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# FoodTech Insights

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## BUILDING RESILIENCE IN OUR FOOD SYSTEMS :
a post-pandemic priority

Pg 20-21

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# EDITOR'S NOTE

## EDITOR:

CHATHUDINA J. LIYANAGE

Dear Reader,

Welcome back! I am glad to be back on track with this new issue of 'FoodTech Insights' (FTI) magazine after a lapse of almost two years. We were unable to stick to our original plan of publishing two issues per year due to several circumstances, while adjusting ourselves to the 'new normal' settings triggered by the COVID-19 pandemic. Thanks to the major breakthroughs in the development of vaccines, we are gradually emerging from a bleak period of time where a weekly trip to the nearest grocery shop turned out to be an adventure of its own. During the past two years our conventional university education system also explored and embraced new dimensions to carry out its key roles with the support of an array of digital tools and technologies, which was perhaps a blessing in disguise. Besides all the valiant efforts by the health workers to keep us alive and healthy, we should not forget the efforts of all the workers in the Agro-Food industry and food supply chain who have contributed immensely to the survival of us during the pandemic, with an uninterrupted supply of our food. A big salute to all of them, for not failing on us, as we could find all essential food and beverage items we needed even during the lockdowns, from fresh to processed food, in the shelves of our grocery stores. While many supermarkets ramped up online shopping and delivery capacity, it is questionable whether such approaches were sufficient to assure the availability and access of food to the masses, two of the four pillars of food security. What we have witnessed during the pandemic is precisely what one would expect from a fragile food system, nurtured by a cascade of panic buying and misinformation on food and ultimately highlighting the flaws in our food system and food economy. This is perhaps the right time to identify those vulnerabilities exposed and fix the flaws in our food system before another global emergency hits us. In light of these circumstances, we decided to dedicate our cover story to the theme 'building resilience in our food systems: a post-pandemic priority'.

Besides our regular articles, this issue contains several feature articles on a wide spectrum of topics ranging from edible lichens to applications of cold plasma technology in food industry, contributed by the undergraduates and academics of the food science related degree programs in Sri Lankan universities. I would like to extend my utmost gratitude to all of them for their outstanding contributions. The content reviewers, coordinating editors, editorial assistants, editorial advisory board, are greatly acknowledged for their time and unfailing support in publishing this issue of FTI. Also, I am grateful to Head and the members of the academic staff of the Department of Food Science and Technology who continuously supported us to improve the quality of FTI.

I hope you enjoy reading 'FoodTech Insights'.

Sincerely
Chathudina J. Liyanage

# ACADEMIC'S PERSPECTIVE

**Dr. Isuru Wijesekara**

Senior Lecturer
Department of Food Science & Technology
Faculty of Applied Sciences
University of Sri Jayewardenepura

## FUNCTIONAL FOODS FROM SRI LANKAN SEAWEEDS

Seaweeds are marine habitat macroscopic algae and they were underutilized in Sri Lanka during the past few decades. However, recently there is a leading trend to cultivate and process these valued marine bio-resource to generate an additional foreign income. Seaweeds are mainly classified into three groups, such as green, brown and red seaweeds, according to the availability of pigments. Seaweeds are composed of higher amount of sulfated polysaccharides, minerals, proteins, vitamins and minute amount of lipids. They are widely consumed in the East Asian countries and some European countries as sea vegetables. In Sri Lanka, there are a number of economically potential edible seaweeds to be developed as functional food ingredientss but the lack of awareness of their health benefits is a limited factor in promoting.

Green seaweeds such as Ulva sp. ("Sea Lettuce") and Caulerpa sp. ("Sea Grapes") are widely available and rich sources of soluble dietary fibers, proteins, minerals and vitamins. They can be used to develop functional bakery foods, incorporated meat-based foods and vegan sausages with more plant proteins. These dried green seaweeds can be incorporated to the above-mentioned food products up to 5% (dry weight basis) to improve the nutritional profile and yielding some functional properties like antioxidant activity. Sargassum spp. are the most abundant brown seaweeds in Sri Lanka and they can be used to extract phycocollodes such as alginate and fucoidans. The alginate is a common food additive in the food industry and it is widely used in ice-creams and milk-based beverages as a stabilizing and thickening agent. Moreover, these brown seaweeds contain fucoxanthin as the dominant pigment and in other countries fucoxanthin is used as a natural food colourant against some carcinogenic artificial food colours. Moreover, Sargassum sp. has a potential to develop a wide range of bakery foods (string-hoppers and cookies) and beverages like "seaweed tea" with beneficial health benefits including antioxidant effect. Gracilaria edulis, G. verrucosa and G. salicornia are common red seaweeds available in Sri Lanka and they have a great potential to extract agar-agar, a phycocolloid. The agar-agar is widely used as a gelling and thickening agent in the food industry. In addition, Kappaphycus alvarezii, commonly known as Doty-Doty is the only cultivated seaweed in Sri Lanka. It is a red seaweed and used to extract κ-carrageenan, another widely used gelling and thickening agent in the food industry. Collectively, the exploration of this valued marine bio-resource of Sri Lanka for the development of functional foods will be a promising task not only for the local consumption but also for the foreign market to generate an additional income to the country.

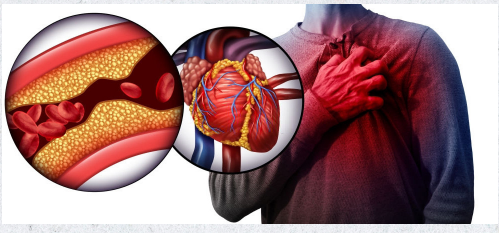
# >> PERSONALIZING NUTRITION USING NUTRIGENETICS FOR OBESITY AND CARDIOVASCULAR DISEASES PREVENTION:

*Vinuri Rasanga Arambepola | Faculty of Agriculture | University of Peradeniya*

Epidemiological data support the view that both Obesity and Cardiovascular Diseases (CVD) are responsible for a high number of total morbidity and mortality in adults globally. Both CVD and Obesity have complex interplay mechanisms of genetic and environmental factors that specially include our lifestyle around the food we eat and the beverages we consume.

Obesity represent a major risk factor for CVD as one of the most important consequences of obesity is the widespread impairment of cardiovascular physiology as a result of structural and functional adaptations induced by Obesity. These adaptive mechanisms translate into profound hemodynamic alterations due to increase in blood volume, cardiac output, stroke volume, and heart rate, resulting in a progressive cardiac remodeling in terms of left atrial enlargement, left ventricular (LV) dilation, and eccentric or concentric LV Hypertrophy. It has been widely established that the excess of adipose tissue exerts a number of endocrine influences, including synthesis and release of hormones and cytokines (adipokines) that leads to development of inflammation that increases the risk of CVD development. The excess of Adipose tissue that build up in the Viscera increases the epicardial adipose tissue deposition that in turn has been recognized to lead to development of cardiovascular complications related to Obesity.

Nutrition is an environmental factor and it has a dominant and significant role in how we manage health and how we can prevent Obesity and Obesity related Diseases including Atherosclerosis that gives rice to heart complications. But when we peruse the Statistical analyses that have been clinically performed, there is a notable variation in how Cardiovascular Disease occur and function in the body of patients with obesity and with people who have the same dietary pattern but may not be Obese, considering both groups are equally liable to the disease, taking into consideration that certain genetic conditions and circumstances of other environmental factors changes how our genes are expressed in our body and how the factors outside and inside our body interacting with our genes can express certain disease conditions. The Different Genetic Polymorphisms that could explain why the same dietary pattern Interacting with our genetic factors and environmental factors under different conditions can give vastly varying results, have given rise to the concepts of Nutrigenetics and Nutrigenomics. Nutritional genomics or Nutrigenetics is the science that studies and characterizes gene variants associated with differential response to specific nutrients and relating this variation to various disease conditions, metabolic Disorders, Hormonal Discrepancies and in this case, CVD in relation to Obesity. The Personalized Nutritional recommendations based on the knowledge of an Individual person's genetic background and profile, may improve the outcomes of a Specific Dietary Intervention and may even lead to discoveries of new dietary approaches and novel concepts to address health in specific reference to curing and preventing Obesity and CVD.



