



ANNUAL SCIENTIFIC SESSIONS OF THE NUTRITION SOCIETY OF SRI LANKA

2024

PROCEEDINGS



THE NUTRITION SOCIETY OF SRI LANKA

“Towards Health and Wellness with Personalized Nutrition in a
Challenging Era”

Proceedings of the Annual Scientific Sessions

Of

The Nutrition Society of Sri Lanka

***“Towards Health and Wellness with Personalized
Nutrition in a Challenging Era”***

**27th – 28th January 2024
at Ramada Hotel, Colombo 3**

Editor: Dr. Thushanthi Perera

Editorial Assistance: Ms. Hasintha Sanali & Ms. Mifra Sarap

Cover Design: Ms. Shiwanthi Dharmapala

Proceedings of the Annual Scientific Sessions of the Nutrition Society of Sri Lanka
27th – 28th January 2024

<i>“Towards Health and Wellness with Personalized Nutrition in a Challenging Era”</i>	
DAY 1 Programme: Saturday 27th January 2024	
Time	Event
7.30 a.m.	Registration
8.10 a.m.	Lighting of oil lamp & National Anthem
8.15 a.m.	Welcome Speech Dr. Dhammika Senanayake, President, NSSL
8.20 a.m.	Address by the Chief Guest – Dr. KM Mohotti, Director/CEO, Tea Research Institute
8.30 a.m.	Keynote Address Nutrition Resilience, Strategies & Innovations in the Face of Global Challenges Prof. Anoma Chandrasekara Professor of Food Science & Nutrition Department of Applied Nutrition, Wayamba University of Sri Lanka
9.00 a.m.	Presidential Address Dr. Dhammika Senanayake, President, NSSL
9.15 a.m.	Vote of Thanks Dr. Thamilini Joshepkumar, Joint Secretary, NSSL
9.20 a.m.	TEA BREAK
9.45 a.m.	Symposium 1 Trends in Child Health and Nutritional Wellbeing: Dedicated to Prof. Priyani Soysa Symposium Chair: Prof. Narada Warnasuriya, Senior Professor of Paediatrics, General Sir John Kotelawala Defence University, Sri Lanka Plenary Lecture: Feeding, Nutrition and Growth in Early Childhood Prof. Pujitha Wickramasinghe, Department of Paediatrics, Faculty of Medicine, University of Colombo, Sri Lanka
10.15 a.m.	Symposium Lecture: Trends and Challenges in Childhood Obesity Prof. Aruna de Silva, Department of Paediatrics, Faculty of Medicine, University of Ruhuna
10.35 a.m.	Symposium Lecture: Endocrinology Background on Obesity Dr. Navoda Atapattu, Consultant in Paediatrics Endocrinology, Lady Ridgeway Hospital (LRH), Colombo, Sri Lanka
Panel Discussion	
11.15 a.m.	Symposium 2 Role of Nutritional Supplements in Human Wellbeing Symposium Chair: Prof. Ananda Chandrasekara, Professor in Applied Nutrition, Wayamba University of Sri Lanka. Plenary Lecture: Food First or Not Always Food Only: Are Dietary Supplements Safe and Effective? Prof. Renuka Silva, Professor of Applied Nutrition, Department of Applied Nutrition, Wayamba University of Sri Lanka
11.45 a.m.	Symposium Lecture: Regulatory Guidelines and the Significance of Nutritional Supplements on Health and Wellbeing

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	Dr. Ananda Wijewickrama, Consultant Physician and Chairman of the National Medicines Regulatory Authority (NMRA), Sri Lanka
12.10 p.m.	Symposium Lecture: Nutritional Supplements for Critically Ill Patients Dr. Upeka Samarawickrama, Acting Clinical Nutrition Physician, DGH Gampaha
Panel Discussion	
12.30 p.m.	LUNCH BREAK & POSTER COMMUNICATIONS
1.30 p.m.	Symposium 3 Exploring Obesity in Adulthood Symposium Chair: Prof. Chandima Wickramathilake, Department of Biochemistry, Faculty of Medicine, University of Ruhuna
2.00 p.m.	Plenary Lecture: State of Obesity 2023 Prof. Carel Le Roux, Professor of Chemical Pathology, University College Dublin, School of Medicine, Ireland
2.20 p.m.	Symposium Lecture: The Impact of Obesity on Psychological Well-being Prof. Athula Sumathipala, Professor of Psychiatry, Institute of global health and well-being, Keele University, United Kingdom
2.40 p.m.	Symposium Lecture: Dietary Strategies for Effective Obesity Management Prof. Ranil Jayawardene, Professor in Nutrition, Faculty of Medicine, University of Colombo
Panel Discussion	
3.00 p.m.	TEA BREAK
3.15 – 4.15 p.m.	Free Paper Session
4.30 p.m.	Prof. T.W. Wickramanayake Oration Dr. (Mrs). Renuka Jayatissa, Consultant in Community Medicine & Nutrition Specialist, Vice Chancellor, International Institute of Health Sciences Multiversity, Sri Lanka
7.00 p.m.	Nutrifeast Dinner at Lotus Tower Colombo Sri Lanka
DAY 2 (Virtual) Programme: Sunday 28th January 2024	
9.30 – 10.00 a.m.	Free Paper Session
10.00 a.m.	TEA BREAK
10.15 – 11.30 a.m.	Free Paper Session
11.30 a.m.	Special Guest Lecture: Supplements for Health & Performance in Sport Prof. Ron Maughan, School of Medicine, St Andrews University, St Andrews, UK
12.00 p.m.	Awards & Appreciations
12.30 p.m.	Closing Remarks Address by the Conference Chair, NSSL Annual Sessions 2024
1.00 p.m.	Annual General Meeting of NSSL

Message from the President - Nutrition Society of Sri Lanka



Dr. Dhammika Senanayake
President - Nutrition Society of Sri Lanka

Dear Esteemed life Members and Supporters of the Sri Lanka Nutrition Society,

As we embark on another chapter in our collective journey toward fostering health and well-being, I am honoured to address you as the President of The Sri Lanka Nutrition Society. In the pursuit of our mission to promote nutrition science, education, and advocacy, I am filled with a profound sense of responsibility and enthusiasm for the opportunities that lie ahead for the nutrition society.

For the past two years, The Sri Lanka Nutrition Society actively engaged with communities by providing nutrition education to pre-school teachers and parents. Our outreach extended to school children, youth, sports coaches, and government servants through targeted programs including Nutrica-art competition. Collaborating with industries, the society fostered partnerships for practical nutritional initiatives. Webinars served as a platform for disseminating current nutritional information. Additionally, the society established a community center offering free nutrition advice to government servants and conducted community-based research to address local nutritional challenges.

Our society plays a crucial role in shaping the nutritional landscape of our nation, influencing policies, and empowering individuals to make informed choices for their health. In this rapidly evolving world, where the significance of nutrition is increasingly recognized, our role becomes even more pivotal.

As we contribute to the ongoing dialogue on nutrition, it is imperative that we stay at the forefront of research and innovation. The challenges we face require a dynamic and collaborative approach, drawing on the expertise of our diverse membership. Together, we can bridge the gap between scientific advancements and practical application, ensuring that our efforts have a tangible and positive impact on the lives of individuals and communities.

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This year, let us focus on strengthening our partnerships, both within our society and with external stakeholders. By fostering collaboration, we can amplify our voice and influence, creating a more significant ripple effect in the realm of nutrition advocacy.

Education remains a cornerstone of our society, and I encourage all members to actively engage in knowledge-sharing initiatives. Whether through workshops, seminars, or publications, let us disseminate evidence-based information that empowers individuals to make informed choices for their nutritional well-being.

I extend my heartfelt gratitude to the council (2022-2023), dedicated members of the Sri Lanka Nutrition Society, whose passion and commitment continue to drive our mission forward. Together, let us navigate the challenges, celebrate the successes, and work tirelessly to build a healthier and more nutritionally conscious society.

I look forward to a year of growth, collaboration, and impactful contributions from each of you. May our shared dedication to nutrition science lead us to new heights, promoting a healthier and more vibrant Sri Lanka.

Message from the Joint Secretary - Nutrition Society of Sri Lanka



Dr. Thamilini Joshepkumar
Joint Secretary - Nutrition Society of Sri Lanka

It is my great pleasure to write this message on behalf of the Nutrition Society of Sri Lanka. First of all, let me welcome you all to this leading annual session that has been providing a platform for young scientists to present, discuss, debate, and validate their research findings at a distinguished forum.

Let me start by extending our heartfelt gratitude to our Chief Guest, Dr. Keerthi Mohotti, Director, Tea Research Institute, who honored this function with his inspirational thoughts. I would also like to thank the keynote speaker, Prof Anoma Chandrasekara, Senior Professor, Department of Applied Nutrition, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka. Dear Madam, your valuable insights helped us ignite the momentum and highlighted our role during this unprecedented time as a professional network.

We have outstanding events in line for you for two days, and the event is enriched by invited presentations of eminent Scientists from different institutions from different parts of the country. My sincere appreciation and gratitude go to all Symposium speakers, Judges, Abstract reviewers, Award application evaluators, awardees, all presenters, and all who contributed in numerous ways to make this scientific session a monumental success.

We as the council of The Nutrition Society of Sri Lanka sincerely acknowledge the generous provision of the sponsors, without their support this event would have not been a reality. Thank you so much for your collaboration in identifying your social responsibility and partnering with us in this important endeavor.

I express my sincere thanks to the hosting team, visual coverage, and compering teams for making this function a successful one. It has been a real pleasure to work with this very fine and capable group of people. My sincere thanks to all the delegates, including other distinguished guests and the participants, members of the NSSL. This event would not be a success if it weren't for your involvement.

Last but not least, I must mention the support provided by the council members of the NSSL. Thank you team! without our collective effort, this achievement would be a nightmare.

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While begging your pardon for any omission or any inconvenience, I wish you all a Happy, healthy, and prosperous new year in which we will be able to better march towards our mission!

Message from the Conference Chair
Annual Scientific Sessions of Nutrition Society of Sri Lanka – 2024



Ananda Chandrasekara, Professor in Applied Nutrition
Conference Chair, Annual Scientific Sessions - 2024
The Nutrition Society of Sri Lanka

As the Conference Chair, it is my honor and privilege to welcome you to the prestigious Annual Scientific Sessions of the Nutrition Society of Sri Lanka (NSSL). The NSSL plays a pivotal role in uniting nutritionists, healthcare professionals, scientists, and all individuals passionate about the field of nutrition, with a shared goal of enhancing the nutritional well-being of Sri Lanka. This year's conference marks a significant milestone for the NSSL, embodying our collective resilience and commitment to advancing nutritional science.

Our two-day program, themed **“Towards Health and Wellness with Personalized Nutrition in a Challenging Era”** promises an enriching experience with three key symposiums: Trends in Child Health and Nutritional Wellbeing, Role of Nutritional Supplements in Human Wellbeing, and Exploring Obesity in Adulthood. This year's response to our call for abstracts was exceptional, leading to a rigorous selection process. The program will feature 17 oral presentations and 19 poster presentations, covering a broad spectrum of topics in food, nutrition, and health. These presentations, along with symposium sessions will stimulate thought-provoking discussions on current nutritional challenges and opportunities. I am confident that these sessions will foster productive discourse, not only in advancing nutrition science but also in addressing the nutritional well-being of Sri Lankans.

The success of this conference is a testament to the dedication and hard work of many individuals. I extend my profound gratitude to Dr. Dhammika Senanayake, President of the NSSL, and all council members for their unwavering dedication. I am also grateful to our Chief Guest, Dr. Keerthi Mohotti, Director, Tea Research Institute. Special thanks to Prof. Anoma Chandrasekara, our Keynote Speaker, the symposium chairs, guest speakers, judges, abstract reviewers, award application evaluators, and the researchers presenting their insightful findings. I would also like to acknowledge Dr. Renuka Jayatissa for delivering the Prof. T.W. Wickramanayake Memorial Oration.

My heartfelt appreciation goes to the conference coordinator Ms. Hasanga Rathnayake and the organizing committee members who diligently worked on every aspect of the conference

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programme. Additionally, our sponsors deserve special recognition for their generous support, making this event possible. On behalf of the Conference Committee, I eagerly anticipate welcoming you to Colombo for what promises to be an enlightening and inspiring event.

Keynote Address

Nutrition Resilience, Strategies & Innovations in the Face of Global Challenges



Anoma Chandrasekara

Professor of Food Science & Nutrition

Department of Applied Nutrition, Wayamba University of Sri Lanka

People live longer but it is necessary to have healthier lives. Today we live in an era of 'polycrisis'. We experience the harsh impacts of climatic changes, natural disasters, economic disruptions, rising chronic illnesses, global pandemics, and new and protracted civil conflicts taking place simultaneously in the lives of people around the world. In addition to direct devastating effects on individuals and communities, the 'polycrisis' disrupts the key systems associated with food, health, education, water and sanitation, and social protection that influence the achievement of optimum nutrition of people especially cornering the most vulnerable segments in the population.

Nutrition and resilience are interconnected. Well-nourished and healthy individuals and communities can withstand and endure longer external shocks and stresses as well as recover quickly and effortlessly. On the contrary, the least resilient households and communities are the most affected and therefore face the risk of malnutrition. Strategies for nutrition resilience are needed to strengthen the capacities of target populations to absorb, adapt to, and transform at the time of crisis thus safeguarding access to nutritious diets, essential nutrition services, and positive care and feeding practices.

Social change to healthier lifestyles is necessary to achieve a significant global shift towards better nutrition during the era of global challenges. This necessitates overcoming barriers such as lack of scientific alignment on the purpose and value of nutrition by all sectors, and revisiting cultural, emotional, and habitual ties towards diets. Mitigation of food and nutrition insecurity by multisectoral engagement with the support of legislative and policy environment to build sustainable, productive, equitable, and resilient food systems is pivotal to ensuring nutritious foods and services. Technological advances such as alternative proteins, sensor technologies, biotechnology, nanotechnology, artificial intelligence, big data and machine learning, and robotics and automation among others can be used to make food systems resilient. The use of innovative digital technologies, shared management information systems and collaborative platforms enable swift decision making ensuring key systems, namely food, health, education, and social protection are resilient to safeguard nutrition in crisis.

Within the context of a world of ‘polycrisis’, it is essential to identify nutrition-sensitive shock-responsive innovative approaches to protect vulnerable populations and provide optimal nutrition. This entails the active engagement of a wide range of stakeholders from various sectors at different levels in strengthening legislation and policies, programmes, and multiple systems for nutrition resilience.

