, 63, 49, 51, 30, 39, 44, 40, 39 and it gave decreasing trend. The estimated maize grain requirement for poultry by the year 2021 and 2030 were 451 198, 674 567 metric tons, respectively, which was nearly 50% increment. Only 4% of farmers are engaged with contract-based farming. 100% of respondents produced maize for the main purpose and sold it for intermediate buyers. The majority (64%) of farmers sold production at the available price without a store. 80% of respondents had awareness of maize forage cultivation however, there were no forage producers among them. Poverty, inadequate subsidies, disease, high cost of production, buying price fluctuation, lack of infrastructure facilities and damages from animals were the main constraints.

Keywords: Demand, feed, livestock, maize, per capita consumption, poultry

Analysis of acceptance and factors affecting the consumption of goat milk in Sri Lanka

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Goat milk products have received greater attention recently due to their higher digestibility and hypoallergenic nature and play a significant role in infant and elderly nutrition. Although goat farming is popular in the dry zone of Sri Lanka, it has a great potential to be developed into a main economic driver, in particular in rural and marginal areas. The characteristic "goaty" flavour is considered a major limitation associated with goat milk and related products that limit goat milk consumption. The objective of the current study was to analyze the acceptance and factors affecting the consumption of goat milk in Sri Lanka. A questionnaire was used to obtain consumption and purchase habits of goat milk among Sri Lankans. Three hundred thirty-six participants were responded to the questionnaire concluding that the major causes for non-consumption of goat milk by non-consumers were due to never tested goat milk before and the non-availability with a percentage of 48% and 24%, respectively. In this study, more than half of goat milk consumers (51.72%) also stated that consumption of goat milk is limited due to non-availability. Consumption of goat milk was significantly affected by age, gender and goat meat consumption ($P < 0.05$). About 50% of goat milk consumers were goat meat consumers. Previous studies have shown that fermentation can reduce the "goaty" flavour. Therefore, a consumer test was carried out to evaluate the acceptance of goat milk and semi-fermented goat milk compared to cow milk. Friedman's test was used to analyse consumer test data. It has shown that the consumer acceptance of three milk types was significantly different ($P < 0.05$). Results indicated that despite the reduction of "goaty" flavour by fermentation, this milk remained least accepted over whole goat milk and whole cow milk.

Keywords: Consumer testing; goaty flavour, goat milk, non-bovine milk, goat

A survey of dairy calf-rearing practices on peri-urban dairy farms in the Central Province of Sri Lanka

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Although calf-rearing practices have an impact on future dairy cattle productivity, little is known about which practices maximize calf development, welfare, and future production success. This investigation was done to identify common calf rearing techniques on peri-urban dairy farms in the Central Province of Sri Lanka, identify special calf rearing practices on peri-urban dairy farms in the Central Province of Sri Lanka, and get a good picture of calf management practices on registered dairy farms in Central Province Sri Lanka. To reach dairy cattle farms in Sri Lanka's central province, a survey was done via telephone conversationsand in-person interviews. A survey of 62 farms in the Central Province of Sri Lanka was done to identify management-related risk factors that could impair dairy calves' welfare. Survey was conducted in Kandy (n = 22, 35.48%), Matale (n = 16, 25.81%) and Nuwara eliya (n = 24, 38.71%). The questionnaire contained 34 questions on the following areas of calf rearing, farm characteristics, calving and care of the newborn, calf housing, calf feeding, calf disease and mortality in pre-weaned calves. Details of calf rearing practices on registered dairy farms in Central Province according to districts were obtained. Data obtained from the survey were analyzed by using R software. Round means of a number of animals were summarized for the peri-urban dairy farms in Kandy, Matale, and Nuwara Eliya districts. It was 2, 6, 3 animals respectively. The relationship between districts of central province and some categorical variables were evaluated, such as access to pasture, access to hay, access to concentrate, weaning time, the quantity of first colostrum feeding. It showed that there was a relationship between calf rearing practices and common diseases of the calf. In conclusion, calf raring practices directly affected dairy calf growth and disease control.