Given these Possibilities due to application of this Novel Concept and related applications in Food Production, Health Guidelines etc. it is intuitive to suppose that the elucidation of diet and gene interaction could support specific and effective dietary interventions for both Obesity and CVD Prevention through personalized Nutrition Based on the Data based on Nutrigenetics which we can postulate.

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# ExPosé

The staff and students of the Department of Food Science and Technology, Sabaragamuwa University of Sri Lanka have been jointly conducting many research and development leading to new food products with high commercial viability. A promising research was conducted very recently, based on three products in partnership with Food and Nature (Pvt) Limited (FADNA): Shape-Up Tea, Ezy Tea and Immunni Tea. The extensive study carried out by the research team was proposed to the 28th International Conference on Functional Foods, USA and accepted for presentation. FADNA places much importance in continuous research with the objective of manufacturing healthy and natural products for an active, happy and healthy lifestyle for their consumers. The partnership with one of the leading local universities in food and health studies, the Sabaragamuwa University, has ensured that such research is conducted on a regular basis to ensure the effectiveness, quality and richness of FADNA herbal products.

Another promising product developed with the contribution from our students and staff is a tasty soursop wine with the potential to fight diabetes, cancer and boost the immune system. This wine aspires to win overseas markets with its unique product profile. The research team at the university has entered into a licensing agreement with a local entrepreneur to produce the beverage and introduce it to the market. This wine contains multiple pharmacologically active compounds that help to boost immunity. Soursop is already popular in Sri Lanka for its delicious flavor and impressive health benefits and preparation of a wine from soursop is a novel approach and an important value addition.

# DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

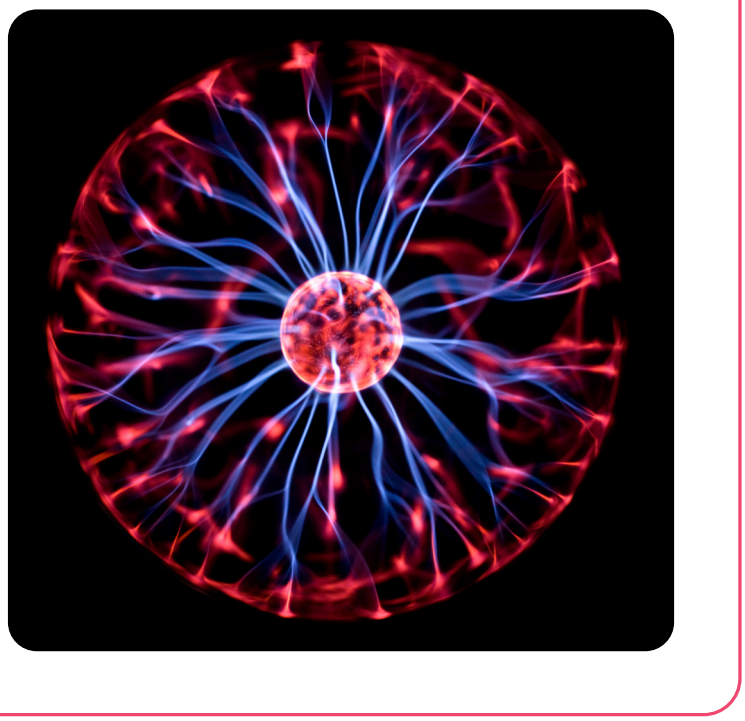
Contemporary dietary trends and regimes such as vegetarianism and flexitarianism have triggered a massive demand worldwide for plant-based food products. Especially, the demand for plant-based meat alternatives is quickly growing globally, owing to the rising environmental concerns associated with livestock production and the perceived negative health impacts of red meat. Even though many people want to switch to plant-based alternatives or meat analogues, there are limited products that have similar taste, texture, and nutrition value to meat products. Products such as plant-based burgers are virtually non-existent in the Sri Lankan market, although such products are going mainstream in several countries currently.

Identifying this gap and considering the availability of a wide range of local raw materials for formulating such products, a team of undergraduates in the Department of Food Science and Technology came forward with a proposal to develop and commercialize a meat analogue using low-cost, locally sourced raw materials, with the guidance of the academic staff of the Department to conduct the research and development work. The project proposal has been granted Seed Capital from the University Business Linkage Cell (UBLC) and will be introduced to the market with the partnership of Loops Digital (Pvt) Ltd.

# >> COLD PLASMA TECHNOLOGY

## APPLICATIONS IN FOOD INDUSTRY

*E.D.P.Tharindu | Department of Food Science and Technology | Sabaragamuwa University of Sri Lanka*

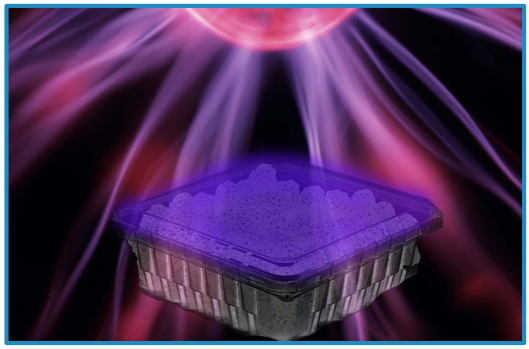


Ensuring food safety with minimum impact on the sensory and nutritional value of foods is an existing challenge in food industry. Cold plasma technology (CPT) is one of the novel non thermal and green processing technology which provides solution for this matter. Plasma is the fourth state of matter which is made up of equal amount of positively and negatively charged particles. External energy sources such as electrical energy, magnetic current, intense ultraviolet and laser lights involve generation of plasma products such as electrons, ions, neutrons, protons, atomic oxygen, reactive oxygen, hydroxyl radicals and nitrogen containing species.

CPT contributes in many ways for inactivation of spoilage and pathogenic microorganisms. Reactive oxygen species such as hydroxyl radicals, hydrogen peroxide and superoxide anions present in the plasma contribute to the production of melondialdehydes within microbial cells causing cellular death via formation of DNA adducts. OH* radicals are produced during plasma treatments account for 90% destruction of DNA as well as destruction of cellular membranes and other components via chain oxidation. Furthermore, oxygen radicals present in plasma involves destruction of macromolecules such as proteins, fats and DNA in microbial cells leading to death. Plasma etching is based on the interactions between energetic ions and reactive species within microbial cells. Accumulated charge particles generate electrostatic force which leads to irreversible cell membrane ruptures. According to previous studies, enzymes involve in enzymatic browning of fresh plant-based products are inactivated into considerable extent by cold plasma treatments.

For generating plasma, methods such as corona discharge, dielectric barrier discharge, arc discharge and jet discharge can be applied concerning the intended target reaction. Generated plasma can be exposed in three ways; direct exposure, indirect exposure and plasma activated water. The efficiency of microbial decontamination depends on input power, extent of exposure, design of the system and properties of the food sample.

CPT can be applied for many aspects in food industry. Studies have been conducted for decontaminations in the grain processing sector aiming microorganisms such as Bacillus cereus, Bacillus subtilis, Aspergillus spp and Penicillum spp in grains. Except the decontamination effect, cold plasma involves improving swelling capacity and decreasing water holding capacity, cooking temperature and pasting viscosity of grains. In meat sector, surface decontaminations of microorganisms such as Salmonella spp., Listeria monocytogenes and E.coli related to chicken, beef and pork using cold plasma technology have been successfully studied. Reduction of water holding capacity and modifications of the functionality of packed meat products have been reported. Decontamination of *S.enteritidis* and *S.typhymurium* which present



on the surface of egg shell membrane is found to be possible with cold plasma technology. This technology can be applied in dairy processing sector as an alternative technique related to whole milk, skim milk, UHT milk and sliced cheese. CPT provides positive and negative impacts on fruit and vegetable processing sector. According to previous studies, it contributes for reducing rate of enzymatic degradation and for removing microorganisms such as Salmonella spp and E- coli on fruit and vegetable surface but alter the pH, texture and color of the products with storage. Initially, cold plasma treatments are applied for packaging materials to enhance modification of surface and printability. Recently it's applied for post packaging decontaminations. Furthermore, cold plasma enhances packaging properties such as sealability, glazing appearance and barrier properties.