Orator Address

The Future of Nutrition in Sri Lanka



Renuka Jayatissa

Consultant in Community Medicine & Nutrition Specialist

Vice Chancellor, International Institute of Health Sciences Multiversity, Sri Lanka

Sri Lanka is far ahead of other countries in the South Asia region with respect to infant, under-five, and maternal mortality. However, there is mounting concern among government policy makers and development partners that the rate of decline of child undernutrition has slowed and the country is experiencing high levels of under-nutrition in relation to the Gross Domestic Product and infant mortality. The country had seen significant progress from 1977-78 to 2000-01; child stunting was halved from 50.4 percent in 1977-78 to 18.4 percent by 2000-01 and underweight from 49.8 to 22.8 percent over the same period. However, as of 2000, there has been limited progress in both stunting and underweight. Wasting has remained practically unchanged over the last two decades and is at a critical level. The latest data available through the National Nutrition and Micro-nutrient Survey (2022) indicates that child wasting has increased to 20% in 2022 with the economic crisis and appears to be worsening. As in other countries, the period of most rapid increase for both stunting and wasting is in the first two years of life, which supports the global focus on children under two as the latter part of the 'window of opportunity' for addressing child undernutrition.

Moreover, there are significant regional variations reflected in district estimates. Wasting, however, is a nationwide problem with 'high' or 'Very High' rates (based on WHO standards) reported in most parts of the island. Low birth weight and anaemia are also grave concerns in Sri Lanka. The proportion of low birth weight babies has remained at around 16 percent in the last decade and is a factor in increased risk of retarded growth. Primary causes of malnutrition relate to childcare practices and maternal nutrition. In contrast, primarily due to the economic transition in the country, an increase in the proportion of overweight children and mothers has been documented and is becoming an increasing area of concern.

Improvements in nutrition achieved in the past are likely due to the high coverage of health services. The strong focus on public health has led to impressive falls in maternal and child mortality. Many of the 'normal' causes of poor maternal and child nutrition appear to already have been addressed. In considering the causes of undernutrition in Sri Lanka it is probably necessary to split the country into three: (i) the Northern, and to a lesser extent in the Eastern,

Provinces; (ii) the estate sector and (iii) ‘the rest’ of Sri Lanka. There is a need for a better understanding of the causes of undernutrition in these areas and for developing specific interventions in these areas.

The overall good indicators in the rest of Sri Lanka hide wide disparities and inequalities. The remaining undernutrition appears to be concentrated in the most vulnerable and marginalised communities that have not benefited from the country’s socio-economic achievements. Thus maternal and child undernutrition rates are highest in the poorest families and those in which the women have lower educational attainment. Low maternal BMI, low birth weight, and child stunting are all seen to vary largely depending on the wealth quintile, much more so than wasting or anaemia. Bivariate and multivariate analyses have been undertaken which concluded that food insecurity is an underlying modifiable risk factor for both low birth weight and stunting, suggesting that unequal wealth and consumption play a significant part.

The Government of Sri Lanka has long recognised the importance of nutrition and has operated food subsidy and poverty alleviation programs for many years with improved nutrition as one of the objectives. The Thriposha program provides fortified supplementary food for all pregnant and lactating women and all children under five who are underweight or have growth faltering. There is limited data on the effectiveness of this intervention. However, the Ministry of Health meanwhile is providing an integrated package of interventions for maternal and child health and nutrition. This package has achieved high coverage and includes many effective and feasible interventions identified by the Lancet medical journal as having strong evidence for global scale-up in order to reduce undernutrition.

Overall, it appears that a two-pronged approach is needed in Sri Lanka which consists of improved coverage of the effective health sector interventions targeted to those not yet reached and introducing some additional health sector effective interventions not yet implemented. The second prong would be implemented by other sectors to reduce inequalities in Sri Lanka in relation to poverty reduction, food security, water and sanitation access, and maternal education. Social protection measures such as conditional or non-conditional cash transfers could be considered. In this crucial stage, the Presidential Taskforce needs to develop a roadmap, action plans, coordination, and monitoring mechanisms for a more comprehensive, coordinated, and effective strategy for maternal and child undernutrition. Overall, the two prongs must focus on reducing inequities in the conditions and services conducive to good nutrition, which will improve both maternal and child nutrition.

Unlike undernutrition, overnutrition will not be solved by economic growth and development. It may be a shift to less physical economic work, urban migration trends, increased taste preferences for sweet and fatty foods, and consume more processed foods. Food behaves metabolically. Overall, we need innovative approaches such as integrated interventions to different “types” of malnutrition, linkages between climate/agriculture and food/development, and wholesome individual nutrition. Nutrition is not a study of individuals and not a disease, it is about food and health.

Symposium 1: Trends in Child Health and Nutritional Wellbeing: Dedicated to Prof. Priyani Soysa

Plenary Lecture: Feeding, Nutrition and Growth in Early Childhood

Prof. Pujitha Wickramasinghe, Department of Paediatrics, Faculty of Medicine, University of Colombo, Sri Lanka



Symposium Lecture: Trends and Challenges in Childhood Obesity

Prof. Aruna de Silva, Department of Paediatrics, Faculty of Medicine, University of Ruhuna



There is a major concern and a robust call for action by the authorities, over the changing epidemiology and increasing trends of childhood obesity, which has risen steadily over the past decade all over the world. However, the progress in reducing the burden at a global level has been negligible. It is a greater concern that the relative increase in overweight and obesity is significant in the developing world which forecasts a future increase in the burden of non-communicable diseases among low and middle-income countries. Obesity arises when a mix of genetic and epigenetic factors, behavioral risk patterns, and environmental and sociocultural influences affect the body weight regulation systems of energy homeostasis, including leptin level. Previous studies have shown that preconception and prenatal environmental exposures, including high maternal pre-pregnancy BMI and, gestational weight gain, gestational diabetes, and maternal smoking, are also associated with childhood obesity, potentially through effects on the in-utero environment. Many other behavioral factors are associated with an increased risk of childhood obesity, including increased intake of energy-dense micronutrient-poor food, increased screen time, and reductions in physical activity. These factors have been influenced by multiple changes in the past few decades, including the widespread marketing of food and beverages to children, reduced time for outdoor activities, the rise in motorized transport, rapid changes in the use of technology, and the move away from traditional foods to ultra-processed foods.

Increased BMI, especially in adolescence, is linked to a higher risk of many health outcomes, including metabolic disorders, such as raised fasting glucose, impaired glucose tolerance, type 2 diabetes mellitus, metabolic syndrome, and fatty liver disease. Other well-recognized obesity-associated complications include coronary heart disease, asthma, obstructive sleep apnoea syndrome, orthopedic complications, and a range of mental health outcomes including depression and low self-esteem.

Dyslipidemia was highly prevalent among the obese children that we investigated in the Galle district where 38.14% and 28.86% had increased total cholesterol and triglyceride concentrations respectively. The exponential rise in childhood overweight/obesity has also made NAFLD one of the most important causes of chronic liver disease. However, it is still underdiagnosed mainly due to poor awareness and recognition, expenses associated with diagnosis, and the absence of properly validated diagnostic tools among children. In a recent study conducted in the Gampaha district among a population of overweight and obese

children, the prevalence of NAFLD was 32.5% and that of NASH was 26.5%. According to a study that we conducted, NAFLD was diagnosed via Ultrasonography in 38.13% of obese children in the Galle district. A previous study conducted by us in the Galle district using a modified STOP-Bang questionnaire revealed that 27.8% of obese children had a higher risk of obstructive sleep apnoea syndrome (OSA) and 49.5% had an intermediate risk. However, it is an under-diagnosed clinical entity, especially in the pediatric population. It is often dismissed and not brought to the attention of the doctor as many parents have the misconception that it is normal for a child to snore especially if the child is obese. OSA comprises a spectrum of sleep-disordered breathing that ranges from partial to complete upper airway obstruction. Untreated OSA has adverse consequences that affect the child's school performance, ability to learn, behavioral abnormalities, aggression, pulmonary hypertension, and even death. The modified STOP bang questionnaire was validated in Caucasian and Hispanic children but not in Asians. It is well established that polysomnography which is considered as the gold standard is required to distinguish OSA from primary snoring. However, polysomnography is an expensive investigation that requires an overnight stay in a hospital and there are practical issues associated with children.

Approaches to the prevention of obesity and non-communicable diseases must start early and effectively. These include clear targeting of appropriate care and education for schoolgirls and adolescents, and working with families and communities to promote a healthy lifestyle, physical activity, and reduction in the intake of ultra-processed commercial foods. Obesity prevention and management requires working across sectors, including social protection and education, and the development of strategies for regular monitoring of outcomes. WHO and major funding bodies have a key role in the promotion of high-quality and high-impact implementation research in obesity prevention and management. Considering the looming emergency of obesity and non-communicable diseases, funding for obesity research should be a priority. A previous study conducted by us emphasized the urgent requirement of country-specific growth references for the assessment of malnutrition in children and adolescents in Sri Lanka. Such growth references will enable accurate diagnosis of overweight, and obesity and prompt early interventions for the prevention of complications of childhood obesity including metabolic syndrome later in life. With the collaboration of the Family Health Bureau and the Department of Education, screening programs should be implemented for different age groups in the early detection of risk factors and symptoms of overweight and obesity among school children. Public awareness programs should be introduced addressing all the factors that contribute to childhood obesity targeting all stakeholders including the child, family, school, society, and country as a whole.

Symposium Lecture: Endocrinology Background on Obesity

Dr. Navoda Atapattu, Consultant in Paediatrics Endocrinology, Lady Ridgeway Hospital (LRH), Colombo, Sri Lanka



Obesity is a chronic medical condition resulting from an imbalance of energy expenditure and consumption. It has become a leading cause of preventable illness, disability, and premature death. Socio-economic, environmental, and genetic factors contribute to obesity.

Rarely endocrine diseases hypothyroidism or Cushing's syndrome result in obesity. Obesity itself can result in endocrine dysfunction. Insulin resistance plays a major role in the pathophysiology of endocrinopathies related to obesity. Insulin resistance is directly related to adipose tissue. Excess energy is stored as fat in adipocytes. Adipose tissue increases insulin secretion and causes insulin resistance through the release of excess free fatty acids (FFA). An inverse relationship between GH and BMI has been observed in patients with obesity. However, serum IGF-1 does not appear to be significantly different. The final adult height of patients with obesity is not reduced compared to non-obese patients. Obese patients have growth hormone-independent growth via leptin and insulin. Children with obesity are significantly taller than their normal-weight peers. However, beyond 12 years in boys and 9 years in girls, the height SDS curves converged resulting in no differences in final height. Advanced linear growth at early ages increases cardiovascular diseases.

Insulin resistance leads to a decrease in sex hormone-binding globulin. Obesity can affect the release of gonadotropin-releasing hormone (GnRH) and alter the luteinizing hormone (LH) pulse amplitude. Alterations of these hormones can increase the risk of hypogonadism in men and the risk of infertility in women with obesity. Girls with obesity go through early puberty and boys tend to have delayed puberty because of sex-specific leptin and gonadotrophin interaction.

Hyperandrogenism is commonly seen in females with obesity. Adipose tissue plays a major role in the pathogenesis of hyperinsulinemia and infertility, like characteristics seen in polycystic ovarian syndrome (PCOS).

It has been demonstrated that obesity itself is associated with thyroid dysfunction. Leptin links thyroid and body weight. Insulin resistance may play a role in elevated TSH. Free T3 levels are increased in obesity due to changes in the monodeiodination pathways. Increases in TSH and peripheral thyroid hormones may be an adaptation process to increased basal energy metabolism, and thus to energy expenditure.

Endocrine-disrupting chemicals have received growing attention in medical research as a contributing factor to obesity and type 2 diabetes. These are complex mixtures of compounds found in nature. Even a low level of environmental exposure may still have significant and long-term biological impacts that may go down generations. Exposure during prenatal, in utero, and adolescence period may increase the vulnerability to EDC. There are two major types of EDC; obesogens which disrupt normal lipid metabolism leading to obesity and diabetogens which kill β -cells or disrupt their function and interfere with normal energy metabolism leading to diabetes.

It is important to highlight that the ultimate endocrine disorder of uncontrolled obesity is type 2 diabetes, which increases the risk of strokes, heart attack, and kidney failure.

Symposium 2: Role of Nutritional Supplements in Human Wellbeing

Plenary Lecture: Food First or Not Always Food Only: Are Dietary Supplements Safe and Effective?

Prof. Renuka Silva, Professor of Applied Nutrition, Department of Applied Nutrition, Wayamba University of Sri Lanka



Dietary supplements, encompassing various vitamins, minerals, herbs, and other substances, play a significant role in modern nutrition. The global usage of supplements varies across demographics, with higher prevalence among older individuals, women, and those with higher socioeconomic status. In low and middle-income countries, where specific micronutrient deficiencies (MNDs) are prevalent (e.g., of iodine, iron, zinc, and vitamin A), supplementation is recommended when food-based approaches such as dietary modification, fortification, or food provision are unable to achieve inadequate intake. Those with increased requirements secondary to growth, chronic disease, medication use, malabsorption, pregnancy and lactation, and aging may be at particular risk for inadequate dietary intake.

It has been found that certain outcomes, such as anaemia, responded to several intervention types. The risk of anaemia was reduced with iron alone, iron-folic acid, multiple micronutrients (MMN) supplementation, micronutrient powders (MNPs), targeted fortification, and large-scale fortification. Stunting and underweight, however, were improved only among children who were provided with lipid-based nutrient supplementation (LNS), though MMN supplementation also slightly increased length-for-age z-scores. Vitamin A supplementation likely reduced all-cause mortality, while zinc supplementation decreased the incidence of diarrhoea.

However, in recent decades, Sri Lanka has made substantial progress in reducing the burden of MNDs in children by the provision of vitamin A megadose and micronutrient supplementation programs for children of 6–23 months, along with universal iodization of salt. Yet, the prevalence of MNDs is unacceptably high among selected vulnerable populations in Sri Lanka where dietary patterns are typically energy (especially carbohydrates) rich but nutrient-poor. Supplementation as a strategy to combat MNDs requires that the provision of supplements is feasible and that adequate educational programs are in place to gain

compliance. Although supplementation does not address the root cause of the deficiency, it offers a relatively cost-effective short-term solution to MNDs.

Recent literature critically assesses the impact of dietary supplements on all-cause mortality, cardiovascular diseases, cancer, type 2 diabetes, and osteoporosis. Contrary to common beliefs, the evidence suggests limited benefits of supplements in reducing the risk of these non-communicable diseases. Notably, some supplements may even pose potential harm, particularly in high-risk populations. The analysis underscores the importance of distinguishing between nutrients obtained from foods and supplements, as their health effects may differ. Observational studies highlight the potential confounding factors, and caution is advised in applying findings from trials in high-risk populations to healthy individuals. The studies emphasize the synergistic interactions between nutrients and bioactive substances in foods, supporting the notion that nutrient intake from foods may offer unique benefits. There are several misconceptions surrounding dietary supplements.