Keywords: Calf management, disease, questionnaire, risk factors

Mapping dairy food system in Southern Province: An essential analysis for policy, industry and research

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Mapping a dairy food system is essential to understand the behaviour of different actors and their relationships, marketing behaviours, participations and constraints, and opportunities which they have met. This study aims to conduct a thorough analysis and a value chain mapping of dairy food systems and determine the structure and functionality using a value chain mapping approach. Primary data were gathered through focus group discussions, visits and key informant interviews with dairy value chain stakeholders. Secondary data were obtained through the Department of Animal Production and Health and relevant authorities. The qualitative thematic analysis combined with a flowchart was created to describe the role of each segment in the dairy food chain and their interaction. Six segments were identified in Southern province dairy systems. They were input suppliers, dairy farmers, collecting centres, transporters, dairy processors and distributors, dairy vendors and consumers. The intensive management system was identified as a dominant system in the Hambantota district. "Milk producing villages" were established with the association of the Sri Lankan government to build up the rural economy. No dominated management system was found in the other two districts. Large processing companies' profiles indicated production and distribution of high volumes and value-added processing. Their products were distributed to pre-fixed retailers, wholesalers, and customers. Large and medium scale processors reported that they have established an "autonomous dairy farmers association" as village wise to collect milk. The cost for each segment was doubled during the last six-month time period. Verbal contractual arrangements were identified among those segments than written arrangements. The quality evaluation process, efficiency and productivity were not at a satisfactory. A system-wide approach and intervention should be required to enhance the productivity of the dairy food system. This study provides a methodological approach for organizations and policymakers to understand and address the structural and functional susceptibilities in each segment of the dairy value chain.

Keywords: Dairy, mapping, Southern province, value chain

Effect of the COVID-19 pandemic on Animal-source Food consumption among adults in Kalutara district

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The COVID-19 epidemic has had a tremendous effect on the Sri Lankan community and the livestock and fisheries sectors differently. Proteins and micronutrients required to boost immunity are abundant in animal-source food (milk, dairy products, meat, meat products, fish, seafood, and eggs). In the event of a pandemic in Sri Lanka, there is insufficient data on the animal-source food supply and consumption. Therefore, a cross-sectional survey was employed through a combination of online and printed questionnaires ($n = 385$) using the convenience sampling technique to investigate the effect of the COVID-19 pandemic on beliefs and behavioural changes related to animal-source food consumption among adults in the Kalutara district. The majority of the participants (28.57%) were 35 – 44 years old and 57.66% were female. Nearly 65% of respondents admitted that their income was decreased during the pandemic. Comparative to before the pandemic, the purchasing of meat products ($p < 0.05$) was significantly increased while the meat was significantly decreased ($p < 0.05$) during the pandemic period. The consumption of animal-source food during the pandemic was significantly different from before the pandemic ($p < 0.05$), excluding the consumption of milk powder ($p > 0.05$). The majority of respondents indicated that food prices of meat and meat products (60.26%), fish and seafood (60.78%) and milk and dairy products (50.65%) were increased and the supply was decreased. Online purchasing was increased by 22.86%. Nearly 47% of participants were uncertain about the virus transmission through animal-source food. Homemade dishes were preferred to consume in future pandemics by 89.35% of respondents. The consumption of animal-source food was affected due to the income, living and family status, panic buying, travel restrictions/lockdowns, freshness, quality, price, availability and accessibility of food with the pandemic. This study also found that animal-source food at low prices was the priority factor by consumers than the quality and safety.

Keywords: Animal-source food, epidemic, food availability, lockdown, panic buying

Drivers and barriers to adopt best dairy cattle management practices: Survey among small and medium scale dairy farmers in North Western Province

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North Western Province is a major cattle milk-producing province in Sri Lanka. Both small and medium-scale farmers significantly contribute to this milk production. But province's annual cattle milk production has been reducing in the last few years. Therefore, this study was conducted to identify drivers and barriers for best dairy cattle management practices among small and medium-scale farmers in this province. The study was conducted among 84 cattle farmers in 7 Divisional Secretariat divisions in North Western Province by personal interviews through a pre-tested questionnaire. The sample was included 47 medium-scale and 37 small-scale farmers. According to the results, the high cost of concentrates (88.1%) was the main barrier for both scale farmers. Other feeding constraints were the shortage of concentrates and the low performance of some commercial feeds. Results showed that both small and medium-scale farmers had breeding problems due to less success of artificial insemination in nearly the same percentages (72-73%). Out of the total, 71.4% and 42.9% of farmers had problems with medical costs and disease conditions. Major silage production constraints were Lack of awareness and high cost of production. Further, the cost of improved breeds, one-time milk collection and unavailability of natural forages and cultivation lands were other main constraints. Out of the total, more than 90% of both scale farms had clean water throughout the year. Drivers in breed and breeding management were farmers' heat detection knowledge (96.4%), availability of improved breeds (91.7%), and mobile and on-time artificial insemination services (72.6%). About 92% of farmers had common knowledge about disease identification and 76.2% of farmers were always supplied veterinary support. Large coconut estates, training programmes and private companies were other major drivers. The study concluded that the identification of drivers and barriers for dairy management practices is a key for developing milk production in this province.