Application of CPT in food industry has some limitations. There are recommended sizes and volumes for the foods which are intended to be treated. Moreover, bulky as well as irregular shape food materials are also difficult to be treated. Some reactive oxygen species of cold plasma are less penetrable. Studies reveal plasma treatments enhance lipid oxidation of meat products as well as oxidative degradation of cereals due to presence of reactive oxygen species. Sensory and nutritional losses related to some fruit and vegetable-based plasma treated foods have been determined for some extent. Nutritional properties and toxicology of cold plasma treated foods have not been determined yet. Lack of studies related to commercialization is another limitation.

In this technology, efficiency of microbial decontamination is achieved at relatively low temperature. Thus, it suits for treating heat labile food products. It requires less power input and exposure time in comparison with other common food preservation methods. Cold plasma treatments do not alter nutritional and sensory attributes of foods. Equipment cost is relatively low since usage of inert gases instead of solvent systems for processing.

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# >> EDIBLE FOOD PACKAGING

*N.D.Dilshani Madushika Gunathilaka | Department of Export Agriculture | Uva Wellassa University*

Food packaging intends to pack and protect food from environmental, physical and chemical damage occurred during transport, storage, distribution and retailing up to its final consumer. Recently, concerns have arisen regarding conventional packaging, specifically plastic and its derivates, due to the environmental impact occurred when disposed of and due to their non-renewable character. In order to overcome this problem, researches tend to develop new packaging systems such as edible food packages; which have low environmental impact.

However, edible coatings or films have received considerable attention recently. Edible food packaging is more beneficial than synthetics because these may be safely eaten as a part of the food products and are environmentally friendly. At the same time, they increase the shelf life of fresh products.

## Materials for edible packaging

The materials of the packaging is derived from edible ingredients such as natural polymers that can directly consumed by humans without any potential health risk. These materials must meet two requirements as follows.

- Should be edible
- Ability to form a continuous layer or film

Based on the sources edible packaging materials can be categorized as follows.

- Materials from direct biomass or natural sources (protein, polysaccharides and lipids)
- Materials produced by micro-organisms usually belonging to specific types of polysaccharides.
- Materials produced from bio-based monomers

| Polysaccharides | Proteins | Lipids | Composites |
|---|---|---|---|
| Starch, Gums, Pectin, Cellulose, Alginate, Agar, Chitosan/Chitin | Collagen, Casein, Corn sein, Gelatin, Soy protein, Pea protein, Wheat gluten | Paraffin wax, Bee wax, Mineral oils, Fatty acids, Vegetable oils | Bilayers, Multi-stacks, Conglomerates, Blends |

## Different types of additives used in edible films

In order to enhance mechanical, structural and handling properties or to provide active functions to the coating, several materials are incorporated into edible films. They are;

### Plasticizers

For the enhancement of flexibility and durability of edible films. (Ex: glucose, sucrose, glycerol)

### Emulsifiers

Essential to attain sufficient surface wet-ability to ensure proper surface coverage and adhesion to the wrapped surface

### Antioxidants

Added to edible packaging materials to delay the rate of oxidation reactions and to increase food quality and safety. (Ex: butylatedhydroxytoluene, citric acid, ascorbic acid, tartaric acid)

### Plant extracts

Essential oil extracts from plants naturally add antioxidants and antimicrobial agents into edible food wrappings. Plant extracts which often used are cinnamon, clove, onion, garlic, mustard, green tea extract, rosemary, mint extract and grape seed extract.

### Antimicrobials

Helps to enhance the shelf life of food products and also used as carriers of nutrients. The most commonly used antimicrobials are organic acids (benzoic acid, acetic acid, fumaric acid, malic acid, lactic acid).

## Advantages of edible packaging

- Environmental friendly (Biodegradeble)

They reduces the amount of plastic waste produced and reduces the need for recycling.

- Provide physical and mechanical protection to the food products
  - Enhance shelf life
  - Maintain quality and safety
  - Act as barrier to microbes, rodents, insects and other animals
  - Reduce environmental impacts (moisture, light and gaseous)

- Convenience and quality preservation

Edible films and coatings retard surface dehydration, moisture absorption, oxidation of ingredients, aroma loss, and microbial spoilage of food products.

- Adds nutritive value and improves sensory properties of the food

Seaweed Cupcake Wrappers

Edible Serving Bowl


Edible Popcorn Bowl

## Drawbacks of edible packaging

- Development of off-flavors
- Unsanitary conditions can be occurred during food handling
- Secondary synthetic package should be used during food distribution and storage
- Expensive than synthetic packages

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# ALUMNI PERSPECTIVE

## TONY SUSANTHA UKWATTAGE

**SENIOR MANAGER**
**QUALITY ASSURANCE AND REGULATORY AFFAIRS-ANSELL**

The Food Science & Technology degree programme of the Sabaragamuwa University of Sri Lanka is well designed to furnish the undergraduates with vital knowledge and skills required to operate effectively in the rapidly advancing food industry. Moreover, the interdisciplinary insight created by the programme enhances the potentiality of the graduate to perform exceptionally well at various professional and management levels.

Being a fresh graduate produced by this prestigious degree programme, I started my career as a Management Trainee in Ceylon Biscuits Limited in 2007. Then I joined Lion Brewery Ceylon PLC as a Quality Assurance Executive and the wide array of skills I had acquired from the degree programme guided me to diversify my working scope into the Assistant Manager-Innovations, New Product Development/Process Improvement Position at Lion Brewery Ceylon PLC.

My next movement was to Nestle, a global leader in the food industry, as a Quality System Expert. Within the time span of ten years after graduation, I joined Jiffy Products International, World's leading manufacturer in the substrate and Growing media, as the Senior Manager in Quality Assurance.

Today I head the Quality and Regulatory Assurance Department of Ansell, the global glove manufacturing pioneer as a senior manager reporting to the global directorate. At the moment I am a council member of the Sri Lanka Association for the Advancement of Quality and Productivity (SLAAQP) which is the national body for quality including the organizing of the national quality convention. In addition I'm a member of American Society of Quality (ASQ) too.

My very rapid professional growth from the level of a management Trainee to a Senior Manager in a diverse range of industries bears witnesses to the strength of the foundation that this programme lays on the undergraduates who follow it and the diverse set of skills that the curriculum of the degree programme instill in its products to thrive successfully in many professional disciplines with its special design to infuse the essential subject proficiency and technical expertise of the "Farm to Fork" continuum.

# >> FLAVORS OF SRI LANKA, SHARED WORLDWIDE >>

*Anuja Akalanka Lokeshwara | SLIIT Business School*

*"Food for us comes from our relatives, whether they have wings or fins or roots. That is how we consider food. Food has a culture. It has history. It has stories. It has relationships."*

As an essential ingredient in human existence, food has always played a vital role in building interstate relations and diplomatic traditions. It has been used to project influence, communicate culture, and even express acquaintance or enmity (Luša & Jakešević, 2018), emphasizing its prominence in connecting and building relationships.

The concept of "culinary diplomacy" is also popularized in academia as "gastro diplomacy" and is defined as the use of food and cuisine in understanding, creating, and improving interactions and cooperation between cultures (Chapple-Sokol, 2013). Though the terminology might seem novel, the use of food as a public diplomacy tool can be seen in various nations since ancient times (Zhang, 2015). Over time, gastro diplomacy was further extended in promoting national identity and branding to a broader international audience. This is evidenced through the national tourism promotion campaigns being developed, explicitly focusing on food by various countries.

As quoted by Chapple-Sokol (2013, pg. 170), "to invoke the power of its cuisine as the tool of the national brand, so when foreigners take a bite of food, they recognize its belonging to the country of origins, and strengthen their association with that country", this reiterates the potential that a nation's cuisine has in making the country's position highlighted in the world map, unfortunately this is yet to be developed adequately in many countries.