In the context of sports nutrition, the studies provide specific recommendations for supplement usage, such as optimal carbohydrate intake during exercise and the benefits of creatine supplementation for post-exercise recovery.

The key messages emphasize the importance of prioritizing a balanced and diverse diet over excessive reliance on supplements. Future research is needed to delve into the differing health effects of nutrients from foods versus supplements, synergistic interactions, personalized supplementation based on nutrigenetics, and specific needs in low and middle-income countries.

Symposium Lecture: Regulatory Guidelines and the Significance of Nutritional Supplements on Health and Wellbeing

Dr. Ananda Wijewickrama, Consultant Physician and Chairman of the National Medicines Regulatory Authority, (NMRA), Sri Lanka



Symposium Lecture: Nutritional Supplements for Critically Ill Patients

Dr. Upeka Samarawickrama, Acting Clinical Nutrition Physician, DGH Gampaha



Introduction:

Nutrition plays a pivotal role in the recovery of critically ill patients, influencing both short-term outcomes and long-term prognosis. For healthcare workers working in intensive care units, understanding the importance of medical nutrition therapy (MNT) is essential. This presentation aims to shed light on the importance of supplements in optimizing nutritional support for critically ill patients, with a focus on evidence-based strategies to improve patient outcomes.

Understanding the Nutritional Challenges in Critically Ill Patients:

Critically ill patients often experience a hypermetabolic state, leading to increased energy expenditure and nutrient depletion. Factors such as inflammation, organ dysfunction, and prolonged fasting contribute to malnutrition, which can further compromise the patient's ability to recover. Recognizing these challenges is crucial for tailoring effective nutritional interventions.

Key Components of Medical Nutrition Therapy:

Medical nutrition therapy encompasses a multi-disciplinary approach, involving physicians, dietitians, and other healthcare professionals. It aims to provide targeted nutritional support based on the patient's condition. In critically ill patients, MNT involves a careful balance of macronutrients, micronutrients, and fluid management. Ensuring an adequate intake of protein, energy, vitamins, and minerals is essential for preventing nutritional deficiencies and promoting recovery.

Role of Supplements in Medical Nutrition Therapy:

Supplements play a vital role in bridging nutritional gaps in critically ill patients. They provide a concentrated source of nutrients, ensuring that the patient receives the necessary elements for recovery. Commonly used supplements include macronutrients including protein supplements, immunomodulators, vitamins, and minerals. Each supplement serves a specific purpose in addressing the nutritional needs of the critically ill.

Protein Supplements:

Protein is a cornerstone of nutritional support in critical illness. Adequate protein intake is associated with improved muscle strength, immune function, and wound healing. However, achieving protein goals through regular dietary intake can be challenging in critically ill

patients. Protein supplements, such as whey protein or specialized enteral formulas, offer a convenient and effective way to meet protein requirements.

Vitamins and Minerals:

Micronutrient deficiencies are common in critically ill patients and can exacerbate complications. Supplementation with vitamins and minerals, such as vitamin D, zinc, and selenium, can support immune function, reduce infection risk, and aid in overall recovery. Tailoring these supplements to individual patient needs is essential for optimizing outcomes.

Evidence-Based Strategies for Supplement Use:

While the use of supplements is widespread in critical care settings, it is essential to base their administration on solid evidence. Recent research has provided valuable insights into the efficacy of specific supplements in different clinical scenarios. Highlighting these evidence-based strategies can guide healthcare professionals in making informed decisions regarding supplement prescription.

Challenges and Considerations in Supplement Administration:

Despite the potential benefits of supplements, challenges exist in their administration. Issues such as gastrointestinal intolerance, absorption issues, and drug-nutrient interactions need careful consideration. Monitoring patients for adverse effects and adjusting supplement regimens based on their response is integral to successful implementation.

Conclusion:

In conclusion, optimizing nutritional support through supplements is a critical aspect of medical nutrition therapy in critically ill patients. Understanding the unique challenges these patients face and tailoring supplement regimens based on evidence-based strategies can significantly impact outcomes. This presentation aims to empower healthcare professionals with the knowledge and tools necessary to navigate the complex landscape of nutritional support in critical care, ultimately contributing to improved patient care and recovery.

Symposium 3: Exploring Obesity in Adulthood

Plenary Lecture: State of Obesity 2023

Prof. Carel Le Roux, Professor of Chemical Pathology, University College Dublin, School of Medicine, Ireland



Symposium Lecture: The Impact of Obesity on Psychological Well-being

Prof. Athula Sumathipala, Professor of Psychiatry, Institute of global health and well-being, Keele University, United Kingdom



Symposium Lecture: Dietary Strategies for Effective Obesity Management

Prof. Ranil Jayawardene, Professor in Nutrition, Faculty of Medicine, University of Colombo



Obesity is a pressing global health concern, with its prevalence showing an alarming increase. Addressing this complex issue necessitates a comprehensive approach, where dietary strategies take center stage. This abstract provides a concise overview of the symposium lecture, encompassing both established and novel theories of weight management.

At its core, effective obesity management begins with caloric restriction, focusing on reducing overall calorie intake. However, beyond this fundamental principle, emerging theories are shedding new light on the intricacies of weight management.

One of the innovative concepts gaining prominence is personalized nutrition. The idea that individuals respond differently to various dietary approaches has led to the development of tailored dietary plans. These plans consider an individual's genetic makeup, metabolic profile, and gut microbiota composition to create a more precise strategy for weight loss and health improvement. Another novel theory explores the role of chrononutrition.

This theory suggests that not only what we eat but also when we eat matters. Aligning dietary choices with circadian rhythms may optimize weight management by promoting better metabolic health and reducing the risk of obesity-related complications. Furthermore, the concept of metabolic flexibility is gaining ground. Metabolic flexibility refers to the body's ability to switch between different fuel sources efficiently. Strategies that enhance metabolic flexibility, such as intermittent fasting and targeted dietary interventions, are being investigated for their potential in obesity management.

Special Guest Lecture: Supplements for Health & Performance in Sport

Prof. Ron Maughan, School of Medicine, St Andrews University, St Andrews, UK



ABSTRACTS OF ORAL PRESENTATIONS

Fruit and Vegetable Stories: Digital Storytelling to Influence Dietary Behaviors of Young Children

A.A.H.N. Gunasena¹ and T.Perera¹

Storytelling has played a significant role in the preservation of history and cultural legacy in many communities. Digital storytelling is an innovative approach that blends storytelling with digital technology. As technology-driven nutrition education tools are becoming emerging strategies, it is pertinent to evaluate the effects of digital storytelling in influencing healthy eating behaviors among different population groups. Hence, this study aimed to develop an interactive and novel digital tool named 'Magic Creatures and the Nutri-Garden' along with a digital gaming component to influence fruit and vegetable consumption of primary-aged school children. A sequential explanatory mixed method approach was employed. A series of focus group discussions (27 in 9 schools in the Uva province covering 67 students, 61 parents, and 55 teachers) and a pre and post-survey were conducted to identify the current consumption of fruit and vegetables among the children. The storybook prototype was developed along with a gaming component with the themes that emerged through the focus group discussions. Its' prototype was pretested with 20 parents and their children using pre and post-quantitative questionnaires. The preliminary results indicated an increase in the preference for several vegetables such as Carrots, Beans, Pumpkin, Cabbage, and Bitter guard and fruits such as Banana, Ambarella, Guava, Mango, and Amla after the use of the newly developed digital tool. Teachers, parents, and students perceived that digital storybooks offered an avenue to increase nutritional knowledge among young children. Future studies should warrant further investigation of the developed digital storybook along with the gaming component to educate and promote sustainable healthy eating habits in primary school-aged children.

Keywords: Children, Fruit and Vegetables, Focus groups, Storytelling, Sri Lanka

Conflicts of Interest: No conflict of interest to report in this study.

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, 60170, Sri Lanka

Malnutrition among Preschool Children in Medical Officer of Health Area Sammanthurai

M.H.M. Azaath¹

The double burden of malnutrition in under five years of age is a significant public health issue and it has become a critical concern during the economic downturn in Sri Lanka. Increasing malnutrition will aggravate the health inequalities between districts. There is a vacuum of study on malnutrition in rural settings. This study aims to assess the nutritional status of preschool children in the MOH area of Sammanthurai. A descriptive cross-sectional study among 350 preschool children aged 4-5 years in the Sammanthurai MOH area was conducted from 1st July to 31st July 2023. A convenience sampling technique was used to collect the data from 10 preschools from rural areas registered under the Sammanthurai Divisional Secretariat. Anthropometric measurements of height and weight of children were measured by using a stadiometer and a digital scale. Children's anthropometric data were collected after excluding the children whose age was less than 4 years. WHO Anthroplus software was used for data analysis. The average age of the children was 4.7 years, average height and weight were 101.87 cm and 14.61 kg respectively. Out of the total sample, 54.8% were boys and 70% were in the age of 5 years. The percentage of moderately and severely wasted was 16.68% and 3.9% respectively, while the percentage of moderately and severely stunted were 5.7%, and 2.3% respectively. The percentage of moderate underweight was 35% whereas 2.6% were overweight and 0.36% were obese. This study revealed the wasting, stunting, and underweight are higher than results found in other studies and urban settings. Obesity in the study samples remained low. The emergency nutrition plan involving the stakeholders, Community sensitization, and advocacy on appropriate nutrition for preschool children should be implemented. Regular monitoring of the growth of preschool children is crucial in clinical management. Policy decisions and district-specific strategies should integrate the life-cycle approaches. Further studies are recommended to identify the association of socio-economic factors on child malnutrition and micronutrient deficiencies.

Keywords: Child malnutrition, Child nutritional status, Stunting, Wasting, Underweight

¹Base Hospital, Sammanthurai, Sri Lanka

Use of Sun Exposure Determinants to Develop Sun Exposure Questionnaire to Estimate Vitamin D Status in Young Adults

R.M.T.K. Ranathunga¹, M.N.A. Shereen¹, V. Abinajah¹, and A.M.N.T. Adikari¹

Vitamin D deficiency is a common public health problem in many countries around the world, including Sri Lanka. Therefore, this study aimed to: i) identify the vitamin D status and factors associated with vitamin D status among young adults and ii) develop a sun exposure questionnaire to estimate the vitamin D status. A total of 75 young adults aged from 18 to 44 years were recruited from a rural setting in Sri Lanka by stratified random sampling. Socio-demographic and anthropometric information and Physical Activity Level (PAL) were gathered. A three-day diet diary was used to determine vitamin D intake. Sun exposure behaviors were identified using a sun exposure questionnaire. Serum 25(OH)D concentration was assessed using an Enzyme-Linked Immunosorbent Assay (ELISA). The mean serum 25(OH)D concentration of the participants was 49.67 ± 18.16 nmol/L. The percentage of vitamin D sufficiency, insufficiency, and deficiency was 34.5% (n=29), 47.6% (n = 40) and 7.1% (n = 6), respectively. Vitamin D status was associated with gender ($p = 0.006$), where the mean serum 25(OH)D concentration for males (55.46 ± 21.06 nmol/L) was significantly higher than for females (44.03 ± 12.73 nmol/L). Younger people had significantly higher ($p = 0.01$) serum 25(OH) D compared to older people. The nature of the occupation ($p=0.021$), duration of sun exposure ($p=0.003$), and skin exposure body area during weekdays ($p=0.019$) and weekend days ($p=0.043$) were significantly associated with serum 25(OH)D concentration. A sun exposure questionnaire was developed considering the factors that were significantly associated with serum 25 (OH) D concentrations. In conclusion, more than half of the young adults were vitamin D insufficient and deficient. The sun exposure questionnaire, which gathers information on the nature of the occupations, sun exposure duration, and skin exposure area, can be used as a tool to estimate the vitamin D status of young adults.

Keywords: Determinants, Sun exposure questionnaire, Vitamin D status, Young adults

¹Department of Applied Nutrition, Faculty of Livestock Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, 60170, Sri Lanka

Comparative Study of Eight Selected Front of Pack Labelling (FOPL) Systems in Different Countries and Explore the Importance of the Potential Harmonization

H.S.K. Nisansala¹, S.T.C. Mahawithanage¹, and D.M.U.A.J.K. Dassanayake

The accelerated nutrition transition to diets comprising ultra-processed foods is one of the key drivers for the emerging risk of non-communicable diseases (NCDs). Front of Pack Nutrition labeling (FOPL) has been introduced as an NCD-prevention strategy to promote healthier food choices. A variety of FOPL schemes have been implemented in the world which has now become a non-tariff barrier in the global food supply chain. The objective of this study was to explore a potential framework of global harmonization of FOPL. Currently available eight systems were selected and a literature review was done using three databases, particular international guidelines and country-specific regulatory guidelines, amendments, and policies. FOPL schemes can be classified as interpretive and non-interpretive schemes and nutrient-specific and summary indicators. Their variations are due to the country-specific aims and regulations along with presentation possessing their strengths and limitations. It is recommended to follow international standards in line with the World Trade Organization trade policies for every system to prevent trade barriers and for its efficient harmonized usage. Although international guidelines are available, achieving global harmonization is challengeable due to several reasons including different nutritional needs among different populations, different labelling systems, and different priorities and regulations of different countries. Among the various FOPL systems, interpretive, color-coded systems are considered to be more efficient than monochromes in imparting the desired effects of the FOPL. Although global harmonization is challengeable, measures can be still taken to some extent at least for processed and ultra-processed foods while the regional FOPL harmonization with similar nutrition requirements will be more feasible than global. Moreover, government involvement, research studies, public awareness, and continuous monitoring of the particular system with the mutual recognition of standards and requirements of different countries during international trading are suggested for an efficiently working FOPL scheme and potential harmonization.