Keywords: Artificial insemination, concentrates, constraints, improved breeds, silage

Bioactive, physicochemical and sensory properties of non-fermented dairy products (NFDPs) fortified with plant-based additives: A review

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Food fortification is a proven, cost-effective and safe strategy to improve human health. Thus, evaluating the overall properties of fortified NFDPs with plant-derived additives is an increasingly important area to be discussed. In this review, the effect of plant-based additive fortification on bioactive, physicochemical, and sensory properties of NFDPs was examined. The review findings demonstrated that ice cream, pasteurized milk and flavored milk formulated with fruits, vegetables, spices, herbs, nuts/seeds and grains have manifested an increasing trend in bioactivity. Principally, most studies have elaborated the improvement of the antioxidant activity of NFDPs formulated with plant-derived additives. There were only a few studies on the antimicrobial, anti-cancer, anti-diabetic and anti-inflammatory effects. Fruits and fruit residues have enhanced the carotenoid, polyphenol, dietary fiber and fatty acid content in ice cream, pasteurized milk and flavored milk. Vegetables incorporated ice cream and flavored milk were high in carotenoid, polyphenol and crude fiber, while nuts and seeds containing ice-cream products were high in fatty acids. The addition of plant-based natural additives both positively and negatively influenced the sensory qualities such as color, aroma, taste, texture and overall acceptability of NFDPs. Adding fruits and fruit residues to ice cream increased ash, total soluble solids and lipids while lowering pH whereas few studies recorded pH had a neutral effect. In conclusion, natural plant-based additives enhanced the bioactivity of NFDPs, but the effect on overall physicochemical and sensory qualities was more complicated. In the future, more studies on natural additive fortification with diverse types of NFDPs will be needed to elaborate on these findings.

Keywords: Bioactivity, Non-fermented dairy products, plant-based additives, physicochemical properties, sensory properties

Synthesis of Calcium Hydroxyapatite Nanoparticle from Eppawala rock phosphate

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The use of nanoparticles is a recent advancement in the agriculture industry. This aimed synthesis of hydroxyapatite nanoparticles from Eppawala rock phosphate (ERP). ERP was dissolved in concentrated HNO_3 and 20% of NH_4OH solution was added to obtain hydroxyapatite nanoparticles. The precipitation step was conducted at 28, 35 ± 5, 45 ± 5 and 55 ± 5°C temperatures, with stirring speeds of 600, 1200 and 1500 rpm. Precipitations were characterized by X-ray powder diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR) and a particle size analyser. Then samples were heated up to 1100°C for one hour in a muffle furnace for defluorination. XRD data were matched with hydroxyapatite (Entry no: 96-900-1234) in COD 2021.06.14 reference database. Nano hydroxyapatite precipitation obtained at 35 ± 5°C and 1200 rpm stirring speed has shown reduced particle size and clear XRD peaks for hydroxyapatite. XRD analysis indicated the formation of nanoparticles and calcination of nano precipitates at 1100°C removed 97.39% Fluoride. The optimum condition for the synthesis of Calcium hydroxyapatite nanoparticles from ERP by acid dissolution. Further studies on synthesized calcium hydroxyapatite nanoparticles should be conducted to utilize the developed product for agriculture and animal feed.