Narrowing the wide scope of gastro diplomacy towards a more local context, it could also be observed that Sri Lanka as a nation is yet to claim the full potential of gastro diplomacy, which can be used to develop the Sri Lankan tourism industry. An industry that was once prided for its high performance but is now battered by various shock events such as the Easter Sunday attack in 2019 and the Covid-19 pandemic. This highlights the need for a properly formulated strategy in reviving the nation's tourism industry and one effective tool that can be used is the gastro diplomacy centered tourism policy framework. Sri Lanka has established its name for Ceylon Tea across the world but slowly losing the fame it once held, yet if the complete cuisine of Sri Lanka was taken into consideration, one could identify the true potential that the Sri Lankan cuisine holds. Sri Lanka has rich and diverse gastronomy shaped through contacts developed with foreign traders, periods of colonization, and even the multicultural population. It is evident that, as a nation which has inherited a unique culinary fare, Sri Lanka is yet to embed this concept of culinary diplomacy into national tourism strategy (Fernando, 2019; Vidanapathirana, 2020).

Without a doubt, one can agree that the Sri Lankan cuisine is unique and appeals to the tastebuds of many. For instance, "Ceylon Tea" has been loved for decades by many countries around the world and is a specialty among Europeans and indirectly paved a greater platform for Sri Lankan exports in terms of tea. If strategically adopted, this can be expanded to other gastronomic niches including Sri Lankan spices, seafood, tropical fruits and even in beverages such as Sri Lankan Coconut Arrack which is rapidly gaining popularity among European cocktails recipes (Velarde, 2017; Fernando, 2019). This demarks a viable potential in the Sri Lankan cuisine to highlight the nation globally and in return bring positive economic impacts to the country while allowing foreign nationals to indulge in unique and exotic culinary experiences. However, the benefits of this potential can only be earned if it is tactfully incorporated in the national tourism policy framework and managed effectively, as seen in several countries including the famous "Global Thai" campaign developed by the Thailand government. Thailand has used the concept of gastro diplomacy effectively by promoting Thai food culture across the world; the success of which is reflected in the growth of Thai restaurants all over the globe from over 15000 outlets in 2016 compared to a mere 800 restaurants in 2005 (The Government Public Relations Department, 2016).

Sri Lanka could also rethink how the delicacies of local cuisine can be deployed as an effective tool in reviving the ravaged tourism industry in addition to developing international relations while maintaining the country's own identity.

Food bring nourishment. Food brings happiness. And happiness is worthwhile when shared. Hence, let's think strategically, how Sri Lanka could implement food diplomacy in sharing our own valued tastes worldwide in a mutually beneficial manner.

Rambutan (A Sri Lankan Tropical Fruit)

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# >> END HUNGER THROUGH FOOD SECURITY

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Food plays a significant role in our day-to-day life. Without food, we cannot survive. It is necessary for living beings for providing energy, development and maintaining life. Furthermore, Food plays a crucial role in the promotion of health and disease prevention. In general, food consists of many essential nutrients, such as carbohydrates, proteins, fats, minerals, and vitamins which are consumed to provide nutritional support for humans for sustain health. Also, food is essential to drive away hunger and malnutrition.

According to the United Nation's Report, hunger is the term that we used to define periods when populations are experiencing severe food insecurity. It means that people go for entire days without eating due to poverty, lack of access to food, or other resources. Hunger has two types: acute hunger and chronic hunger. Acute hunger is sudden and life-threatening. It needs immediate and intense treatment. It accounts for 8% of the world's hunger and it is gradual and occurs seasonally. When occurred, it can last for generations. It is less visible, but it affects many people. Both Acute hunger, as well as chronic hunger, can lead the way to malnutrition.

As the World Food Summit described, "food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." It introduces for main dimensions of food security including, physical availability of food, economic and physical access to food, food utilization, stabilization of the other three dimensions over time.

COVID-19 has had a further and intense impact on hunger and food security. It has worsened food security by disrupting supply chains. Furthermore, food insecurity is triggered by income losses, widening social inequities, altered food environment and price hikes too. Between 720 and 811 million people in the world gave over hunger in 2020 and the prevalence of undernourishment increased from 8.4 percent in 2019 to 9.9 percent in 2020. Food insecurity does not necessarily cause hunger, but hunger is possible after the effects of food insecurity.

Food security is predominantly dependent on the agricultural sector. The yield levels of cultivated food crops have declined, indicating a potential contradiction between the production and national demand, which is on the rise due to population growth and growth of real per capita income. The influence of the rise in extreme weather conditions will further challenge growers because crops are stagnated and production has to switch to new regions, creating short-term fluctuations in food availability.

Additionally, food wastage, water undersupply and changing lifestyles lead the way to urbanization are also challenging to agriculture. Also, lack of crop diversification has created a significant gap between what is available for consumption and what is needed for ensuring proper nutrition. As the world population continues to rise, much more innovation will be needed to sustainably increase agricultural production, improve the global supply chain, decrease food waste, and ensure that people who are suffering from hunger and malnutrition have access to nutritious and safe food. Increasing investment in the research, development of technologies is important to improve the sustainability of food systems. Moreover, recent developments related to food safety will impact the food sector and its ability for delivering food security. Food safety must be an enabler and not an inhibitor of global food security. So, it is clear that we cannot achieve food security unless we implement food safety on a global scale. Only through collaboration among all stakeholders will ensure that the proper food safety knowledge, risk management methods and interventions are successfully applied across the global food supply chain.

The Sustainable Development Goal 02, Zero Hunger aims for sustainable solutions to eradicate hunger in all its forms by 2030, achieve food security and improved nutrition and promote sustainable agriculture. Implementing sustainable practices and working in partnership with other actors throughout the agricultural supply chain are the key factors to the implementation of zero hunger in the world.

Hunger is not just the feeling in your stomach

right before a meal. It's for millions of people around the world, and it's a going on threat to the well-being of humankind. Everybody deserves access to enough nutritious food to keep them healthy. Food is one issue that cannot be solved individually. Therefore, we have to stand together to ensure food security for achieving zero hunger for a better world.

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# >> FOOD WASTE AND UPCYCLED FOODS

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## What is Food Waste?

Food waste is a far-reaching global problem. It leads to a severe environmental impact in the world. Greenhouse gas emission is one of the hazardous environmental concerns in the process. Apart from that, landfills, biodiversity loss, pollution and climate changes are other major impacts on the environment. Additionally, food waste causes financial losses to households. Food waste and food loss are not synonyms; they do mean different. Food loss may be a consequence of improper handling and storage conditions or in the food distribution process nevertheless, food waste may be a result of limited retail shelf life or non-usage of perishable products before spoilage. When the food is wasted, it's not only about the food itself but also all the natural resources such as water, land, energy that were used from the farm to fork.

World Health Organization (WHO) and Food and Agriculture Organization (FAO) have teamed-up to reduce global food waste. United Nations (UN) has estimated about 17% annual global food waste according to the UNEP Food Waste Index Report (2021). Sustainable development has been a wide area to discuss globally. Upcycled food is an innovative approach to address the food waste in order to achieve the sustainable goals as well. United Nations Sustainable Development Goals have included the food security and minimize food waste as world hunger is on the rise. SDG aim to cut in half of food waste by 2030. End Hunger (SDG 2) and Ensure the sustainable consumption and production (SDG 12) are assisted to accomplish the minimization of global food waste in the future. Besides, FAO designated International Day of Awareness of Food Loss and Waste on 29th September every year in order to spread awareness about sustainable consumption and production of the food.

## Upcycled Food is a Solution

When the term Upcycled food is heard, what comes to your mind? It is not recycling. This concept is not still widely understood among the global population. Therefore, Sri Lankan market is also not much familiar for upcycling beyond the term recycling. According to the Upcycled Food Association (UFA), Definition for upcycling foods is that use of ingredients that otherwise would not have gone to human consumption are procured and produced using verifiable supply chains and have a positive impact. "Upcycling." concept works with using low-valued foods or food processing byproducts to generate new food products. Upcycled food is made out of food surplus as a creating new, high quality consumer based product solution. Upcycled food is a good solution for global food and water security. The upcycled food association introduced label on that items. This is an uplifting trend in 2021 and the trend will catch on for next 10 years. Within the sound marketing campaign Upcycled food products will be able to boost their sales up. In fact, moving to commercial benefits while reducing waste is a wise step forward to sustainable business transformation in terms of food businesses.