Keywords: FOPL harmonization, FOPL schemes, Food labelling, Front of pack labelling (FOPL)

¹Department of Biochemistry, Faculty of Medical Sciences, University of Sri Jayewardenepura

²Fonterra Brands Lanka (Pvt) Ltd, Delgoda road, Biyagama

Design of Low-cost One-Dish Meal Menus (ODMs) for Canteens in Public Universities in Sri Lanka

G.M.S. Sarap¹, K.A.R.N. Kavindi¹, M.S.F. Sirasa¹, I.P.M. Wickramasinghe² and G.A.P. Chandrasekara¹

Meals are provided at university canteens to students and employees at concessionary rates in public universities in Sri Lanka. However, pricing and nutritional and sensory qualities of meals provided directly affect the level of acceptance of canteen meals by consumers. This study aimed to design and identify consumer attributes toward innovative, nutritious, low-cost ODMs for canteens in public universities. The study was conducted in two phases. During the first phase food consumption pattern of students and the disparity between recommended dietary intake and actual consumption were determined using 24-hour dietary recalls. Further, a comprehensive market survey was conducted to identify readily available, cost-effective, and nutritious vegetables to be included in ODMs. In the second phase, thirty nutritionally balanced ODMs were developed, using cost-effective ingredients as per food-based dietary guidelines for Sri Lankan adults. Each cooked menu was checked for sensory attributes using 50 untrained sensory panelists. The nutrient composition of each ODM and 24-hour dietary recalls were determined using Food-Base 2000 software. Results of the dietary assessment indicated suboptimal energy (1944 ± 716 Kcal), protein (49.2 ± 19.0 g), and fat (30.7 ± 12.8 g) intake, falling below Recommended Dietary Allowances (RDA) for both genders. Conversely, carbohydrate intake (411.6 ± 193.7 g) exceeded the RDA levels. Designed novel ODMs were commended for their appealing presentation, color, aroma, textures, and flavors. Mean energy, carbohydrate, protein, and fat values of the designed one-dish meals were 889.3 ± 14.0 Kcal, 107.3 ± 1.9 g, 20.7 ± 0.8 g, and $22.7.3 \pm 0.9$ g, respectively, per serving. The estimated nutritional values indicated a well-balanced macronutrient composition. The meals offer substantial energy, carbohydrates, and moderate levels of protein and fat. The canteen meals selected for inclusion were determined based on sensory attribute mean scores, with the top-performing meals achieving mean scores of 5.6, 5.4, and 5.3. The average cost per designed ODM was LKR 120 and was parallel to the present concessionary rate of a canteen meal. In conclusion, tailored nutritious meal options are acceptable to the university community. It is warranted the feasibility of introducing low-cost ODM options to provide adequate nutritional requirements at affordable prices in canteens in public universities in Sri Lanka.

Keywords: Balanced nutrition, Low-cost, One-dish meals, Recommended Dietary Allowances (RDA)

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, 60170, Sri Lanka

²University Business Linkage Cell, Wayamba University of Sri Lanka, Sri Lanka

Sri Lankan Parents' View on Grade 6-11 Food Literacy Education and School Food Environment for Children's Well-being

M.P.S. Rathnayake¹, J. Nanayakkara², T. Perera¹, A. Worsley³, A.O. Booth² and K.D.R.R. Silva¹

Parents can provide valuable inputs regarding their children's food literacy education based on their experience in real-world contexts. This qualitative study aimed to understand parents' perspectives on broad aspects of the current state of grade 6 to 11 food literacy education and school food environment. The study was conducted across six provinces in Sri Lanka, namely Southern, North Western, Northern, Eastern, Western, and Central. A total of 53 participants were recruited for eight focus group discussions using a maximum variation sampling technique to ensure representation from different socio-cultural and economic backgrounds. The discussions were guided by open-ended questions designed to explore parents' opinions, attitudes, and experiences related to grade 6 to 11 food literacy education and the school food environment. Additionally, their suggestions for improving food literacy education were solicited. All discussions were recorded, transcribed, and translated into English for thematic analysis using NVivo 12 software. Five themes were identified; namely (i) the importance of food literacy education, (ii) current food-related behaviours of students (iii) Parental anticipations, (iv) barriers to food literacy education, and (v) school food environment. Parents reported most children had sufficient theoretical food-related knowledge, but did not apply it in their day-to-day life. It is noted that children's involvement was low in some food-related activities like gardening and food preparation. There were several barriers to school food literacy education including the lack of qualified and trained teachers, inadequate kitchen facilities, and insufficient extra-curricular activities in some schools. Parents suggested adding more food preparation lessons in curricula and implementing awareness programs in schools. They also suggested having more control over school canteens to prevent unhealthy food promotion. The study findings support the recommendation that the education authorities implement practical-oriented food literacy education programs and improve the food environment in secondary schools.

Keywords: Focus group discussions, Food literacy education, School, Students, Qualitative research

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¹Department of Applied Nutrition, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), Sri Lanka

²Deakin University, Geelong, Australia, Institute for Physical Activity and Nutrition (IPAN), School of Exercise and Nutrition Sciences

³School of Exercise and Nutrition Sciences, Deakin University, Geelong, VIC, 3220, Australia

Pumpkin (*Cucurbita maxima*) Soup as a Strategic Weight Loss Meal Replacement

D.S. Perera¹, B.A.S.R.P. Wijayarathna¹, S. Mahendran¹ and K.M. Rathnayake¹

Obesity is an alarmingly increasing global public health issue including Sri Lanka. Maintaining a negative energy balance by providing low-calorie meal replacements is a widely used strategy for weight management. *Cucurbita maxima* is a low-calorie nutritious commonly available vegetable in the local Sri Lankan market with blood glucose and cholesterol-lowering effects. This study aimed to evaluate the effect of consuming pumpkin soups as a low-calorie dinner meal replacement on weight and metabolic parameters of adults with overweight or obesity. A parallel, randomized controlled community intervention trial was conducted in 44 adults with mean \pm SEM age and BMI 37.7 \pm 11.2 yrs and 28.8 \pm 4.0 in kg/m², respectively for 8 weeks. Participants were randomly assigned to the test and control groups on a 1:1 ratio. The intervention group (n=22) was provided with a low-calorie meal replacement 'pumpkin soup' prepared using 250g of whole pumpkin as a dinner four times per week, and the control group (n=22) was asked to continue their habitual diets. Both groups received general food-based dietary guidelines before starting the trial. Weight, height, waist and hip circumferences, and body composition measurements were taken at 0, 4, and 8 weeks. Fasting blood glucose, lipid profile, blood pressure, and arterial stiffness in terms of pulse wave velocity were assessed during the baseline and the last visit. There were no significant differences in baseline characteristics between the two groups. There was a significant (P=0.001) weight reduction in the intervention group (2.7kg) than in the control group (1.3kg). A significant reduction in fat mass (P=0.003), visceral fat level (P=0.029), waist circumference (P=0.001), total cholesterol (P=0.002), and LDL cholesterol (P=0.001) were observed in the intervention group than in the control group. In conclusion, the use of pumpkin soup as a dinner meal replacement showed favourable effects on weight reduction and improving cardio-metabolic risk markers in overweight and obese adults.

Keywords: Low-calorie meal replacement, Obese, Overweight, Pumpkin, Weight reduction

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, (60170), Sri Lanka

Opportunities and Barriers of Fruit and Vegetable Consumption among Adolescents, Adult Non-pregnant and Pregnant Women in Sri Lanka

H.S.P. Appuhamy¹, S.M.H.D. Sitisekara¹, S. Pathmarajan¹, O.K.D. Silva¹, H.M.N.J. Karunarathna¹, R.M.T.K. Ranathunga¹, T. Perera¹ and K.D.R.R. Silva¹

Fruits and Vegetables (F&V) are essential components of a balanced diet. However, consumption of F&V among Sri Lankans is below the recommended level of 400g of F&V per day. Understanding the factors affecting on consumption pattern of F & V could be effectively applied in nutritional intervention programmes to promote F&V consumption. Thus, a qualitative study was conducted to discover the opportunities and barriers among adolescents, adult pregnant, and non-pregnant women in Western, North Western, and Northern provinces in Sri Lanka. Focus Group Discussions (FGDs) were conducted among adolescents (18 FGDs), adult non-pregnant women (16 FGDs), and pregnant women (16 FGDs) in selected areas. Study samples were selected purposively according to convenience. Data analysis was done using Nvivo 12 software. In FGDs, four main themes; perceptions (knowledge, attitudes, and perceived health benefits), practices, opportunities, and barriers for F&V consumption; and suggestions to improve F&V consumption were revealed. A positive association between food literacy level and F&V consumption, supported by socio-environmental, personal, and behavioral factors was found among adolescents. Both adult non-pregnant women and pregnant women were found to have awareness about the health benefits of fruits and vegetables but were less aware of the dietary recommendations of F&V. High price, busy lifestyle, less time available for cooking, and preference of their children were the main factors affecting low F&V consumption of non-pregnant women, whereas high cost, myths, personal preference, medical concerns, influence and preference of family members, F&V accessibility and seasonal variations were identified as the main factors affecting F&V consumption of pregnant women. Promoting home gardening, raising awareness of the benefits of F&V consumption, popularizing farmers' markets and financial support are the suggestions to improve F&V consumption among the participants. F&V consumption was influenced by cost, availability, preferences, and convenience among adolescents, pregnant women, and non-pregnant women. Further, targeted behavioral change interventions are recommended to improve the consumption of F&V among the different population segments.

Keywords: Consumers, Focus Group Discussions, Intervention, Perceptions

¹Department of Applied Nutrition, Faculty of Livestock Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, 60170, Sri Lanka

Association between Sucrose Preference & Sugar Content of Favourite Foods & Beverages among Sri Lankan Adults

N.G.C.M. Narampanawa¹, H.M.N.J. Karunaratna¹ and K.M. Rathnayake¹

Preference for sweeter taste is an important determinant of greater intake of high-calorie sugary foods that leads to an increased risk of obesity & related metabolic disorders. This study aimed to determine the association between sucrose preference & sugar content of favorite foods & beverages among Sri Lankan adults. In a cross-sectional study, 64 healthy adults aged between 20-60 years (Mean \pm SD, 25.1 \pm 2.7) were recruited. The Monell-Forced-Choice-Paired-Comparison method was used to measure the sucrose preference of adults. A food-liking survey, which contained seven points facial hedonic scale, was used to identify the favourite food and beverage items consumed by the subjects. The sugar content of favorite beverages & foods was determined using a refractometer & FoodBase 2000 nutrient analysis software modified for Sri Lankan foods, respectively. A self-administered general questionnaire was used to assess the socio-demographic characteristics of subjects. The height, weight, and waist circumference of the subjects were measured. Body composition was assessed using a multi-frequency segmental body composition analyzer. The level of sucrose preferred ($P=0.037$, $\beta= -3.126$, $r=0.261$) correlated with the sugar content of the favorite beverage but not with the food item. Adults who preferred high sucrose levels liked low-sugar beverages while male adults preferred significantly higher sucrose levels than females ($P=0.044$, $r=0.252$). BMI ($P=0.004$, $\beta= -0.122$, $r=0.600$), waist-to-hip ratio ($P=0.009$, $\beta= -2.171$, $r=0.600$) and visceral fat level ($P=0.027$, $\beta= -0.080$, $r=0.600$) significantly correlated with sucrose preference of adults. A higher proportion of underweight subjects (20.3 %) preferred high sucrose levels compared to normal, overweight & obese adults. In conclusion, the level of sucrose preference was associated with the sugar content of the most favorite beverage but not with the food item while males preferred high sucrose levels over females. A larger sample size with a better representation of population characteristics is warranted to generalise the findings to Sri Lankan context.

Keywords: Facial hedonic scale, Monell-Forced-Choice-Paired-Comparison, Preferred sucrose level, Refractometer, Sugar content

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, (60170), Sri Lanka

Physico-chemical and Nutritional Properties of Dehydrated Defatted Coconut Flour-incorporated Sandwich Bread

L.L.W.C. Yalegama¹, H.P.D.T. Hewa Pathirana¹, J.M.N. Marrikkar², and G.S. Hansini¹

Defatted desiccated coconut flour (DDCF) is prepared from the pressed cake virgin coconut oil production process and it is rich in edible fiber. This research aims to develop a low-gluten, high-fiber sandwich bread partially substituting wheat flour from DDCF. The DDCF was separated using the three sieve sizes (>500 µm, 500-150 µm, and <150), and flour properties (oil absorption, water absorption) of each category were analyzed with wheat flour as the control. Different sieve sizes of DDCF were used for sandwich bread preparation and sensory properties were tested. Six composite flour samples were prepared to make sandwich bread with varying proportions of DDCF (without sieving) and wheat flour (T1- 0% DDCF, T2-5% DDCF, T3-10% DDCF, T4-15% DDCF, T5-20% DDCF, and T6-25% DDCF flour). The proximate composition and texture of each bread were analyzed. The treatments were arranged in a completely randomized design, and data were analyzed using Minitab 19 software. Significantly high oil absorption (9.40 ± 0.00 g/ml) and water absorption (9.00 ± 0.00 g/ml) were observed in wheat flour while significantly higher solubility has resulted in the 500-150 µm sieved size having DDCF. The sieve size of DDCF is not affected by the sensory properties of bread and dough properties. Significantly high textural properties and hardness have resulted in T5 treatment (5217 ± 505 g). DDCF 5-15% has a similar texture to 100% of wheat flour bread. However, the crude fiber content increased with the DDCF, and gluten protein and starch were reduced with the substitution of wheat flour. Based on the results of the study, a 5-15% substitution of DDCF for making sandwich bread is recommended.

Keywords: Defatted desiccated coconut flour, Sandwich bread textural properties, Proximate composition

¹Coconut Processing Research Division, Coconut Research Institute, Bandirippuwa Estate, Lunuwila

²National Institute of Fundamental Studies, Hanthana, Kandy

Formulation and Characterization of Bael (*Aegle marmelos*) Pulp-based Biodegradable Edible Packaging

D.M.P.S. Hemantha¹ and R. Sabaragamuwa¹

Edible film development has accelerated dramatically in recent decades which has a significant impact on the environment by reducing plastic usage. The present study was focused on formulating bael fruit (*Aegle marmelos*) pulp extract-based biodegradable and edible film combined with edible glycerol and corn flour as a plasticizer and binder, respectively. Treatments were arranged in a complete randomized design by adding different corn flour ratios including 0%, 3%, 6%, and 9% and the physical and sensorial properties were analyzed. There was no significant difference between the thickness of each treatment at $p < 0.05$. A gradual decline in water solubility, acid solubility, moisture content, and water vapour transmission rate of developed treatments was identified with an increase in corn flour addition, except for water absorption. The film with 3% corn flour has shown the lowest water absorption (17.47 ± 4.62 mg) at room temperature, moisture content (10.78 ± 0.33 mg), and water vapor transition rate (250.97 ± 0.15 mg). Further, water absorption capacity, water solubility, acid solubility using citric acid, moisture content, and water vapor transmission rate of developed treatments were significantly different at $p < 0.05$. Treatment with 3% corn flour has shown a lower fracturability (171.4g) than other corn flour-added treatments while the treatment without corn flour has shown the lowest fracturability. There was a slight increase in the pH value of each treatment after one week of period. Treatment with 3% corn flour was selected as the best film based on the overall results. The developing process of this film would be more economically viable since the satisfactory yield was 80.7%. The study revealed the possibility of developing a biodegradable, edible film based on the bael pulp extract, and it can be used to minimize food waste and plastic usage in food packaging.