Keywords: Eppawala rock phosphate, hydroxyapatite, dissolution-precipitation

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Effect of plant-derived additives on bioactive properties of fermented dairy products: A review

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Food bioactives are compounds that promote health and prevent diseases in the human body through their antioxidant, antibacterial, anticancer, antidiabetic and analgesic properties. Plant-derived bioactives have grown in researchers' interest due to their abundance, low cost and wider acceptability. Technological innovations accelerate this with the development of new products by fortifying plant-based sources. Fermented dairy products are of great importance due to their special characteristics, are an excellent matrix for the incorporation of ingredients and benefits on the host's intestine and microbiome, immunomodulation and anti-allergenic effects. This review has extensively assessed the recent knowledge on the quantitative and qualitative enhancement of the nutritional value of fermented milk products by the enrichment of plant-based bioactive compounds. Fermented dairy products including yoghurt, curd, kefir, sour cream, cheese, buttermilk and drinking yoghurt have been popularly fortified with different fruits, vegetables, herbs, spices, cereals and nuts. The findings of this review demonstrated that the bioactivity of fermented dairy products has increased with the incorporation of fruits since they contain the majority of bioactive compounds such as carotenoids, polyphenols, dietary fiber and fatty acids. Fermented dairy products supplemented with herbs are typically high in polyphenols, fatty acids and carotenoids. It was also shown that spices enriched dairy products had more polyphenols, carotenoids and dietary fibre than unfortified dairy products. Nuts and oil crops, such as walnuts and hazelnuts, have enhanced the fatty acid content of yoghurts. These findings suggest the role of bioactive compounds in promoting antioxidant, antimicrobial, antihyperglycemic, anti-inflammatory and antiradical effects. In the future, it would be interesting to assess more studies on the synergetic effect between the natural bioactive compounds and fermented dairy products to enhance growing demand and potential health benefits.

Keywords: Fermented dairy products, health benefits, nutritional value, plant-based bioactive

The dairy value chain in Sri Lanka and potential risk factors to microbial food safety; A case study from the North Central Province

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Milk is a highly valuable food for balanced nutrition and contributes to food security in developing countries, including Sri Lanka. However, the lack of hygienic procedures follows throughout the dairy value chain affects the quality of raw milk and value-added dairy products. This study aimed to explore the dairy value chain and evaluate the microbiological quality and safety of cow milk at different levels of the value chain in the Nochchiyagama veterinary division in the North Central Province (NCP). Data on management practices, hygienic measures, milk-handling procedures, milk quality checks, backtracking ability, and milk consumption were collected through questionnaires directed for each stakeholder group. The survey was conducted according to the dairy value chain approach starting from farmer, milk collector, chilling centre, processor, supermarket and retailer to consumer. A total of 46 milk samples were collected randomly from the main actor levels and the total coliform count (TCC) and total bacterial count/standard plate count (SPC) tests were performed to determine the microbial quality of milk throughout the value chain. The Coliform counts were varied from 0.37×10^3 to 2.98×10^3 in raw milk, 2.59×10^3 to 2.96×10^3 in milk collected from chilling centres, and almost absent in dairy products. The total bacterial counts (TBC) were 0.34×10^5 to 2.98×10^5 in raw milk and 0.52×10^5 to 1.91×10^5 in milk collected from chilling centres. Among products, the highest TBC was observed in a curd sample. However, 6 out of 8 products had TBC counts of less than 1000 CFU. The average time spent from milking to selling was generally high (125 minutes) and unrefrigerated transport of milk is still very common. It was noted that hygienic deficiencies, particularly at the farm level, at retailers, and customers, may lead to microbial contamination.

Keywords: Coliform, dairy value chain, food hygiene, microbial safety, raw milk

Identification of Production challenges and opportunities using value chain mapping of the dairy food system in Western province, Sri Lanka

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The dairy sector is one of Sri Lanka's most significant sectors with the ability to develop the economy as well as an important source of nutrients. Even though Sri Lanka has been struggling to improve milk production for the last decade, the improvement is less than expected. Western province is considered a significant contributor to the local dairy value chain due to the higher number of processing plants and consumer potential. However, the current status of the dairy food system in Western provinces has not yet been studied. Therefore, this study was conducted to identify the challenges and opportunities of the dairy food system in Western provinces. A value chain mapping was used to describe all inputs and outputs of the value chain, including the value chain actors from farmer to consumer. The study was conducted through a cross-sectional survey and field interviews in all three districts; Colombo, Gampaha and Kalutara. Five different types of pretested questionnaires were carried out to collect primary data. The purposive sampling method was used to select 181 value chain actors in the dairy value chain. High cost of feed, lack of land availability and lack of infrastructure facilities are the major challenges faced by farmers, whereas problems related to milk processing include hygienic problems, quality control of milk, lack of cooling and storing facilities, weak connections between farmers, lack of machines and equipment, lack of labour and financial problems. The opportunities along the dairy food system are government support, high market demand and a well-developed transportation system. According to the findings, the dairy food system in the Western province is not very well organized. Therefore, to develop the dairy food system in Western province, all the challenges identified in this study need to be carefully considered and addressed. Moreover, the opportunities should be utilized maximally to develop a dairy food system.