## A number of upcycling products which are in the global market as follows;

- Fruit pomace- all the fibrous bits left after fruit juice production
- Bolsters - the flavor and nutritional content of snack foods
- Wheat middlings – From everything left after milling– To enrich the content of vitamins, minerals and fiber of breakfast cereal.
- Whey protein from cheese production – To enrich the protein content of health bars and protein shakes
- Flour made from the pulp byproducts of soybean and almond milk production – To produce baking mixes or upcycled flours
- Craft beer from surplus of unsold bread – To prepare fermentation substrate
- Pecan shell flour
- Dried vegetable peels – To prepare soup ingredients
- Powders from waste fruits and vegetables - To make beverages and snack bars
- Snack chip - From brewer's spent grain waste in the beer-brewing industry
- Kpomo/ Ponmo/ Kanda – Produce from cleaned and precooked beef hide
- Barnana – To make banana-based snacks from imperfect bananas
- Wtrmln Wtr – To prepare a cold pressed juice from imperfect watermelons and
- Barvocado - From upcycled avocado seeds to make energy bars



Upcycling becomes effective to produce food products using the most nutritious food parts that are thrown away or unused in day-to-day life.


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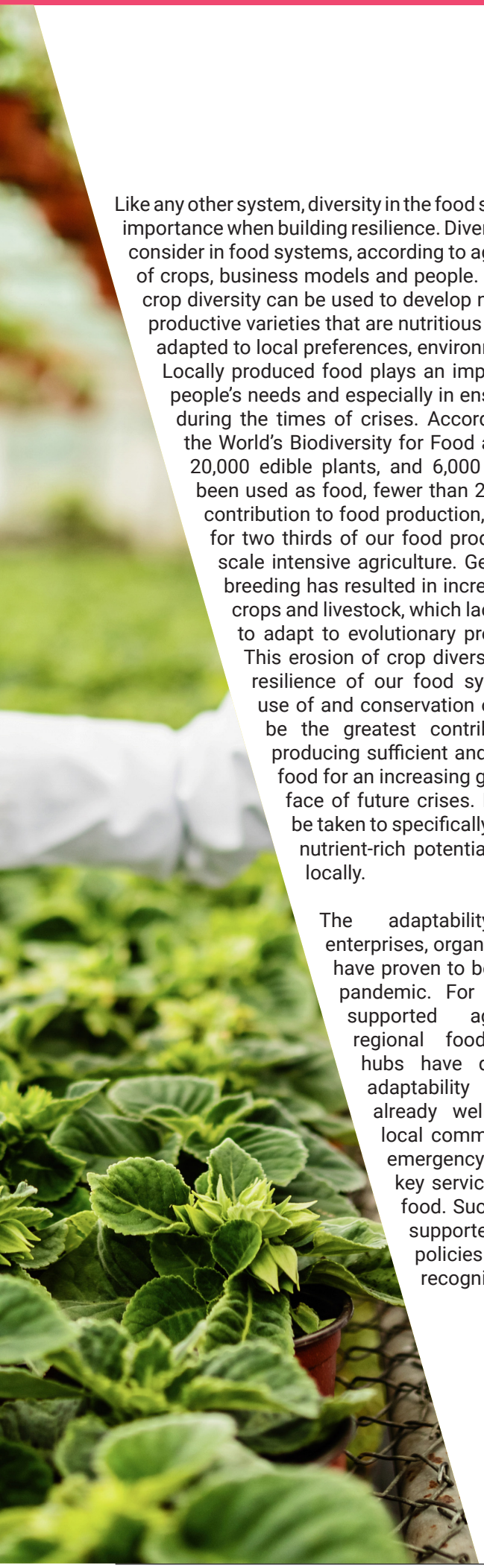
The COVID-19 pandemic has unarguably had profound effects on our healthcare and other key societal systems, creating devastating social, economic, and political crises throughout the world and presenting complex challenges and disruptions to the global industrial, capital-driven food system. As a result of these disruptions food insecurity has been to substantially increased and the diet quality of many millions of people has been greatly threatened. The World Bank estimates that 119 to 124 million people will have been pushed into poverty during the pandemic. The global food supply chain was also greatly affected due to the unprecedented stresses arising primarily from the momentous shifts in demands, also exposing bottlenecks in agriculture and farm workforce, processing, transport, and logistics. While food supply chains have demonstrated substantial resilience by responding to this increased demand, a long-term strategy is needed to ensure that the vulnerabilities in our food system are correctly mapped and fixed. For this, we should think beyond supermarkets! We need to build a holistic framework that incorporate dimensions to reflect how our food is produced, processed, stored, transported, and made available, along with impacts and knock-on effects. This was also highlighted at the first-ever Global Food Systems Summit convened by the United Nations Secretary-General on September 23, 2021.

# BUILDING RESILIENCE IN OUR FOOD SYSTEMS :

## a post-pandemic priority



Like any other system, diversity in the food system is of paramount importance when building resilience. Diversity is a key element to consider in food systems, according to agroecologists, in terms of crops, business models and people. In the face of a crises, crop diversity can be used to develop new, more resilient and productive varieties that are nutritious and tasty, and that are adapted to local preferences, environments and challenges. Locally produced food plays an important role in meeting people's needs and especially in ensuring dietary diversity during the times of crises. According to FAO's State of the World's Biodiversity for Food and Agriculture, out of 20,000 edible plants, and 6,000 that have historically been used as food, fewer than 200 now make a major contribution to food production, and just nine account for two thirds of our food production, through large-scale intensive agriculture. Generations of selective breeding has resulted in increasingly homogeneous crops and livestock, which lack the genetic diversity to adapt to evolutionary pressures like diseases. This erosion of crop diversity is undermining the resilience of our food systems. Therefore, the use of and conservation of crop diversity could be the greatest contributor for sustainably producing sufficient and adequately nutritious food for an increasing global population in the face of future crises. Measures should also be taken to specifically identify and conserve nutrient-rich potential food plants, at least locally.

The adaptability of small-scale enterprises, organizations and initiatives have proven to be high even during the pandemic. For instance, community supported agriculture schemes, regional food banks, and food hubs have demonstrated greater adaptability because they are already well-networked with the local community and can rely on emergency helpers for delivering key services and care, including food. Such initiatives should be supported by well-established policies and should be well recognized in building food system resilience. In this post-pandemic era, policymakers will need to take a broad view of future shocks which may originate within and outside the food system and encourage governments to consider them in their political horizons. The most rational approach for governments would be not to plan for single events, but to expect shocks to combine. Therefore, global issues such as environmental degradation should be addressed by embedding environmental considerations into all policy frameworks. Developing support schemes for food system workers is especially important, recognizing that many of them are poorly paid and have insecure jobs.

The overall approach to strengthening resilience in food systems needs to adopt a whole food-system view of resilience. Joined-up solutions that build coherence along and across all supply chains from production to retail should be explored and implemented. All stakeholders of food systems need to function, and collaborate to keep food commodities flowing in the supply chain and keep food trade alive. This will ensure that the entire food system can operate effectively, even in the face of crises. All stakeholders across entire food value chains need to be protected and well supported. Since COVID-19 has shown how shocks can affect farms, food processors, food transporters, traders, wholesalers, and retailers, a social safety net should be bult to protect all of them. In this context, support for SMEs is particularly important. Measures to improve resilience also need to recognize that food systems are dynamic and complex, comprising many interacting sub-systems.

In conclusion, it is imperative for us to learn the lessons from the COVID-19 pandemic and to rebuild our food systems better so that they are better prepared for a range of future shocks in the global scale.

**Words by Chathudina J. Liyanage**

# >> HEALTH-PROMOTING EFFECTS OF EDIBLE LICHENS

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Lichen Salad

With the emergence of the COVID-19 pandemic, we realized that health is the most valuable thing we could ever ask for. Hence, nowadays most of the people are highly concerned about their health. Furthermore, there are ongoing researches to discover novel natural food sources which can promote health. Interestingly lichens are one of such natural food resources which have health-promoting effects on the human body. However, the studies on edible lichens are still not so common. Thus, this article especially tells you about the utilization of lichens as a food, the nutritional and edible values of lichens, and some of the prospective health benefits of lichens to inspire you about the value of lichens as a food.