Keywords: Bael pulp extract, Biodegradable, Edible packaging, Environmentally friendly

¹Department of Food Science and Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Sri Lanka

Physicochemical, Sensory, and Nutritional Properties of Coconut (*Cocos nucifera*) Kernel-based Curry Cube

E.V.F. Arachchi¹, H.P.D.T. Hewa Pathirana², L.L.W.C. Yalagama², and T.C. Kananke¹

A study was conducted to develop a curry cube to replace coconut milk with coconut paste utilizing all nutritional components of coconut kernel in the food system in food preparation. Ground dehydrated coconut (Coconut paste -CP) in its mature stage and curry mix developed in Coconut Research Institute were the basic ingredients. Treatments were arranged in two factors factorial design as T1 to T3 as 25% CP with three levels (0%, 1.5%, and 3%) of corn flour (CF) while T4 to T6 as 18% CP with CF (0%,1.5%, 3%) and 75% of curry mix was added to each treatment. CF maintains the cube's structural integrity and more cohesive consistency when the cube is dissolved or used in cooking. The functional properties of curry cubes were determined. Dhal curry (100g) was prepared with each curry cube (5g) with water (300ml) and two sensory tests (Test 1: T1, T2 and T3, Test 2: T4, T5, T6) were conducted to select the best treatment and their nutritional composition and shelf life were determined. Water absorption, oil absorption, and disintegration time of curry cubes from 6 treatments were significantly different ($P<0.05$) while bulk density, tapped density, and solubility were similar ($P>0.05$), and no significant interaction between CP and CF except for the disintegration time ($P<0.05$). Curry cube T3 (25% CP with 3% CF) was the best from test 1 and T6 (18% CP and 3%) was the best from test 2. T3 and T6 were rich in crude fat ($32.11\pm0.86\%$, $29.24\pm1.18\%$), crude protein (12.48 ± 0.86 , $12.08\pm0.18\%$) and crude fibre (11.93 ± 1.84 , $12.01\pm1.97\%$) respectively. The concentration of phenolic components and DPPH radical scavenging activity was similar in both cubes. Moisture, peroxide value, free fatty acid content, total plate count, and yeast and mold counts were at acceptable levels in one month of the refrigerator which was the best storage condition. This study concludes that CP can be used to make curry cubes to provide the wholesomeness of coconut kernel.

Keywords: Coconut paste, Corn flour, Curry cube, Functional properties, Nutritional properties

¹Department of Food Science and Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Sri Lanka

²Coconut Processing Research Division, Coconut Research Institute, Bandirippuwa Estate, Lunuwila, Sri Lanka

Dietary Patterns of the Female Sterilization-induced Menopausal Women in Karnataka, India: A Cross-sectional Study

J. Saulam^{1,2}, S.M. Al Hasan³, M. Panaghanti², F. Mikami¹, and H. Yokoi¹

During the menopausal transition, consuming a healthy diet could influence the maintenance of adequate health but data are limited. We aimed to assess the dietary pattern and nutritional status of female sterilization-induced menopausal women in Vijayapura district, Karnataka, India. A multi-stage random sampling process was used for this cross-sectional study and interviewed 270 postmenopausal women aged 45-60 years. The reason for menopause was self-reported by the interviewed women. A food frequency questionnaire composed of food items nested in 16 food groups was used for dietary assessment. This 16-food-group dietary diversity assessment tool was validated for women in resource-poor settings in developing countries. The dietary pattern of the postmenopausal women was identified by principal component analysis. The prevalence of female sterilization-induced menopause among women was about 33%. Age at menopause was found significantly earlier in the female-sterilization-induced menopausal women compared to the natural menopausal women. The average age of women was 52.3 years and 93% of them were housewives. About 43% of the women were found overweight. More than 90% of these menopausal women had daily intakes of dark green vegetables, fruits, legumes, and milk. Vitamin-A-rich vegetables and fruits were taken weekly by most of these women. However, intake of animal-origin foods was not found in most women (more than 85%). Daily consumption of vitamin-A-rich vegetables (25% vs. 10%) and fruits (30% vs. 10%) was found significantly higher in the women who had natural menopause compared to female-sterilization-induced menopausal women. The same pattern was also observed for monthly meat intake between the two groups. In addition, we identified four dietary patterns among the postmenopausal women: almost no animal-origin foods, vitamin-A-rich vegetables, other vegetables-rich, and roots and tubers-rich dietary patterns. Female-sterilization-induced menopausal women in our study had a lower daily intake of vitamin-A-rich fruits and vegetables compared to women who had natural menopause. Most of the respondents had a low intake frequency of animal-origin foods which may cause lower high-class protein intake.

Keywords: Dietary intake, Female sterilization, Food groups, Postmenopausal women

¹Department of Medical Informatics, Faculty of Medicine, Kagawa University, Kagawa, Japan

²Department of Food Processing and Nutrition, Karnataka State Akkamahadevi Women's University, Vijayapura, Karnataka, India

³Department of Nutrition and Food Technology, Jashore University of Science and Technology, Jashore, Bangladesh

Antioxidant and Sun Protection Potential of Crude Bark Extract and Fractions of Ceylon Cinnamon (*Cinnamomum zeylanicum* Blume) *In Vitro*

K.N.K. Senarathne¹, W.P.K.M. Abeysekera¹, W.K.S.M. Abeysekera², G.A.S. Premakumara³, and A.H.L.R. Nilmini⁴

Ceylon Cinnamon (CC), known as true cinnamon worldwide is renowned for a wide range of biological activities that can be used in many applications such as functional foods, nutraceuticals, cosmeceuticals, and nutricosmetics. In recent studies, it has been shown that crude bark extract (CBE) of CC had high anti-oxidant and anti-aging properties via multiple mechanisms. However, no attempt has been made to fractionate the CBE and study its biological activities to be used in the said applications. The present study evaluated CBE and fractions of CC for a range of antioxidant properties (AP) and sun protection potential *in vitro*. Alba-grade bark of CC was extracted in 95% ethanol-water, the solvent was then evaporated, and the resulting sample was freeze-dried. It was then subjected to a sequential partitioning process using hexane, ethyl acetate, and ethanol. The resulting fractions and the CBE were evaluated for a range of AP namely, total polyphenolic content (TPC), total flavonoid content (TFC), ferric reducing antioxidant power (FRAP), DPPH radical scavenging activity, ABTS radical scavenging activity and sun protection factor (SPF) using 96-well microplate assay protocols (n=3 each) *in vitro*. Results showed significant differences (P<0.05) among the CBE and fractions for the studied AP and SPF. The TPC, TFC, FRAP, DPPH, ABTS, and SPF of CBE and fractions ranged from 38.98±1.22-160.33±3.63 mg Gallic Acid Equivalents/g of extract, 1.63±0.25-10.39±1.16 mg Quercetin Equivalents/g of extract 558.14±12.37-2077.60±71.16 mg Trolox Equivalents (TEs)/g of extract, 91.19±9.36-1897.13±774.50mg TEs/g of extract, 103.61±6.12-1243.94±61.33mg TEs/g of extract and 13.87±0.90-52.47±0.26 SPF respectively. The highest TPC, TFC, and FRAP were exhibited by CBE, while ethanol fraction showed the greatest ABTS and DPPH radical scavenging activity. Interestingly, the hexane fraction demonstrated the highest sun protection potential. It is concluded that CBE and ethanol & hexane fractions could be used in the formulation of functional foods, nutraceuticals, cosmeceuticals, and nutricosmetics.

Keywords: Antioxidants, Ceylon Cinnamon, Crude Bark Extract, Fractions, Sun Protection Potential

¹Department of Bio Systems Technology, Faculty of Technology, University of Sri Jayewardenepura

²Department of Agricultural Technology, Faculty of Technology, University of Colombo

³Department of Basic Science and Social Science, Faculty of Nursing, University of Colombo

⁴Department of Materials and Mechanical Technology, Faculty of Technology, University of Sri Jayewardenepura

Development of Butter incorporating Brown Seaweed Powder as a Source of Fucoxanthin

P.P.W. Anuruddhi¹, D.C. Mudannayake¹, B.V.A.S.M. Bambaranda¹, D.I. Egodavitharana¹, and M. Yesna¹

Fucoxanthin is a marine carotenoid and a major pigment of brown seaweeds. Fucoxanthin offers various nutritional and therapeutic benefits. This study was conducted to develop a butter incorporating two brown seaweed species, *Sargassum cristaefolium* (SC) and *Padina antillarum* (PA) as a potential source of fucoxanthin. Fresh seaweeds were cleaned, blanched, and oven-dried at 40 °C for 48 h until moisture reached below 10% and ground to make fine powders. Ethanol extractions of fucoxanthin were prepared using an ultrasound-assisted extraction method. Phytochemical analyses such as fucoxanthin, flavonoids, phenolic, tannin, chlorophyll a and b, total chlorophylls, and carotenoids were performed. Antioxidant activity was assessed using DPPH RSA standard methods for both seaweed powders and fucoxanthin ethanol extractions. PA and SC powders showed fucoxanthin levels of 3.17±9.70 µg/g and 0.89±0.06 µg/g and DPPH RSA levels of 35.38±2.19 and 33.68±3.51 respectively in their dehydrated powders. Although the Fucoxanthin content of the product can be improved using extracted fucoxanthin, considering the commercial feasibility dehydrated seaweed powders were used to prepare butter. Butter was prepared using 0%, 1%, 2%, and 3% w/w of SC or PA seaweed powders, separately. Sensory evaluation was conducted to assess consumer acceptability using 30 untrained panelists and a 9-point hedonic scale. Friedman's statistical analysis revealed that butter incorporated with 2% SC and 1% PA have significantly higher sensory attributes in color, taste, and overall acceptability ($p<0.05$) and were selected for further analysis. Fucoxanthin and DPPH RSA values in the 2% SC and 1% PA added butter were 0.03±0.01 µg/g, 0.003±0.01 µg/g and 62.94±0.29, 65.20±1.05, respectively. Shelf life evaluation was carried out using total plate count, yeast and mold count, and coliform during storage of butter. Dehydrated PA powders contained significantly higher fucoxanthin content compared to that of SC powder. The results revealed that fucoxanthin and other phytochemical compounds-rich butter can be prepared using SC and PA seaweeds.

Keywords: Brown Seaweeds, Fucoxanthin, *Padina*; *Sargassum*

¹Department of Animal Science, Uva Wellassa University, Sri Lanka

Efficacy of Wastepaper and Rubber Sawdust as Substrates for the Cultivation of *Pleurotus eous*: An Analysis of Growth, Nutritional Levels, and Antioxidant Activity

R. Sivakumar¹, W.H.N. Madhushani¹ and G.S.G. Liyanage¹

Pleurotus eous, also known as the Bhutan oyster, is a mushroom species that accounts for 25% of the mushrooms cultivated globally. Since they are rich in nutrients and contain bioactive compounds that exhibit antibacterial, antioxidant, and anti-inflammatory properties, they are utilized in the food and pharmaceutical industries. Various lignocellulosic waste substrates, commonly rubber sawdust, are used to grow *Pleurotus* species. The main objective of this study was to investigate the effect of an alternative substrate; wastepaper (WP) along with rubber sawdust (SD) on the growth, nutritional levels, bioactive compound levels, and antioxidant activities of *Pleurotus eous*. Five substrate combinations; 100%SD (subA), 75%SD + 25%WP (subB), 50%SD + 50%WP (subC), 25%SD + 75%WP (subD) and 100%WP (subE), were used. Quantitative tests like phenol sulfuric assay for carbohydrates, Lowry assay for proteins, phosphomolybdenum assay for total antioxidant capacity, Folin-ciocalteu assay for total phenolic content, and DPPH assay for radical scavenging activity were performed. Mushrooms from subA had the highest total phenolic content (11.87 ± 1.46 mg GAE/g) and total carbohydrate content (4.57 ± 0.48 g/100g). subD combination was the best for producing mushrooms with the highest total antioxidant activity (4.14 ± 0.29 mg AAE/g) and total protein content (7.36 ± 0.68 g/100g). Mushrooms from subE produced the mushrooms with the lowest half maximum inhibitory concentration for DPPH (14.08 ± 1.08 mg/ml). subC produced the mushrooms that had the highest number of fruiting bodies and fresh weight (43.50 ± 2.03 g). In conclusion, it can be suggested that based on the nutritional values and antioxidant properties both 100% substrates and their combinations are effective. However, considering the mushroom yield, 50%SD + 50%WP combination can be recommended as the most effective substrate combination to grow *Pleurotus eous*.

Keywords: Bioactive compounds, Nutritional profile, *Pleurotus eous*, Sawdust, Wastepaper

¹Department of Biotechnology, BMS School of Science, Colombo 06, Sri Lanka

**Starch Digestion Inhibitory Activities by Hot and Cold Brewed Fruit Tea Infusions:
An *in vitro* Study**

T.M.S.L.M. Thennakoon¹, M. Sahabandu¹ and G.A.P. Chandrasekara¹

Prolonged exposure to postprandial blood glucose elevations resulting from the consumption of high-glycemic-index starchy foods is associated with an increased risk of developing type 2 diabetes. Tea, including other herbal beverages that are rich in phenolic compounds, can reduce postprandial blood glucose levels by inhibiting starch digestive enzymes. This study aimed to identify the effect of hot and cold brewed fruit tea infusions on starch digestion inhibitory activities. Java plums (*Syzygium cumini*), wood apple (*Limonia acidissima*), carambola (*Averrhoa carambola*), and June plums (*Spondias dulcis*) fruit tea infusions were studied against black and green teas as controls. Rice and wheat flour were co-digested with fruit teas, black tea, and green tea infusions. The free glucose content of digested samples was determined using the Biorex Diagnostic enzymatic kit following the given protocol. The starch digestion inhibition percentages by tea infusions were calculated. The total phenolic contents of digested tea samples were determined using Folin Ciocalteu reagent. Data was statistically analyzed using SPSS 16.0. All tested tea infusions showed a significant inhibitory effect on the digestion of starch of rice and wheat flour ($P < 0.05$). Java plum and wood apple hot or cold brewed tea infusions showed the highest inhibition of starch digestion. There was no significant effect of the brewing method and total phenolic content on the inhibitory activity of starch digestion ($P < 0.05$). In conclusion, fruit tea infusions may have the potential to serve as a functional beverage in the prevention and treatment of type 2 diabetes.