Keywords: Challenges, dairy value chain, opportunities, value chain actors

Factors affecting conception rate of dairy cows followed by artificial insemination in the Western Province

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The artificial insemination (AI)success rate is low in Sri Lanka due to a lack of knowledge about factors affecting AI among farmers. Therefore, this study aimed to determine factors affecting the conception rate of dairy cows upon AI in the western province of Sri Lanka. Important information was collected from every Veterinary Surgeons' office in the western province and breeding office at Welisara during the period 2021 January to June and 50 questionnaires were filled out by interviewing farmers in the western province. Factors considered for this study were; Breeds, Nutrition, Body condition score, Semen handling techniques, Semen quality, Insemination practice, and Time of insemination. All the data collected were analyzed using statistical software and a table was prepared on the basis of the objective of the study. Feeding only fodder ($p < 0.05$), body condition score 1 ($p < 0.005$), body condition score 5($p < 0.05$), bad quality semen($p < 0.05$), semen thawed at less than 37℃, AI 1-12 hour after the onset of estrus ($p < 0.05$), AI <18 hours after the onset of estrus ($p < 0.05$) were identified as the factors causing for lower conception rate. Breed type Jersey ($p < 0.05$), and Friesian($p < 0.05$), feeding with fodder plus concentrates ($p < 0.05$), body condition score 2($p < 0.05$), body condition score 4($p < 0.05$), practicing AI without using sheath cover ($p < 0.05$), were associated with the risk for low conception rate in AI. Temperate cross($p < 0.05$), fodder plus concentrate plus mineral($p < 0.05$), body condition score 3 ($p < 0.05$), good quality semen($p < 0.05$), thawing semen at 37℃($p < 0.05$), AI 18 hours after onset of estrus ($p < 0.05$), using sanitizer sheath cover ($p < 0.05$) found as the factors for high conception rate. Therefore, it could be reported that the conception rate followed by artificial insemination depends on variable factors.

Keywords: Artificial insemination, cattle, estrus, Western Province

Determination of milk quality parameters and level of adulteration of milk samples obtained from Up Country and Low Country in Sri Lanka

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The geographical location of milk has an impact on its constituents. Each dairy production site requires different milk quality and constituents to keep production costs low. As a result, the study's purpose was to evaluate milk quality parameters and levels of adulteration in the low country and upcountry. Adulterant analysis (adulteration kit & chemical test), microbiological quality (Resazurin test), and composition determination were performed on 64 samples each from both milk points (low country, upcountry). Statistical analysis (T-test, Excel) was carried out. Milk fat and solid non-fat percentage were higher in the low country (4.098 ± 0.079), (8.379 ± 0.052) than those of upcountry (3.979 ± 0.051), (8.323 ± 0.133) whereas milk density was high (1.028 ± 0.006) gcm-^{3} in the upcountry, than that of the (1.027 gcm^{-3}) in the low country. All three clots on boiling, salt, and urea tests were negative for all processed samples. Hydrogen peroxide, alcohol test, and sodium bicarbonate were identified in both milk points with 1.56%, 0%, 4.69% and 0%, 1.56%, 0%, respectively in milk points in the upcountry and low country. Glucose and Maltodextrin testing were found to be 1.56% and 6.25%, respectively, in milk points in the upcountry and low country. Further, the resazurin test showed better quality in milk from the low country. Low country milk showed higher values in the milk parameters such as fat, solid non-fat, alcohol test, glucose, and maltodextrin, while upcountry milk parameters showed higher values in density, hydrogen peroxide, and sodium bicarbonate. The microbial quality of low country milk was better than upcountry milk. There were no significant differences between the two milk points concerning the clot on the boiling, salt, and urea tests.