Can you remember the simple slow growing, leaflike and crusty objects on rocks, walls, and trees in your backyard, or in some other places? Those are called lichens. As you see, they are distinctive kinds of plants in nature. Based on their growth forms there are mainly three types of lichens. They are Fruticose lichens, Foliose lichens, and Crustose lichens. However, some lichens are in between the above three types. Lichens are a combination of a fungal partner (mycobiont) and an algal or cyanobacterial partner (photobiont). They are living together with a symbiotic relationship to make a stable and unique structure called lichen. Photobiont is the one who does photosynthesis, and they have chlorophyll. They can supply organic nutrients for the mycobiont. In return, the fungal partner can supply moisture and inorganic salts absorbed by its hyphae from the environment for the photobiont. Moreover, the fungal hyphae can wind around the photobiont cells and shield the photobiont from external damage. Hence, this association between these two organisms is usually interpreted as a mutualistic relationship. The distinctiveness of relationships inside the lichens has led to establishing an exclusive set of natural organic compounds, with a significant biological value. Lichens are recognized to have high nutritional value, and the active compounds that are extracted from them are known to comprise several health benefits. Even in ancient times, lichens were known to be used in folk foods and medicines in many countries. Nevertheless, the mode of action of the extracted bioactive compounds, and the bioavailability of nutritional compounds obtained from lichens are still under research level.

Lichens are a good source of protein. Also, they contain carbohydrates and some other polysaccharides like cellulose. Furthermore, lichens are

rich in mineral elements and have high crude fiber content. Most importantly they comprise a lower fat content that enhances the edible value of lichens. Rather than the above components, lichens contain high ash content which suggests that the lichens may be rich in various types of minerals as well. The polysaccharides including carbohydrates presence in the lichen have been found to consist of immune activation properties, compounds that act against cancers, antioxidants, antimicrobials like antivirals, and various other biological activities. Even if fiber practically has no nutritional value, it can enhance intestinal health and supports a healthy gut microbiota. Moreover, the intake of fiber can diminish the risk of some chronic diseases, including obesity, cardiovascular diseases, and diabetes. Various advantageous elements that are present in lichens are essential for maintaining healthy life by helping in normal physiological functions inside the human body, like neuromuscular activity, enzyme activators, acid-base balance, and osmotic pressure. Lichens usually contain a high amount of calcium and potassium together with a relatively low amount of sodium. Interestingly, the high potassium and low sodium values in a diet are normally assumed to have the ability to maintain the body's acid-base balance and blood pressure, which in turn help in the prevention of hypertension. In addition, lichens contain iron which is beneficial in the transportation of oxygen and the formation of cellular components in the blood. It can help to avoid getting iron deficiency anemia. Despite all these advantages, unfortunately, lichens can easily accumulate air pollutants as they get the nutrients mainly from the atmosphere.

However, there is a lot of researches in the food technology field that are yet to be done to understand the bioavailability of edible lichens in the human body, novel methods of food processing using edible lichens, and pre-treatment methods to get rid of contaminations and toxic materials in lichens when lichens are consuming as functional foods in the society.

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# >> APPLICATION OF SUPERCRITICAL FLUID EXTRACTION IN THE FOOD INDUSTRY

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The supercritical fluid extraction (SCFE) process has emerged as an alternative to the traditional solvent extraction process which is considered as one of the most popular green extraction techniques used in the contemporary world. Carbon dioxide is the most useful supercritical fluid as it is safe, inexpensive, non-toxic, non-inflammable, and inert while solvating strength and the extraction parameters (time, temperature, and pressure) can be easily adjusted with a modifier. Although supercritical fluid extraction technology was used in the late 19th century as a tool to understand natural mineralization, the commercial exploitation of supercritical fluid extraction technology has begun in the 1970s. This was particularly motivated by environmental concern for replacing toxic industrial solvents and finally, the SCFE processes determined to be economical to liquid extraction and distillation methods.

In supercritical fluid extraction, components to be extracted are mixed with a supercritical fluid to form a mobile phase and then subjected to pressures and temperatures near or above the critical point to enhance the mobile phase solvating power. Extraction is relatively rapid because of the low viscosities and high diffusivities associated with the supercritical fluids. The extraction can be selective to some extent by controlling the density of the medium and the extracted material is easily recovered by simply depressurizing allowing the supercritical fluid to return to the gas phase and evaporate leaving no or little solvent residues. Aspects such as improved selectivity, higher extraction yields, better fractionation capabilities, and lower environmental impacts have resulted in the important growth of SCFE.

Furthermore, non-toxicity and low critical temperature of CO2 lead to apply SCFE in the food industry. The color, composition, odor, aroma, and texture of the extracts are maintained while preventing contamination with residual solvent. SCFE is currently applied in various sectors in the food industry including decaffeinating of coffee and tea, extraction of essential oils (vegetable and fish oils), extraction of flavors from natural resources (nutraceuticals), extraction of ingredients from spices and red peppers, extraction of fat from food products (dairy and meat), extraction of thermally liable food components, production of natural colorants and aromas, removal of alcohol from wine and beer, elimination of pesticides, deodorization of fish oils, encapsulation of oils and treatment and valorization of food waste. Moreover, SCFE has been widely used in the field of food safety. Currently, food safety addresses several safety issues such as detection of frauds, adulterations, contaminations, and food pollutants. Generally, the analysis of food pollutants needs long extraction and cleanup procedures. These procedures are time-consuming, labor-intensive, and employ large volumes of toxic organic solvents. In order to reduce the sample preparation time and the use of large amounts of organic solvents, techniques such as SCFE have been developed. This has been used in food pollutants analysis, mainly pesticide residues and environmental pollutants.

In contrast, SCFE has several disadvantages such as being comparatively more capital intensive due to the requirement of high-pressure operation and very accurate process control and consistency & reproducibility may vary in continuous production.

Supercritical CO2 extracts are the answer to the growing demand for pure and natural substances in the food industry. Known to be one of the gentlest extraction processes, supercritical fluid extraction has garnered a lot of attention due to its effectiveness in producing exceptionally pure and solvent-free extracts ultimately opening the pathways to apply in the growing food industry.

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# >> RICE BRAN OIL

## AN EMERGING SOURCE OF FUNCTIONAL OIL

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Edible oils play an important role in your diet which use in food processing industries by adding directly and/ or during cooking processes. Coconut oil is used primarily for vegetable oil in Sri Lanka. However, by increasing knowledge of food, consumers have the potential of taking functional foods in their diet.

Rice bran oil can be a new concept for you. But it is not a new concept. Such oil is considered premium oil in many Asian countries. Like Japan, China, India, Korea. Taiwan, Thailand, etc. In Japan, rice bran oil is popularly known under the name of "Heart oil"

Rice bran can be considered an excellent source of rice bran oil. It has 12%-23% oil. Rice bran is an inexpensive by-product produced in the rice milling process. However, it has high-quality fat, proteins, starch, reducing sugar, hemicellulose, cellulose, crude fiber, and other significant bioactive compounds. Also, it contains higher lysine content than other cereals.

Rice bran oil is valuable for production from rice bran. It has unique properties and high nutritional value. Such as anti-cancer properties, antioxidant properties, anti-diabetic properties, and many bioactive compounds (gamma-oryzanol, vitamin E, etc.). Also, rice bran is a good source of minerals like calcium, magnesium, zinc, phosphorus, manganese, etc. The fatty acid profile helps to reduce blood cholesterol levels and cardiovascular diseases. Polyphenolic compounds give antioxidant properties, and polyunsaturated fatty acids have in higher amounts. It has the potential for nutraceutical properties.

n the cooking process, rice bran oil is the highest quality vegetable oil. It has a higher smoke point which is 254 0C. Therefore, the oil is suitable for high-temperature cooking and deep-frying process and gives high shelf life compared with other vegetable oils. Also, it contains tastes and flavours that are good for the food. Currently, rice bran oil is used on a commercial basis in the food industry. Like snack food industry. In the last decade, about one-third of all Japanese restaurants in the US have shifted to rice bran oil due to, giving better flavor characteristics to foods and has higher stability than other vegetable oils.