Keywords: Antioxidant, Hot and cold brewing, Phenolic compounds, Rice, Wheat

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, 60170, Sri Lanka

ABSTRACTS OF POSTER PRESENTATIONS

Improving Child Nutrition Through Community Empowerment in COVID-19 Recovery in the Plantation Sector

G.N.D. Guruge^{1,2}, R. Weerathunge², P. Dineshkumar², M. Komaladevi², H.M.S. Kumari², L.R. Perera³, S. Amunugama³, and C.P.V.V. Priyadarshani²

Community-led interventions that produce changes in day-to-day lives are broadly called 'health promotion'. The tea industry represents one of the main aspects of the economy of Sri Lanka and according to the Sri Lanka Demographic and Health Survey (SLDHS) carried out in 2016, the nutritional status of under-five children in the Estate sector is poor compared to Urban and Rural sectors. The present study aims to apply health promotion principles for the improvement of nutrition among the children in communities located in the 'plantation sector' to help them in the recovery from the COVID-19 pandemic. This study was conducted with grass-root health staff and members of mother groups in the Kegalle and Hatton regions. After providing a preliminary training programme that covered various aspects related to child nutrition, focused group discussions and interviewer-administered questionnaires were implemented to gather qualitative and quantitative data. The training was carried out for 6 months (grass-root health staff was trained initially and members of mother groups were trained through them) as interactive sessions that included lectures, educational videos, and role-plays. A total of 90 participants (55 officers and 35 members of mother groups) took part in the data collection. Thematic analysis was performed to analyze the qualitative data, thereby identifying the recurring sub-themes related to knowledge, attitudes, and skills/practices gained by the participants. Quantitative data were subjected to a chi-square test using SPSS. The results indicated that 100% of the participants perceived the capacity-building programme as a productive attempt. As per Qualitative analysis, participants have gained the understanding that nutrition can be gained by the efficient use of the limited resources they have. As per quantitative analysis, the capacity-building programme has developed a significant level of new knowledge, positive attitudes, and important skills/practices related to child nutrition ($P < 0.05$). Notably, the improvements among grass-root level health workers were stronger in the areas of knowledge and attitudes ($P < 0.05$) while the mother group members showed improvement in the areas of attitudes and skills/practices ($P < 0.05$).

Keywords: Capacity building, Child nutrition, Grass-root level health workers, Health promotion, Plantation sector

¹Rajarata University of Sri Lanka, Mihintale

²The Foundation for Health Promotion, 21/1, 1/1, Kahawita Mawatha, Attidiya, Dehiwala

³Plantation Human Development Trust, No: 427/14, Robert Gunawardena Mawatha, Battaramulla

Nutritional Awareness and Perceptions of Fruit and Vegetable Supply Chain Players in Sri Lanka

W.A.D.P. Ishara¹, S.M.H.D. Sitisekara¹, H.M.N.J. Karunaratna¹, T. Perera¹, R.M.T.K. Ranathunga¹ and K.D.R.R. Silva¹

Though fruits and vegetables are indisputably rich in a myriad of nutritional and functional properties, their consumption has been poor in many communities in Sri Lanka. This can be attributed to certain constraints in availability and affordability in the supply chain. This study aimed to investigate the nutritional awareness and perceptions of different players in the fruit and vegetable supply chain and to propose initiatives to address constraints while promoting sustainable healthy diets. A qualitative study was conducted with farmers, agricultural officers, collectors, transporters, wholesalers, retailers and agriculture-related researchers covering the Central, Uva, and Southern provinces of the country. Study locations were selected, considering the supply chain players' availability and convenience. Altogether 30 key informant interviews involving different players in the supply chain were carried out. The interviews were analyzed for common themes that emerged. Nutritional awareness and perceptions were poor in almost all the supply chain players. The gaps identified in the present fruit and vegetable supply chain system mainly included inadequate nutritional consideration among the most of stakeholders including farmers, wholesalers, transporters, collectors, and vendors. Their attitudes, perceptions, and practices have only focused on earning profits with minimal thought given to nutrition. Likewise, unnecessarily long supply chains, lack of planting material and other agricultural inputs, and poor packing houses and infrastructure facilities to minimize postharvest losses were also highlighted as obstacles to increasing the availability and subsequently the affordability of fruit and vegetables for the consumers. The study further revealed that the majority of the supply chain players depended on the price and the outer appearance of the fruits and vegetables, misunderstanding the requirements of the consumers with respect to quality and nutrition. This information provides valuable baseline information to create novel sustainable and effective strategies linking supply and demand sides to promote fruit and vegetables in the Sri Lankan diet.

Keywords: Fruit and Vegetables, Key Informant Interviews, Perceptions, Supply Chain, Sri Lanka

Conflicts of Interest: No conflict of interest to report in this study.

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¹Department of Applied Nutrition, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, 60170, Sri Lanka

Development of a Convenient Breakfast Meal using the Underutilized Yam Variety Hingurala (*Dioscorea alata*)

N.A.A.S. Nishshanka¹, L.A. Wickramaarachchi^{1,2}, and M.A. Jayasinghe¹

Hingurala (*Dioscorea alata*) is an under-utilized tuber crop in Sri Lanka containing an array of nutrients. This study was carried out to develop a functional and convenient powder-form breakfast meal (Nutri Mix). The levels of moisture, total ash, total fat, crude protein, crude fiber, minerals (Calcium, Magnesium, Iron, and Zinc), phytochemicals (saponins, alkaloids) antioxidant capacity, and shelf life were determined in this developed product. In addition to that, the starch hydrolysis rate of Hingurala flour and the caloric value of the product were determined. Sensory evaluation was conducted to identify the best formulation with the highest consumer acceptance. The sensory properties in terms of appearance, texture, odor, taste, and overall acceptability were analyzed by a semi-trained panel of 30 and each property scored above the 4.0 average value. Sensory properties were analyzed statistically using Minitab 14 statistical software. The main ingredient of the powder-based breakfast meal is Hingurala flour (67%). The nutri mix powder contains Kuruluthuda rice flour and Moringa powder in addition to Hingurala flour. The Taguchi experimental design was carried out for the formulation of the product. The developed nutri mix recorded results as, moisture content as 3.40 ± 0.03 %, fat content as 2.57 ± 0.12 %, crude protein content as 9.31 ± 1.44 %, total ash content as 2.25 ± 0.89 % and crude fiber content as 1.71 ± 0.57 %. The mineral composition of nutri mix was recorded as Iron (Fe), Calcium (Ca), Zinc (Zn), and Magnesium (Mg) respectively 1.62 mg/kg, 2616.34 mg/kg, 2.61 mg/kg, and 732.42 mg/kg. The results showed that saponins and alkaloids contents ranged in nutri mix 4.33 ± 0.40 % and 0.013 ± 0.003 CE mg/ml respectively. The IC_{50} value of this product was recorded as 3.10 ± 0.12 μ g/ml for DPPH. Energy from 100g of product was calculated as 383.53 kcal. In conclusion, breakfast meal from *D.alata* yam flour is a suitable ingredient for the development of novel, nutritious, and functional food products.

Keywords: *Dioscorea alata*, phytochemicals, Kuruluthuda, Moringa, Starch hydrolysis rate

¹Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka

²Ceylon Organic House (Pvt) Ltd, 207, Pathiragoda Road, Maharagama, Sri Lanka

Nutrition Knowledge and Dietary Supplement Use of Under-19 Women's Development Cricket Squad in Sri Lanka

W.D.W. Senanayake¹, U.N.J. Dahanayake¹, and C.M. Wickramatilake²

Knowledge of nutrition in young female cricket players and their dietary practices including supplement use are important to enhance their performances and to maintain their general health. The objectives of the study were to describe the nutritional knowledge and dietary practices among the under-19 women's development cricket squad in Sri Lanka during 2022. We collected data using an interviewer-administered questionnaire. Height and weight of the players were measured following standard protocols and body mass index (BMI) was calculated. Data was analyzed using descriptive statistics. A total of 76 players (13-18 years) comprised 18(23.7%) batters, 14(18.4%) bowlers, 30(39.5 %) batting all-rounders and 14(18.4%) bowling all-rounders. Among them, 74 had attained menarche out of whom 62 (83.8%) experienced regular menstrual cycles. The Mean (SD) duration of training per week was 5 ± 2.3 hours and 39 (51.3%) had longer durations of training of more than 5 hours. The majority 41 (54%) were in the healthy weight range based on BMI, while 24 (31.6 %), 8(10.5%), and 3(4.0 %) were underweight, overweight, and obese respectively. Most of them 69 (90.8%) did not restrict their diet. The majority identified carbohydrates as the main energy substrate 39 (51.3%). Most of them are aware of protein as the main nutrient for muscle building 58 (76.3 %). The majority recognized protein as the most important recovery nutrient 32 (42.1%) and water as the best fluid during competition 55 (72.4%). The majority were not on supplements 56 (73.7%) and were aware of the risk of doping with supplement consumption 51 (67.1%). Most of the players were in the healthy weight range. Their awareness of the main substrates for energy and muscle building and the doping with supplement use is satisfactory. However, the majority do not recognize carbohydrates as the main recovery substrate and sports drinks as the best fluid during competition. Most of them do not consume supplements.

Keywords: Diet, Knowledge, Nutrition, Supplement, Women's cricket

¹Institution of Sports Medicine, Ministry of Sports, Colombo Sri Lanka

²Department of Biochemistry, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka

Nutritional Status and Prevalence of Anemia among Female Undergraduates Residing in Hostels of University of Sri Jayewardenepura

M. Ruchirani¹, H. Amithma¹, and R. Perera²

Maintaining optimal health and well-being, especially for menstruating women, relies significantly on proper nutrition. Female undergraduates residing in hostels are at risk, as the transition to university life can significantly affect their access to adequate nutrition. Consequently, anemia, a condition closely tied to suboptimal nutrition, presents a critical concern for this demographic. To assess the prevalence of anemia and to explore the association between nutritional status with anemia among female undergraduates residing in hostels of the University of Sri Jayewardenepura. An analytical cross-sectional study was conducted after obtaining ethical approval, involving 218 female undergraduates residing in hostels. The assessment of anemia prevalence was carried out by analyzing hemoglobin concentration using cyanmethemoglobin method. Severity grading was based on WHO criteria. As anthropometric parameters, Mid-upper Arm Circumference (MUAC), Waist Circumference (WC), Hip Circumference (HC), and Mid-thigh Circumference (MTC) were measured following standard protocols. Data analysis was performed using independent sample T-test and Mann-Whitney U tests. Study participants had a mean age of 23.75 (\pm 1.68) years. Among them 27.98% were underweight, 7.34% were overweight, and 2.29% were obese according to Asian-Pacific cutoff values. The median hemoglobin concentration of the participants was 12.2 g/dl (1.3 IQR). Further, 38.1% were anemic; 11.93% and 26.15% had moderate and mild anemia respectively. Severely anemic females were not observed. There were statistically significant associations between MTC, MUAC, and hemoglobin concentration with anemia ($p < 0.05$). Female undergraduates with high MTC and high MUAC were more likely to have anemia. There were no statistically significant associations between HC, WC, Body Mass Index (BMI), and WHR (Waist to Hip) with anemia ($p > 0.05$). The study population had a high prevalence of anemia (38.1%) compared to WHO and Sri Lankan norms. It is recommended to conduct additional iron studies within this sample to elucidate the reasons behind the observed elevated prevalence.

Keywords: Anemia, Anthropometric parameters, BMI, Nutrition

¹Department of Allied Health Sciences, Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka

²Department of Biochemistry, Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka

**Bio-active Properties of Encapsulated Dandila (*Dioscorea alata*) anthocyanin:
A Natural Food Colourant**

W.A.E.M.P. Menike, J.W.A. Sajiwanie, and R.M.U.S.K. Rathnayaka²

Bio-active properties and attractive colour range are the major reasons for anthocyanins to become a promising alternative for synthetic food colours as well as an ideal ingredient for functional foods worldwide. However, their high instability acts as a barrier limiting these applications. Because of that, encapsulation has been introduced as a successful solution to protect the highly degradable anthocyanin pigments from environmental conditions to ensure their utilization in the industry while enhancing storage stability. Dandila (*Dioscorea alata*) anthocyanin, with successful utilization of the encapsulation technique, is a stable natural colourant with several effective food applications. However, their bio-active properties were not well studied. Therefore, the aim of this study was to identify the bio-activities of this natural colourant, developed in powder form by microwave-assisted encapsulation of anthocyanin pigments from Dandila yams. The colourant was analyzed for Total Phenolic Content, antioxidant and anti-microbial activities. Total Phenolic Content was determined using the Folin-Ciocalteu assay method. Gallic acid was the standard used, and the results were expressed as milligrams of Gallic acid equivalents in 1g of colourant. The antioxidant activity determined in relation to 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging ability using the Trolox standard was expressed as milligrams of Trolox equivalent antioxidant activity of 1g colourant. The agar well diffusion method was used to evaluate the anti-microbial activity against six bacterial strains: *Escherichia coli*, *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Listeria monocytogenes*, *Shigella dysenteriae* and *Salmonella typhi*. Total phenolic content and antioxidant activity were recorded as 5.27 ± 0.05 mg GAE/g and 4.00 ± 0.02 mg TE/g respectively. Among the tested bacterial strains, the natural colourant showed inhibitory activities against *Escherichia coli* and *Streptococcus pneumoniae*. The study reveals the potential utilization of natural colourant in functional foods with promising bio-activities, including numerous phenolic compounds and positive activities against free radicals and bacterial strains of *Escherichia coli* and *Streptococcus pneumoniae*.

Keywords: Bio-activities, Dandila, Encapsulation, Functional food, Natural colourant

¹Faculty of Graduate Studies, Sabaragamuwa University of Sri Lanka, Belihuoya, Sri Lanka

²Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Belihuoya, Sri Lanka

Practices on Hand Hygiene Measures among Food Handlers in Koggala Free Trade Zone

R.Y.W.B. Jayadeepa¹, T.U.W. Abeyegunasekara², and P.A.A. Chandrasiri³

Food poisoning outbreaks are a common problem in mass-cooking kitchens. Proper hand hygiene measures are crucial in the prevention of food-borne infections. This study aims to assess the practices of the food handlers in the Koggala Free Trade Zone (FTZ) on hand hygiene measures. This study employed a cross-sectional descriptive analysis to examine the practices of seventy food-handling employers in Koggala FTZ cafeterias. Practice was evaluated under two categories: self-claimed practice and observed practice. The self-claimed practice data was collected using a self-prepared interviewer-administered questionnaire. The observed practice section utilized a systematic, single-masked observational procedure. It was found that there is a significant difference between self-claimed practice and observed practice. 87.2% of respondents reported washing their hands with soap and water after blowing their nose, sneezing, or coughing. However, only 34.3% of participants followed the practice. Similarly, 70% of respondents said they cleaned their hands with soap and water after handling money, but only 15.7% did it. 77.2% of respondents said they washed their hands with soap and water before using gloves, while only 25.7% did. 85.7% of food handlers claimed to wash their hands with soap and water after touching pimples or noses, but only 21.4% followed through. However, in situations like washing hands with soap and water after handling waste (self-claimed - 84.3%, actual - 90%), after using the toilet (self-claimed - 90%, actual - 95.7%) and after handling animals (Self-claimed - 81.4%, Actual - 97.1%) showed a higher percentage of actual practice than self-claimed. Most of the food handlers showed moderate actual practice (n=36, 51.4%). This study indicates a contradiction between actual and self-claimed practice levels among food handlers in the Koggala FTZ regarding hand hygiene measures.