Keywords: Clot on boiling test, resazurin test, solid non-fat

Detection of Extended-Spectrum Beta-Lactamase Producing *E.coli* Isolated from Chicken Meat

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There is a high demand for poultry products such as chicken meat in Sri Lanka and *E. coli* is a major foodborne pathogen associated with poultry meat. Pathogenic *E. coli* contamination for poultry meat happens via poultry manure, feed, and slaughterhouse waste. Antibiotics are commonly used to treat infections associated with *E. coli*. *E. coli* show resistance to some antibiotics because they produce enzymes that hydrolyze extended-spectrum cephalosporins called extended-spectrum β-lactamases (ESBLs). ESBL producing *E.coli* infections can be treated by clavulanic acid. This study was conducted to check EBSL producing *E.coli* isolates obtained from chicken meat. A total of 30 *E. coli* isolates were tested for third-generation cephalosporin antibiotics, namely amoxicillin-clavulanic acid (30/10 mcg), ceftriaxone (30 mcg), ceftazidime (30 mcg) and cefotaxime (30 mcg) using double disc synergy test (DDST). Positive *E. coli* samples from the DDST test were phenotypically confirmed by phenotypic confirmatory disc diffusion test (PCDDT) using amoxicillin-clavulanic acid (30/10 mcg) and cefotaxime (30 mcg). According to the two tests, n = 16 (53.33%) samples were ESBL-producing and n = 14 (46.67%) isolates were ESBL-non producing out of 30 isolated samples. The findings of this study indicate a high frequency of intestinal ESBL-producing *E. coli* in chicken meat. Hence, chicken meat can be an important source for ESBL-producing bacteria and should practice prudent usage of antibiotics.

Keywords: *E.coli*, extended-spectrum β–lactamases, double-disc synergy test, phenotypic confirmatory disc diffusion test, third-generation cephalosporin antibiotic discs

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General management characteristics of small-scale dairy cattle farms in Western Province

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Proper management is the most crucial factor affecting the production and productivity of dairy cattle farming. Therefore, a survey was conducted with the objective of identifying different management characteristics of small-scale dairy cattle farms in Western Province, Sri Lanka. Five different management practices were considered: housing, feeding, breeding, milking and calf management. For the survey, 72 small-scale dairy cattle farms (herd size 3.57 ± 1.046: Mean ± SD) were randomly selected from the study area. Data collection was performed by individual interviews with the farmers using a pre-tested questionnaire and data were descriptively analyzed. All three types of management systems were observed (29.2% intensive, 52.8% semi-intensive, 15.3% extensive) and in 2.8% of farms, both intensive and semi-intensive management systems were practiced together. Housing facilities were provided by 84.7% of farmers. Of those, 88.5% of sheds were constructed with a cement floor. Both grazing and cut-and-feed methods were practiced together in 61.1% of farms as the grass-feeding method. Coconut poonac was the most prominent type of concentrate used. Water quality provided to cattle was a concern for 88.9% of farmers. In 69.4% of farms, artificial insemination was practiced as the breeding method. Bulls were reared in 25% of farms. Only 43.1% of farms, cows were provided bedding materials during calving. Furthermore, in 43.1% of farms, the weaning of calves was not practiced. Naval code disinfection of newborn calves was practiced in 81.9% of farms. In 90.3% of farms, milking was done only in the morning. Hand milking was practised by 98.6% of farmers. Farmers' participation in small-scale dairy product processing was not observed in any surveyed farm. Overall, results revealed that there is a potential to expand small-scale dairy cattle farming within the area by improving farmers' knowledge of different management approaches and inspiring them to be actively engaged in dairy farming.

Keywords: Artificial insemination, calf, feeding, housing, milking

Consumer perception and sensory profile of goat milk yoghurt

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Recently, there has been an increasing trend for goat milk and related products as promising probiotic carrier foods as they deliver viable probiotic microorganisms in sufficient quantities. The current study aimed to investigate (i) consumer preference for various goat yoghurts and (ii) the effects of adding probiotics and whole milk powder (WMP) on the sensory properties of goat yoghurts. Three formulations of goat milk yoghurts: (1) a control yoghurt produced by adding conventional yoghurt culture (CON), (2) a probiotic yoghurt with *Lacticaseibacillus rhamnosus* GG (LGG) in combination with conventional yoghurt culture (PY), and (3) a yoghurt fortified with 10% whole WMP (WMP) were produced and subjected to instrumental analysis. A consumer test was employed to measure consumer preference for sensory characteristics on a 7-point hedonic scale. A qualitative descriptive analysis was performed using 10 sensory attributes to examine correlations between sensory attributes and treatments. In the consumer preference test, probiotic goat yoghurt received higher mean scores for all sensory characteristics tested: appearance (5.5 ± 1.4), colour (5.6 ±1.0), odour (5.3 ± 1.3), texture (5.3 ± 1.2), taste (5.5 ± 1.5), after taste (5.2 ± 1.7), and overall acceptability (5.5 ± 1.4) compared to that of the CON and WMP. Consumers rated the appearance and colour of the WMP higher than that of the CON. In contrast, CON received higher mean scores for odour, taste, after taste and overall acceptability compared to WMP. Two principal components (PC) explaining 100% variance were obtained from descriptive sensory data. The first PC explained 87.4% of the variance and presented a positive correlation with oral viscosity, creaminess, oral consistency, colour, rancid butter, firmness, visual consistency and goaty. The second PC explained 12.6% of the variance and was correlated positively with sweetness and sourness. Results conclude that the sensory characteristics of plain goat yoghurt can significantly be improved by the addition of the exopolysaccharide-producing probiotic LGG.