Recently, A number of nanoencapsulation and micro-encapsulation studies are being carried out for rice bran oil to increase stability and control release bioactive compounds in rice bran oil.
Rice is a staple food and paddy is a mainly cultivated crop in Sri Lanka. According to FAOSTAT (2020), in Sri Lanka, the production of paddy was estimated at a record of 5.1 million tonnes. Therefore, a higher amount of rice bran is produced in the rice milling process in Sri Lanka. However, rice bran is mostly used in Sri Lanka as livestock feed and the majority of rice bran is wasted. The production of rice bran oil can be a valuable product in the functional food processing industry in Sri Lanka, and it can open up a new market timeliness.

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# >> TESTING METHODS FOR THE DETECTION OF SPICES ADULTERATION

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Food adulteration is a term used to describe the process of lowering the quality of food by adding low-quality ingredients or extracting valuable substances. While adulteration in spices is illegal, it is present in such a way that it may misguide or confuse the consumer due to their similar appearance but lower quality and value, or it could be intentionally mixed in spices to make lots of money. Spices are frequently adulterated with husk, artificial color, starch, chalk powder, sawdust, horse dung, lead chromate and argemone, and papaya seed, among other things.

## 1. Turmeric powder

**(a) Adulterant: Lead chromate**

The turmeric powder is mixed with water and placed in a beaker. If the tested turmeric powder is adulterated one, it will immediately leak streaks of watersoluble colour.
Turmeric powder added to the water and kept in a beaker. If the turmeric powder used in the test is adulterated, it will rapidly leak watersoluble color streaks.

**(b) Adulterant: Artificial coloring materials**
**Metanil yellow**

The turmeric powder is placed in a test tube to test this at home. It is then diluted with alcohol (3-5 ml) and vigorously shaken. The test tube is then filled with 10 drops of hydrochloric acid. The presence of the chemical Metanil yellow is confirmed if the contents of the test tube turn pink or violet.

**(c) Adulterant: Corn flour (starch), yellow colored chalk powder or sawdust**

Adding a teaspoon of turmeric powder to a glass of warm water is one of the simplest ways to check for adulteration in turmeric powder. Leave it alone for 20 minutes without stirring. If the turmeric powder is pure it settles at the bottom of the glass with clear water above it, while cloudy water indicates the probability of adulteration.

## 2. Red chili powder

**(a) Adulterant: saw dust and brick powder**

One teaspoon of chilli powder is added to a glass of water and swirl it. Adulterated chilli powder will dispel a red swirl of color.
One teaspoon of chilli powder is mixed with water. Red swirl of colour is dispel in the adulterated chilli powder.

**(b) Adulterant: Soap stone**

One teaspoon of chilli powder is mixed with water. Soap stones were settled as a smooth white powder at the base of the glass.

**(c ) Adulterant: brick powder and sand**

Rub some chilli powder in the bottom of a glass vessel to see if it's adulterated. If it feels gritty, it's because it's been mixed with brick powder or even sand.

**(d) Adulterant: artificial colors like Sudan Red**

One teaspoon of chilli powder is added in a glass of water and mixed well. Change in the water colour will prove the presence of an adulterant- Sudan Red.

**(e) Adulterant: starch**

Add few drops of iodine solution to the powdered spice. If the colour change into blueish colour, it indicates the presence of starch.

### 3. Cumin powder

mostly with charcoal dust, starch

(a) Adulterant: sawdust

In a glass of water, dissolve a tablespoon of cumin powder and set aside for a few minutes. Adulterants will rise to the top of the glass, while pure spice will settle to the bottom.

(b) Adulterant: husk

It was shaken after one teaspoon of cumin powder was added to a glass of water. The husk will rise to the surface because it is lightweight, whereas the pure spice will sink to the bottom of the glass.

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**Answers to the puzzle** ⇨

| *Vertical* | *Horizontal* |
|---|---|
| 1. Carbohydrate | 2. Calciferol |
| 3. Cholesterol | 4. Casein |
| 5. Passionfruit | 5. Pasteurization |
| 8. Amine | 6. Adipose |
| 9. Renin | 7. Carrot |
| 10. Aseptic | 11. Irrigation |
| 13. Beriberi | 12. Lactose |
| 16. Salmonella | 14. Enzyme |
| | 15. Cereals |

# IN THE SPOTLIGHT

## THE PROSPECTS IN THE VALUE ADDITION OF SRI LANKAN SPICES


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Spices have been a part of man's history for centuries. Since earliest times, spices have been used to flavour many foods and beverages around the world. As a result the spice trade has spanned the world for thousands of years. Ceylon spices are well known, prized, and highly valued in the whole world, for their characteristic flavor. Being a tropical country offers different microclimates and temperature variations through the island which facilitate enhancing the intrinsic value of spices grown in the country. Ceylon cinnamon is the most famous spice from Sri Lanka and the country contributes over 90% of the world market share. Other than cinnamon, pepper, cardamom, clove, and nutmeg are other traditionally grown spices in Sri Lanka. According to the Department of Export Agriculture, Sri Lanka, 56% of Sri Lankan agricultural exports consist of spices, essential oils, and allied products.

Spices are rich in different functional properties and, thousands of researches have been conducted in different countries to screen their properties. Literature proves that Ceylon spices are rich with many functional properties when compared to the spices grown in many other tropical countries like India and, Vietnam. However, in cooking, spices are used in nutritionally insignificant quantities as a food additive for the purpose of flavoring. Many of these spices have other uses, such as food preservation, medicine, cosmetics, perfumery, or pesticides. Most of the western countries import spices for many of the above purposes rather than for food uses.

There is a big argument among the experts that Sri Lanka is not to obtain the true potential of spices from the international market. Traditional systems and methods have been used to grow and process spices by the country and most of the spices are exported as bulk commodities without any value addition. Producing valuable medicines, cosmetics, or pesticides by using spices as a raw material would lead to gaining more foreign revenue. The international demand for natural products is increasing. Therefore, the department of export agriculture, many reputed laboratories, and researchers in Sri Lanka focus on enhancing and evolving its value-added range. However, value addition is not easy since it needs many laboratory experiments. Further, the global food industry has been focusing on food safety and hygiene and the developed markets have introduced many entry requirements such as GAP (Good Agricultural Practices) GMP (Good Manufacturing Practices) HACCP (Hazard Analysis and Critical Control Points) for all food products entering the international market.

Fulfilling the above requirements becomes challenging as the majority of spice producers in Sri Lanka are small-scale level and the production is largely limited and grown in home gardens. Some other countries in Asia produce and introduce huge bulks of nutmeg to the international market with added value. Asian countries such as India, Vietnam, and Indonesia have become large suppliers of value-added spices and herbs. Even though value addition is the best path to earn more foreign revenue and the most requested form of the international market, in the Sri Lankan context value addition for spices is still negligible. Currently, crushed/ground spices are the only way to add value for many Ceylon spices. However, as a rich source of many biological properties such as antimicrobial, anticancer, anti-inflammatory, antioxidant, etc, spices can be used for many product developments.

As the demand for natural products is very high as increased interest of consumers as they are considered safer and more cost effective than synthetic drugs, cosmetics and agro-chemicals in many occasions. Further, according to World Health Organization (WHO), about 80% population of most developing countries still rely on traditional herbal medicines for their primary health care needs. As a population in a country who still use spices as home remedies for many diseases and as a pesticide for many plant pathogens, there is a huge potential to develop new products using our day today spice applications. However, screening bioactivities of spices would be much useful to get ideas for product developments, thereby to introduce it in different products to the local and international market. Again, it will open some other paths for spice farmers to raise their income rather than by producing and selling primary forms of spices.

Therefore, it become a responsibility of the researchers in the food and agriculture sectors in Sri Lanka to explore more research findings and should take the leadership to help and direct spice producers to produce for new product developments.