Keywords: Food handlers, Hand hygiene, Practices

¹Department of Nursing, Faculty of Allied Health Sciences, Galle, University of Ruhuna, Sri Lanka

²Department of Nursing, Faculty of Allied Health Sciences, Galle, University of Ruhuna, Sri Lanka

³Office of the Regional Director of Health Services, Galle, Sri Lanka

Evaluation of Food Colour Regulations Persist in Sri Lanka with Comparison of the Global and Comparative Food Colour Regulations

L.A. Wickramaarachchi^{1,2}, K.P. Kariyawasam¹, H.M.T. Herath¹ and S. Wijesinghe¹

Food color could be employed as an additive to improve the physical appearance of a food. Year-round demand, drives food color usage for food products. However, eventually, there are arguments that using food colors excessively results in danger to public health. The review article will investigate the adverse effects of synthetic food colors using evidence from international law, the Sri Lankan legislature, and scientific literature sources. There are limitations in the implementation of food regulations in Sri Lanka in comparison to developed nations. The major legislation in Sri Lanka, controlling the addition of food colors to products is the Food Act, No. 26 of 1980. The Act lacks information about food color limitation values, which can seriously harm nationwide food and beverage production and possibly to cause serious health risks. World Health Organization (WHO) and the Food and Agriculture Organization (FAO) collaborated in 1956 to determine acceptable levels of use for food additives, creating the Codex Alimentarius Commission to develop food standards, guidelines, and codes of practice under the Joint FAO/WHO Food Standards Program. Worldwide food ingredient classifications from countries like the U.S. (21 CFR Section 73), EU (EFSA Regulation EC 1333/2008 EU), Chinese GB2760-2011 National Food Safety Standard regulates food additives, Australia New Zealand Food Standards Code and Canadian Food and Drug Act Division 6- B.06.01 allows certified colors, with amaranth allowance. Artificial colorants like Azorubine, Ponceau 4R, Erythrosine have scientifically proven facts of showing hyperactive behavior in children (in combination with sodium benzoate), intolerance development, and mutagenicity, triggering of cancer in rats respectively at high dose accumulations. Although synthetic colors cause defects, due to heat instability and pH-dependent color variations, natural colors are underused in the food industry. The aim of the study is to review the capability of the Sri Lankan Food Act in Food color limitations compared to the global legislature to ensure food safety. However, Sri Lanka should be keen on sufficient provision of food safety laws to ensure the public well-being.

Keywords: Food Act, Food Colour, Food Laws, Food Safety

¹Food Technology Section, Modern Research and Development Complex, Industrial Technology Institute, Colombo, Sri Lanka

²Department of Legal Studies, Faculty of Humanities and Social Sciences, Open University of Sri Lanka

Effect of Hot and Cold Brewing on Phenolic Content, Antioxidant and Enzyme Inhibitory Activities of Novel Fruit Teas Available in Sri Lanka

W.D.L. Udani¹, M. Sahabandu¹ and G.A.P. Chandrasekara¹

Fruit teas are becoming more popular among tea drinkers due to their antioxidant properties, taste, and aroma. Fruit teas are prepared through hot or cold brewing. The aim of this study was to determine the phenolic contents, and antioxidant and alpha-amylase inhibitory activities of hot and cold brewed infusions of fruit teas. These fruit teas were prepared using Wood apple (*Limonia acidissima*), Java plum (*Syzygium cumini*), June plum (*Spondias dulcis*), and Carambola (*Averrhoa carambola*). These samples were received from the manufacturers. Black and green tea (*Camellia sinensis*) were used as control beverages. The total phenolic content (TPC) was examined using the Folin-Ciocalteu method. The total flavonoid content (TFC) and proanthocyanidin content (PC) were determined by using the UV/Vis spectrophotometric method and anthocyanin content (AC) was measured using the spectrophotometric pH differential protocol. The antioxidant properties were evaluated through DPPH radical scavenging activity (DRSA), reducing power (RP), and ferrous ion chelating activity (FICA). Enzyme inhibitory activity was determined using alpha-amylase inhibition. The TPC of fruit teas ranged from 108.18±1.90 to 536.35±1.57 microgram gallic acid equivalents. Significant variations in TPC, TFC, PC, AC, DRSA, RP, FICA, and alpha-amylase inhibition were observed among tea types. Green tea exhibited the highest TPC, TFC, PC, DRSA, and RP, while black tea showed the highest alpha-amylase inhibitory activity. Java plum tea demonstrated high AC, and FICA was high in Carambola tea. Among fruit teas TPC, AC, DRSA, and RP were high in Java plum tea, and TFC and FICA were high in Carambola tea. In conclusion, fruit teas showed considerable levels of phenolic contents, and antioxidant and alpha-amylase inhibitory activities. The proanthocyanidin content of fruit teas was lower than green tea and black teas. Therefore, the findings of the present study give insight into the importance of fruit teas as one of the functional beverages for promoting human health.

Keywords: Alpha-amylase inhibition activity, Antioxidant capacity, Bioactive components, Brewing, Fruit tea

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, 60170, Sri Lanka

Comparison of Docosahexaenoic acid (DHA) of Locally Available Stage One Infant Formulas in Sri Lanka

Y.M.W.H.M.A.H.K. Kiridana¹, D.I.A. Jayathissa², M.J. Moufith Ahamed³ and K. Anusha⁴

Ideal infant nutrition emphasizes breastfeeding for the initial six months. However, in Sri Lanka, there is a notable rise in the use of infant formula influenced by diverse medical and other factors. Our study focuses on assessing the DHA content in locally available infant formulas, considering its essential role in infant physiological functions. Therefore, our study aims to examine the DHA content in locally available infant formulas. We conducted a comprehensive analysis of these formulas by carefully studying their packaging labels. This survey involved collecting data from over six different brands of stage 1 infant formulas, All the relevant data from these formulas were carefully extracted from food composition tables and organized in a spreadsheet. Per Codex Alimentarius International food standard incorporating DHA into infant formula requires matching or surpassing ARA concentration. Additionally, the content of EPA should not exceed that of DHA and the European Union standard must contain DHA at ~0.33%-1.14% of total fat. Among the four stage-one infant formulas analyzed, only three provided specific information about their DHA content. These three products displayed varying DHA levels, with values of 0.325%, 0.322%, and 0.216%, respectively. Two of the analyzed products follow the recommended DHA: ARA ratio, while one does not. Additionally, two of the formulas meet the European Commission's recommended DHA content. Notably, there is a lack of specific information in Sri Lankan standards regarding this aspect. In conclusion, our study identified a lack of uniformity in how different infant formula products present information about fatty acids. The DHA: ARA ratio and DHA content were not compliant in one product, and the units given for fatty acids also differed across products. This inconsistency in food labelling may confuse consumers during their purchasing decisions and emphasizes the importance of establishing consistent standards for providing nutritional information on infant formula products.

Keywords: ARA, DHA, Infant formulas, Sri Lanka

¹Department of Basic Sciences, Faculty of Health Sciences, Open University of Sri Lanka

²Department of Basic Sciences, Faculty of Health Sciences, Open University of Sri Lanka

³Department of Pharmacy, Faculty of Health Sciences, Open University of Sri Lanka

⁴Department of Basic Sciences, Faculty of Health Sciences, Open University of Sri Lanka

Self-reported Daily Water Intake of Sri Lankan Adults: An Online Survey

A.M.N.T. Adikari¹, P.G.S. Dilshan¹, W.G.N. Wijesinghe¹ and M.K.D.O. Warunika²

As the human body is comprised of 60% water, it is critical for human survival. Humans can only survive for a few days without it. The National Academies of Sciences, Engineering, and Medicine suggests a total daily water intake (from all beverages and food) of about 3.7 liters for men and 2.7 liters for women. Since a limited number of studies have been conducted to assess water consumption among Sri Lankan adults, this study aimed to determine the daily water intake of adults. A cross-sectional study was conducted with 385 healthy adults (male and female) using a pre-tested, self-administered online questionnaire to collect socio-demographic details and recall 24-hour fluid consumption. The self-reported data for this study was collected through a Google Form distributed via social media, with participants providing informed consent at the beginning of the survey through a concise online consent form. By including questions at the beginning of the Google form, about recent health issues, adults with cognitive impairment, pregnant or lactating mothers, those engaging in fluid-losing activities, and those with recent diarrhea, vomiting, severe blood loss, or high fever were excluded. Participants were requested to provide their total daily water intake from three major sources: pure water, beverages, and water from food gravy. The average daily water intake was determined by using the Pearson Chi-square test. Microsoft Office Excel 2019 and SPSS 16.0 software were used for data analysis. The study participants had a mean age of 37.6 years (SD = 11.0) and ranged from 18 to 60 years. The average daily water intake was 2.09 L (SD = 0.7), with an average of 2.04 L for women (n = 196) and 2.13 L for men (n = 189). Most of the men (94%) and women (85%) had an average daily water intake below the recommended level. It highlights the need for interventions to increase daily water intake to meet recommended levels for a healthy life.

Keywords: Beverages, Drinking water, Fluids intake, Food water, Hydration status

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila (60170), Sri Lanka

²Department of Dietitian, Asiri Central Hospital Limited, Colombo, Sri Lanka

Strategies to Maintain Food Safety and Quality at SriLankan Catering

R.G.S.P. Rathnayake¹, A.M.N.T. Adikari¹ and D. Samarakoon²

Ensuring food safety and maintaining high-quality standards are critical in the catering industry to protect consumer health and enhance customer satisfaction. As the sole airline caterer in Sri Lanka, SriLankan Catering has recognized the significance of maintaining food safety and quality. This study assessed the strategies that follow to maintain food safety and quality at SriLankan Catering. Reviewing literature, observation, and discussion with key persons were conducted. The company strictly adheres to international food safety standards, such as Hazard Analysis and Critical Control Points (HACCP), ISO 9001 (Quality Management System), ISO 22000 (Food Safety Management Systems), and ISO 14001 (Environmental Management Systems). It implements quality control procedures throughout the entire process flow from the receiving point to point of aircraft loading by identifying potential hazards, implementing control measures, and regular inspections and monitoring. Pre-requisite programs (PRPs) and Good Manufacturing Practices (GMPs) lay the foundation for the HACCP system. Physical, chemical, and biological hazards are controlled by monitoring temperatures throughout the process, inspecting the quality of raw materials, inspecting personnel and equipment hygiene, verifying the disinfection procedure at pot-washing and ware-washing, shelf-life monitoring of finished products, ensuring hygiene and cleanliness of supplying vehicles and high – loaders. Temperature monitoring is considered the main strategy to control biological hazards. Thus, five critical control points have been identified in the process such as receiving, storage, cooking, food portioning, and tray-setting. Further strategies have been implemented to avoid cross-contamination and avoid adulterates. To ensure the quality of all finished food products and incoming materials, microbiological analyses are conducted daily. Chemical analysis and microbiological analysis are done for ice and water samples to ensure no cross-contamination. The implementation of proper waste management practices further supports the company's commitment to maintaining a clean and hygienic environment. In conclusion, SriLankan Catering adopts a multi-faceted approach to maintain food safety and quality. The strategies collectively contribute to delivering safe and high-quality meals, ensuring customer satisfaction, and upholding SriLankan Catering's reputation in the industry.

Keywords: Critical Control Point, Food safety & quality, Hazards, SriLankan Catering

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila (60170), Sri Lanka

²SriLankan Catering, Katunayake, Sri Lanka

Practices of Mothers on Recommended Nutritional Supplements Consumption and Associated Factors Following the Delivery; A Community-Based Cross-Sectional Study from Hiripitiya MOH Area, Kurunegala

D.N.W. Kulathunga¹ and I.L.A.N. Darshana²

The lost nutritional status during pregnancy of a mother can be replenished during her postpartum. For that purpose, the Family Health Bureau of Sri Lanka recommends that mothers should be supplied with Iron, folic acid, vitamin C, and calcium for 6 months postpartum. But the problem is the majority of mothers who are in their postpartum period are not taking these micronutrient supplements (MNS) properly resulting in significant influences on not only their health but also on their child's health. This study aimed to assess the practices of mothers on recommended MNS up to six months following the delivery and to assess associated factors with good practices. A cross-sectional study was conducted among 276 mothers who were completed 6 months of the post-partum period and attended well-baby clinics at the Hiripitiya MOH area & participants selected using a purposive sampling method. Associated factors were assessed using the chi-square test at 0.05 significance level. The practice level was analyzed as a percentage according to marks obtained by participants. The optimum level of practice is considered as more than 75% of total marks. Considering the whole sample (n=276), only 91.3% (n=253) of participants had been compliant with taking micronutrients up to six months postpartum. While assessing the practices only 253 mothers were included and others were excluded. The rate of participant's optimum level of practice towards post-partum MNS was 39.3% (n=108). 75.4% (n=208) of participants presented with daily consumption of at least one MNS. Of them, 55.8% (n=116) of participants have taken at least one micronutrient supplement for 6 months continuously. The average usage duration was 4.7 (SD=1.8) months. The most common nutritional supplement during pregnancy (95.7%, n=264) and also postpartum (87%, n=240) was iron. Age (p=0.006) & birth weight of baby (p=0.009) were factors associated with practice level and there was no significant association between practice level and maternal ethnicity, education, occupation, income & number of children. Maternal practices on nutritional supplements following the delivery should be optimized using further nutritional education on the use of MNS.