Keywords: Goat, yoghurt, *Lactobacillus*, probiotics, quantitative descriptive analysis

Exploring young consumers' attitudes to sensory and physicochemical properties of different commercial yoghurt formulations

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Yoghurt is one of the most popular dairy products worldwide, including in Sri Lanka. There are different yoghurt formulations available in the market. The identification of young consumers' attitudes about different yoghurt formulations is important to connect the yoghurt industry with the youth. The aims of the current study were (i) to define 'trendy yoghurt' for young consumers and (ii) to identify physicochemical and descriptive sensory properties of liking in yoghurts for the youth. There were two phases in the study; phase I) explored young consumers' attitudes towards different yoghurt formulations using an online survey, and phase II) determined the relationship between consumer preference, sensory profiling and physicochemical data of five different commercial yoghurt formulations. Those data were related using Principle Component Analysis (PCA). According to the online survey results, the most important attribute of yoghurt for young consumers was found to be the expiry date (4.50.± 1.179: Mean±SD). Duration of shelf life, storage conditions, proximate composition/ nutritional labeling and flavour were also considered valuable attributes. More than 80% of respondents indicated that 'tastes good' and ' is nutritious' were the phrases that better explain probable attributes expected in a trendy yoghurt. According to the consumer preference data, jelly fruit yoghurt (Y5) was the most preferred yoghurt and plain yoghurt (Y1) was the least preferred yoghurt. Descriptive data showed significant differences ($p \leq 0.05$) among the samples for 8 of the 12 attributes analysed, including appearance, flavour and texture parameters. Two principal components (PC) explaining 91.6% of the total variance were obtained from descriptive sensory data. The first PC explained 66.9% of the variance and presented a positive correlation with firmness, oral consistency, bitterness, saltiness, and sourness, and negatively with sweetness and colour. The second PC explained 24.7% of the variance and was correlated positively with oral viscosity, visual consistency and flavour intensity, negatively with buttery and creaminess. In conclusion, yoghurts should have the characteristics of fruity, flavoured, nutritious, and tasty to better connect with young consumers.

Keywords: Preference, sensory profile, yoghurt, young consumers

A survey analysis of farmer practices and perceptions of mineral feeding to dairy cattle in Central Province of Sri Lanka

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The dairy industry in Sri Lanka is still struggling to become self-sufficient and poor feeding management is one of the key reasons for this drawback. Identifying the farmer's perception is important to identify the strong and weak points in mineral feeding to optimize the local dairy production. The central province stands out with higher milk yield, improved breeds, and optimum climate conditions than other provinces. Hence, this study was conducted to identify current mineral feeding practices and perceptions of dairy farmers in Central Province. A total of 100 dairy farmers, including 46 small, 46 mediums, and 08 large scales dairy farms, were selected by convenience sampling method. The primary data were collected through a pre-tested questionnaire. Mineral mixtures, salt, mineral blocks, and calcium-containing gel were the mineral feed types used by the respondents. All selected respondents (100%) implemented daily mineral mixture feeding. Overall, 85 % of farmers, including all small-scale farmers, used the "mixing with concentrate" approach for feeding mineral mixture, whereas 15% used the "total mixed ration" method. Small, medium, and large scale farmers utilized salt as a major sodium source in percentages of 37%, 47.8%, and 50%, respectively. Mineral blocks and calcium-containing gel were used by only a few farmers in medium and large-scale farms. Only 2% of large-scale farms made their mineral feed. The majority of farmers had a positive perception towards mineral feeding as an important feeding practice; however, higher cost associated with mineral feeding was the major challenge. Mineral feed preparation on the farm, the impact of mineral feeding on the animal's health, nutrition, and milk production were identified as farmers' knowledge requirements. Further studies on mineral feeding can be benefited from the findings of this survey and can be used to address poor feeding management practices to improve the dairy sector.