Keywords: Calcium, Folic acid, Iron, Post-partum, Vitamin C

¹Department of Nursing, Faculty of Allied Health Sciences, University of Ruhuna

²Department of Community Medicine, Faculty of Medicine, University of Ruhuna

An Analysis of the Nutritional Fact Panel Information and Label Features of Animal-Source Foods Marketed in Sri Lanka

J.A.P.U. Weerasinghe¹, N.S.B.M. Atapattu¹, and N.M.N.K. Narayana¹

Information given on the food labels guides shoppers to make healthier food choices. Regulations prescribe the mandatory information and other features applicable to the food labels. Given the high cost and health concerns associated with the consumption of animal-source foods (ASFs), nutritional fact panel information (NFPI) given on the labels of ASFs is of particular importance. Since a substantial proportion of ASFs available in Sri Lanka are imported from numerous countries as various products, NFPI and label features of ASFs vary widely. The objectives of this study were to compare the nutrient levels as displayed on the labels of ASFs and other major food categories marketed in Sri Lanka and, to determine the level to which labels comply with the Food (Labeling and Advertising) regulations of Sri Lanka. NFPI and other features of 388 ASFs and 85 non-ASFs (NASFs) marketed in four supermarket chains in Sri Lanka were collected. Food items were selected using a purposive sampling technique. Data were statistically analyzed using the Kruskal-Wallis test and Mann-Whitney U test. Energy and carbohydrate contents were significantly ($p < 0.05$) higher in NASFs. Protein and fat contents were not significantly different between ASFs and NASFs. Further, Na and Zn levels were significantly higher in ASFs. Protein content was highest in ASF alternatives followed by fish, meat, and dairy. Fat content was lowest in ASF alternatives and highest in confectionaries. Calcium content was highest in dairy products. Meat products were high in Na. Fat contents of meat products were significantly different. Energy and carbohydrate contents were highest in milk powder while protein, total fat, and Ca were highest in cheese. Powdered milk had the most informative labels. NFPI was lacking or minimal in processed meat and buffalo products. Contact information, barcode, hotline, batch number, storage instructions, and ingredient list were given in more than 50% of the labels of ASFs. Social media, promotions, certificates, preparation instructions, ingredient amounts, and colour light information were given on less than 50% of the ASF labels. In 82% of the labels, information was given in Sinhala, English, and Tamil languages. SLS certification was comparatively low among ASFs. Protein, milk fat, and moisture content of full and non-fat milk powder met the SLS standards. Total reliance on the nutrient levels given in the NFPI is considered the main limitation of the study. The study highlights the need for more informative and interactive digital labelling systems over printed labels for ASFs.

Keywords: Animal, Food, Information, Label, Nutrient

¹Department of Animal Science, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya, 81100, Sri Lanka

Compliance with Nutritional Supplements and Factors Associated with Compliance Among Pregnant Women Attending Antenatal Clinics in Medical Officer of Health Area Kolonnawa

F.N. Aboothahir¹ and A.C.M. Basnayake²

Nutritional supplements(NS) including micronutrients (Iron, Folic Acid, Calcium, Vitamin C) and food supplements (Thripasha) are recommended during pregnancy. These are provided to pregnant women free of charge by the government in view of improving maternal health while reducing low birth weight and congenital anomalies among the babies. The objective of this study was to determine the compliance for NS and to assess the factors associated with compliance among pregnant women. A descriptive cross-sectional study was conducted among 271 pregnant women attending ante-natal clinics in MOH Kolonnawa. Participants were selected from each clinic using probability proportionate to the size of clinic visits according to the attendance register. Every third woman fulfilling the inclusion criteria in each clinic was recruited till the sample size was achieved. A pretested interviewer-administered questionnaire was used to collect data. A scoring system was used to assess compliance while factors associated with compliance were assessed using a chi-square test for significance and overall compliance was assessed with predetermined cut-offs. Ethical approval was obtained from PGIM, Colombo and the study period was from February 2020 to March 2021 (extended due to COVID-19). The mean age of the participants was 28 years (SD= 5 years) and the majority (61.6%, n=167) were educated up to General Certificate of Education (Ordinary Level) while 9.2%(n=25) & 0.4%(n=1) had higher education and no schooling respectively. The majority of the participants(85.2%, n=231) were unemployed while 45%(n=18) were professionals or managers. At the booking visit, the mean period of amenorrhea was 8 weeks (SD=3.6) and the mean hemoglobin level was 11g/dL (SD=1.44). Though there was no statistically significant association with most of the socio-demographic and antenatal characteristics of the participants ($p>0.05$), a statistically significant association was found between ethnicity and compliance for NS ($p=0.008$). Among the participants, 26.6% (n=72), 70.1% (n=190), and 51.7%(n=140) had good knowledge, attitude, and practices regarding the consumption of NS respectively. There were no statistically significant associations between knowledge and attitude with compliance to NS. However, associations between compliance with practices and side effects of supplements with compliance were statistically significant ($p<.001$ and $p=.05$ respectively) while service-related factors assessed were not statistically significant ($p>0.05$). Overall good compliance for NS among pregnant women was 28% (n=76). Therefore, pregnant women should be empowered with appropriate knowledge to improve compliance with recommended nutrition supplements during pregnancy.

Keywords: Antenatal clinic services, Compliance, Factors associated with compliance, Nutritional supplements, Supplements in pregnancy

¹Directorate of Mental Health, Ministry of Health

² World Health Organization

**Nutritional values and pharmacological properties of three selected Unani Medicinal Syrups
(Functional beverages)**

M.N.F. Rizniya¹, M.R.F. Rifna¹ and M.S.M. Nasmeer¹

Unani medicine, like many other conventional systems of medicine, emphasizes the use of natural ingredients to promote health and well-being, and it has a treasure of functional foods and beverages. *Sharbat e Anar*, *Sharbat e Ananas*, and *Sharbat e Ghudal* are some of the syrups in Unani pharmacopeia. The main ingredients of these syrups are *Anar* (Pomegranate), *Ananas* (Pineapple), and *Ghudal* (China rose flower). Ready-to-use drinks with these syrups are palatable and believed to possess many health benefits. This study focused on exploring the nutritional contents and pharmacological properties of these syrups in relation to the management and prevention of diseases. Unani classical texts and journal articles published in the English language in Google Scholar and PubMed from 2012 to 2023 were searched for in this review. The keywords used were Botanical name OR common English name OR Unani medicinal name AND Nutritional values OR Pharmacological actions OR medicinal uses of principle ingredients of syrups: *Anar*, *Ananas*, and *Ghudal*. 122 abstracts with full papers were found. After filtering the not directly relevant and duplicated papers 53 papers were reviewed. The Unani textbooks and pharmacopeia revealed that all three syrups have *Muqawwwi e Qalb* (Cardiotonic), *Muffarih* (Exhilarant), and *Muallid e Dam* (Haemopoiesis) actions. The iron content of 100 g of *Anar*, *Ananas*, and *Ghudal* was 0.1 mg, 1 mg, and 1.7 mg respectively. Anthocyanins and the unique fatty acid profile of the pomegranate play a role in its health effects. Malic acid in pineapple boosts immunity; promotes smooth, firm skin; and helps maintain oral health. *Gudhal* was also found to possess significant immunostimulatory action on the immune system. Hence, it could be concluded that the above syrups support beneficial physiological functions. As these medicines consumed from time immemorial, further research with clinical trials will provide the way for novel functional food product development.

Keywords: China rose, Functional beverage, Pineapple, Pomegranate, Unani syrups

¹Faculty of Indigenous Medicine, University of Colombo, Rajagiriya

Evaluating the Sensory Attributes and Functional Properties of Yogurt through the Integration of Mango (*Mangifera indica*) and Banana (*Musa acuminata*) Peel Pectin

S.M.D.S.C. Senaratne¹, G. Somaratne², and D. Roy³

The study explores a unique approach to enhance the functional, sensory, and prebiotic characteristics of yogurt by integrating varying concentrations of pectin extracted from the peels of fresh, healthy, and symptom-free mango (*Mangifera indica*) called “Karthakalambu” and banana (*Musa acuminata*) called “Kolikuttu” fruits. To obtain the pectin, fruit peels were initially dried and then pulverized to create peel powder. A solution was prepared by adding distilled water to the peel powder, acidifying (pH-2) it with citric acid, and then heating it. The resulting supernatant was recovered through filtration, and the pectin was precipitated by adding alcohol. The extracted pectin from both peels was separately incorporated into a yogurt mixture with ABY 10 starter cultures with probiotics. Experimental samples with pectin concentrations of 0.1%, 0.5%, and 1%. and control samples were prepared without adding pectin after incubation at 42°C for setting, all yogurt samples were analyzed for syneresis, pH, shelf life, and sensory attributes following storage at 4°C. Significantly lower ($p < 0.05$) in syneresis were observed in yogurts containing 1% pectin. Yogurts with 1% mango peel pectin exhibited the lowest syneresis, indicating a higher water-holding ability. Additionally, yogurts with 0.5 % and 1% pectin from both peels had a significantly ($p < 0.05$) lower pH than the control, likely due to microbial breakdown of pectin-generating organic acids, enhancing yogurt's functional qualities. Sensory attributes of yogurts with banana peel pectin were more similar to the control, while mango peel pectin integration significantly ($p < 0.05$) differed from the control, affecting sensory attributes and shelf life. Notably, mango peel pectin integration resulted in a shorter shelf life compared to the control and banana peel pectin-incorporated yogurts. In conclusion, yogurt incorporated with mango peel pectin demonstrated higher functional qualities, particularly in terms of reduced syneresis and lower pH. However, for sensory attributes and shelf life, the integration of banana peel pectin was favored over mango peel pectin.

Keywords: Banana, Mango, Organic acids, Pectin, Syneresis

¹Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka

²Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka

³Riddet Institute, Massey University, 4472, New Zealand

Glycemic and Satiety Responses of Cereal and Legume-based Formulated Breakfast Meal

S.A. Wijesinghe¹, D.V.S.S. Diyapaththugama¹, and G.A.P. Chandrasekara¹

Foods with high satiety response, are useful in managing overweight and obesity which is a condition that contributes to the etiology of several non-communicable diseases including type 2 diabetes. A novel breakfast meal developed using whole grain rice, horse gram, and coconut flour was used in this study. The aim of the present study was to determine the satiety response (SR) and the glycemic response (GR) of the cereal and legume-based novel breakfast meal. This randomized cross-over clinical trial was conducted with 17 healthy normal-weight adults which included 11 females and 6 males aged 23 - 27 years. Anthropometric measurements such as weight and height, of the participants were taken at the commencement of the study on the first day. During the next two visits on separate days, participants consumed two isocaloric 1255.2 kJ (300 ± 5 kCal) servings of test and reference meals to check the SR. Satiety ratings were obtained every 15 min over 2 hours using a 7-point hedonic scale. For determination of Glycemic response, they consumed 40 g of breakfast meal (one serving of the meal) equivalent to 30 g of available carbohydrate as the test food and glucose as the reference. Their blood glucose levels were monitored for 2 hours at baseline before consumption, and postprandial at 15, 30,45, 60,90, and 120 minutes using a glucometer. The GR value obtained for the breakfast meal was 61 ± 21 and the satiety score was 152 ± 35 %. There was a significant reduction in blood glucose levels at 30, 45, 60, and 90 minutes after having the test food compared to the standard. No significant correlation between GR and SR was observed. In conclusion, a novel cereal legume breakfast meal shows a medium level of GR and a high level of SR. The limitation of the study is that the results are from one round of determination. There is a potential of using the novel legume mixed breakfast meal product as a healthy breakfast option for the management of weight of adults.

Keywords: Anthropometric indices, Diabetes, Isocaloric, Obesity, Randomized cross-over clinical trial

¹Department of Applied Nutrition, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila

Expression of Antioxidant Capacity of Pigmented and Non-Pigmented Rice Varieties by FRAP in Relation to Pericarp Colour Strength Before and After Milling and Cooking

R.F. Hafeel¹, V.P. Bulugahapitiya², G.E.D. De Zoysa³, A.P. Benttoa⁴, and K.H.C.H. Kumara⁵

The health benefits of naturally pigmented foods rich in antioxidants are documented frequently. To explore antioxidants in pigmented (red, 20) and non-pigmented (white, 20) rice varieties which comprise improved, traditional, and exotic varieties were grown simultaneously. Experimental plots were laid to a Randomized Complete Block Design. Potential antioxidants that reduce the ferric ion (Fe^{3+}) to ferrous ion (Fe^{2+}) and form colour complexes ($\text{Fe}^{2+}/\text{TPTZ}$), were detected for total antioxidant capacity by spectrometric absorption at 593 nm in FRAP (Ferrous Reducing Antioxidant Power) assay. FRAP assays were done after milling and cooking to discover the effect on total anti-oxidants and results were analyzed. Lightness (L), redness (a), and yellowness (b) of aforesaid grains were measured by CR-20 colourimeter. Variation in antioxidant content was found within whole, milled, and cooked rice varieties. FRAP values ranged from 1.2×10^2 to 30.5×10^2 , 0.9×10^2 to 20.4×10^2 and 0.19×10^2 to 2.2×10^2 $\mu\text{M}/\text{ml}$ in whole, milled, and cooked rice, respectively. Pigmented rice had more antioxidants compared to non-pigmented ($p \leq 0.05$). Out of these pigmented varieties, *Masuran* and *Nonabokra* (traditional varieties $\geq 30.4 \times 10^2$ $\mu\text{M}/\text{ml}$) and *Ld 368* and *Ld 408* (improved varieties $\geq 20.5 \times 10^2$ $\mu\text{M}/\text{ml}$) had the highest total antioxidants. Irrespective of the colour pigmentation a drastic decline in total antioxidants was observed with milling (52%) and thereafter cooking (90%). Removal of the outermost layer of the rice grain which is known to accumulate anti-oxidants has affected the reduction of antioxidants from 6 to 86 % through milling and 30 to 98% by cooking. However, on average whole, milled, and cooked pigmented rice contain six, three, and two times more antioxidants than non-pigmented varieties, respectively. Colour values of whole and milled varieties also had significant differences ($p \leq 0.05$) and there was a positive correlation between FRAP value and colour values of the whole (0.59) and cooked rice (0.56). In conclusion, the antioxidant capacity is significantly higher ($p \leq 0.05$) in pigmented rice, and milling followed by cooking reduced the antioxidants irrespective of the variety and the pericarp colour.

Keywords: Colour strength, Ferrous reducing antioxidant power. Pigmented rice, Milling, Cooking

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¹Regional Rice Research and Development Center, Department of Agriculture, Bombuwala, Sri Lanka

²Department of Chemistry, Faculty of Science, University of Ruhuna. Wellamadama, Matara, Sri Lanka

³Department of Bio-Chemistry, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka

⁴Ministry of Agriculture, Battaramulla, Sri Lanka

⁵Rice Research Station, Department of Agriculture, Ambalantota, Sri Lanka

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