Keywords: Dairy cattle, farm categories, farmer, feeding management, mineral mixture

Effect of the probiotic *Lacticaseibacillus rhamnosus* GG on the physicochemical and sensory properties of buffalo milk ice cream and its viability during cold storage

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Demand for probiotic dairy products is increasing over the years due to their well-known health benefits to the host. Due to the higher fat content in buffalo milk compared to cow milk, it may act as a promising probiotic carrier that ensures higher probiotic survivability during storage. Loss of viability during storage is one of the major limitations associated with frozen probiotic dairy products. Therefore, the objective of the current study was to evaluate the probiotic viability of buffalo ice cream over frozen storage and to determine the effect of the probiotic on the quality characteristics of ice cream. Two experimental ice cream products: (a) unfermented plain buffalo ice cream (control) and (b) fermented buffalo ice cream containing *Lacticaseibacillus rhamnosus* GG (LGG) and conventional yoghurt culture (probiotic ice cream) were prepared and stored under freezing conditions (-18 ℃ ± 2 ℃). Physico-chemical properties, sensory attributes and probiotic viability were evaluated at weekly intervals for over 28 days. Results showed that probiotic ice cream has lower total solids, protein and fat contents compared to control. After 28 days of frozen storage, the titratable acidity of the probiotic ice cream and control was 0.87 and 0.21, respectively. Whereas the pH was 4.7 and 6.2 in probiotic and control ice cream, respectively. The overrun percentage (%) and melting rate of the two samples were not significantly different ($P > 0.05$). Among the sensory attributes, only the appearance and taste of the two ice creams were varied significantly ($P < 0.05$). However, the colour, odour, texture, after taste, mouthfeel and overall acceptability of the two ice creams were comparable ($P > 0.05$). The viability of LGG counts in probiotic buffalo milk ice cream was maintained at $>10^7$ CFU/mL over the frozen storage. Results conclude that buffalo milk ice cream is an ideal matrix to deliver probiotics at therapeutic levels ($>10^6$ CFU/mL) and the probiotic LGG has a significant effect on the overrun%, pH, titratable acidity, appearance and taste of the buffalo ice cream.

Keywords: Buffalo milk, frozen dairy, *Lactobacillus*, probiotics, probiotic viability

Determining the effect of Heifer Calf Rearing Scheme on weight gain of AI-born female calves in Matugama veterinary division, Sri Lanka

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Higher milk productivity in dairy cows can be achieved through enhancing the growth rate of the heifer calves to reach the age of first calving early in their lives. In this study, a Heifer Calf Rearing Scheme was conducted on female calves born to artificially inseminated cows in Matugama veterinary division, Sri Lanka. 32 female calves were taken for the study as the treatment group. They were given a "Super Feed" at the rate of 100, 200, and 350 g/day in successive 3 months after the birth. Milk feeding was restricted. For deworming, *Albendazole* oral suspension was administered 21 days after birth and thereafter monthly for three months. Treatments for wound healing and de-ticking were administered if required. 7 female calves were taken as the control group, which did not receive HCRS treatment. The weight of the calves was measured monthly for 3 months. Feed management data were obtained using a questionnaire. AI record data were obtained regarding the length of pregnancy, gender of newborn calves. According to the findings, there was a significant effect by HCRS project on the rate of weight gain of calves within the 2nd and 3rd months, but not in the 1st month. The rate of weight gain was higher by 1.6375 and 1.9464 kg/month in the 2nd and 3rd months, respectively. Recorded female and male births were 46.60%, 53.40%, respectively. There was no significant difference in the mean duration of pregnancy for male and female calf births, 279.91 ± 0.631 days. The major feeding material was naturally grown grass which was given to all the calves; 97.06% of calves were reared under semi-intensive systems, 94.06% of the calves were cut and fed, 97.06% of farmers used poonac for compound feed. Under local management systems, HCRS proved to have an effect on enhancing calf growth rate.

Keywords: Early calving, calf growth, calf management, starter feed

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