# >> HERBS AND SPICES AS NATURAL ANTIBIOTICS IN INDUSTRIAL FOOD PRESERVATION

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Synthetic antimicrobial agents have long been used to inhibit microbial pathogens in the treatment of infectious diseases, management of agricultural crops and preservation of food (Chowdhury et al., 2019; Baljeet et al., 2015). However, the abuse and overuse of antibiotics have led to the alarming proliferation of resistant bacteria owing to their ability to acquire and transmit the resistance to other bacteria (Chowdhury et al., 2019). This bacterial evolutionary process of resistance has vastly created an imbalance in the ecosystem resulting in a high mortality rate of one-third of the 55 million deaths in 2011 as reported by the World Health Organization (WHO) (Chowdhury et al., 2019; Liu et al., 2017; Baljeet et al., 2015; Asimi, Sahu and Pal, 2013).

The chemical antimicrobial preservatives used in the food industry, particularly raw vegetables and meat, do not entirely destroy the pathogenic microbes like E. coli, methicillin-resistant Staphylococcus aureus and Listeria monocytogenes, which ultimately results in the emergence of multiple drug-resistant micro-organisms (Baljeet et al., 2015; Kong, Wang and Xiong, 2007; Prabakaran, 2017). The fat, protein, water and salt content of food were found to influence microbial resistance, according to the study by L.A. Shelef in 1983 (Chattopadhyay and Bhattacharyya, 2007). Moreover, the increasing consumer demand for natural preservatives like spices over chemical preservatives in the food industry has warranted the need to replace chemical antibiotics and preservatives with alternative plant-based antimicrobial remedies to assure safety and longer shelf life of food products (Chowdhury et al., 2019; Fahrinda et al., 2018; Baljeet et al., 2015).

Spices have been used traditionally in most of the Asian countries, mainly India and China, to combat pathogenic infections, prevent cellular oxidative bursts, preserve food and alleviate indigestion since pre-historic times (Chitra et al., 2019; Al- Talib et al., 2016; Britto et al., 2012).

In addition, the spices and herbs have also been used in culinary to enhance flavour, aroma and colour (Asimi, Sahu and Pal, 2013; Rahman et al., 2011) and have better tolerance level against microbes with little to no side effects than synthetic drugs (Chitra et al., 2019; Chowdhury et al., 2019; Liu et al., 2017; Prabakaran, 2017). The

antimicrobial property of spices and herbs is attributed to the secondary metabolites such as alkaloids, flavonoids, isoflavonoids, tannins, coumarins, terpenes, glycosides and phenols, which plants synthesise as part of a defence mechanism against foreign organisms (Chowdhury et al., 2019; Chitra et al., 2019; Baljeet et al., 2015; Mukhtar and Ghori, 2012)

The pressing need to replace commercially available antimicrobial agents with natural alternatives is reflected by the policy imposed by the WHO that promotes the traditional medical practice in developing countries like Sri Lanka (Chowdhury et al.,

2019). Using natural preservatives could be economically feasible since it cuts down the cost of manufacturing chemical-based antibiotics (Chitra et al., 2019; Asimi, Sahu and Pal, 2013).

Gram-positive bacteria are more sensitive to the spices due to the single peptidoglycan layer with 2% lipid, which allows the permeability of hydrophobic and volatile active compounds in contrast to the double phospholipid membrane in Gram-negative bacteria (Wolde et al., 2018; Yetgin, Canlı and Altuner, 2018; Macwan et al., 2016).

In the case of Gram-negative E.coli, the research by Freidman in 2004 reports that ten antimicrobial compounds were identified to have potent activity against E. coli: "carvacrol, oregano oil, geraniol, eugenol, cinnamon leaf oil, citral, clove bud oil, lemongrass oil, cinnamon bark oil, and lemon oil" which indicates E.coli can be inhibited by spices (Kong, Wang and Xiong, 2007).

The mechanism of action of the active ingredient in spice is highly specific to the strain used and cannot be simplified as one standard mechanism for all bacteria (Tyagi et al., 2015). Even though more studies focus on analysing the individual extracts of spices as antimicrobial agents, only fewer reports investigate the synergistic, additive or antagonistic antibacterial effect of combined extracts (Chowdhury et al., 2019; Prabakaran, 2017; Baljeet et al., 2015).

Synergistic interaction increases the microbial action; the additive effect is similar to the individual effect, while the antagonistic effect of combined extract creates lower microbial action than individual capacity (Baljeet et al., 2015). Synergism occurs when one spice supports another spice's antimicrobial interaction, which improves the efficacy of the combined extract as a potent antimicrobial agent (Chowdhury et al., 2019). Therefore, the knowledge of synergistic and antagonistic antimicrobial effects of combined spice extracts is crucial to understand the potential of spices as antimicrobial agents for industrial food preservation (Baljeet et al., 2015).

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# >> AN OVERVIEW OF PALM OIL USAGE IN FOOD INDUSTRY

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Palm oil is a nutrition enriched edible vegetable oil extracted from the harvest of oil palm trees (Elaeis guineensis). Two oil types are extracted during the manufacturing procedure; Crude palm oil and Palm kernel oil. Color of this oil is reddish or golden color mainly with the enriched carotenes.

During the manufacturing procedure, initially fresh fruit bunches are collected from the oil palm plantations and the bunches are subjected for sterilization. To make the fruits free from the bunches, threshing is done. Finally, oil is extracted separately from the flesh and the kernel and are purified prior to usage.

## Crude palm oil vs Palm kernel oil

Crude palm oil is extracted by squeezing the flesh of oil palm fruits while the kernel of the fruits is crushed for palm kernel oil extraction. The nutrient content of the oils varies specifically based on saturated and unsaturated fat content. Around 80 % of the fat content in palm kernel oil is identified as saturated. Comparatively, crude palm oil is with around 50 % of saturated fat amount. At high temperature levels, color of this oil is changed to pale yellow with eradication of carotenoids in it. But as the saturated fat content minimize the rate of breakdown, it is much popular in food science and technology. At room temperature, the fat content of the palm oil is in solidified nature. Both oils create significant negative effects on human health mainly with the saturated fat content.

## Importance of palm oil in food industry

In commercial scale, a variety of edible oils are identified but based on refining fractions of palm oil, a versatility is given for different sets of food applications. Major effect behind this versatility is trans free and genetic modification free nature of palm oil. Based on this feature, direct blending of palm oil with other vegetable oils are practiced in food industry specially to meet the trans-free fat requirement in food products. Most triacylglycerols of palm oil are esterified with oleic and linoleic acids. The semi-solid nature of palm oil promotes to be used as a spread and also it has the ability to make the food products last for a longer period of time with its resistivity for oxidation. Palm oil is also recommended for frying food because of its ability to withstand high temperature levels. Also, a better bio availability is provided for food with essentials fats provided with the use of palm oil in food industry.

## Nutrition information of palm oil;

One-tablespoon of palm oil can be served with 120 calories, 0 g of proteins, fiber, sugar and carbohydrates as well as 14 g of fat. It is highly enriched in Vitamin E and antioxidants.

## Are there any negative effects of having palm oil in food technology?

1. Increase cholesterol levels; Increase "bad" cholesterol specially with high saturated fat.
2. Promotes for risk of Atherosclerosis; with the consumption of reheated palm oil.
3. Increase the risk of heart diseases and chronic health conditions; due to higher concentration of saturated fat in palm oil.
4. Become cancerous when food is processed in palm oil at very high temperature level.

## Should foodies consume palm oil usage or prohibit the use of palm oil?

Fresh palm oil from the flesh of oil palm seeds is much healthier to be consumed for maintenance of the immune system healthier and also for supporting better communication among cell with vitamin E and antioxidants provided.

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# TOWARDS FLEXITARIANISM >> BEING GREENER IN DIET

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Other than the trends that we usually come across from time to time in terms of dietary habits; such as being vegan, vegetarian or metatarian; have you ever heard of people being flexitarian?

Unlike vegans or vegetarians who would totally avoid the consumption of animal based products, being flexitarian is a concept that a person being flexible with the diet and being an occasional consumer of livestock products.

The word "Flexitarian" has officially added to the Oxford Dictionary in year 2014 and up to the recent times this has been a concept largely followed, just by the people who were engaged in activities related to animal welfare, with the intention of getting public attention towards the limited use of animal based food products.

In terms of grounds which made a lot of people around the world to move their long driven dietary habits recently towards flexitarianism, and for this aspect to become more exposed, cannot be unhooked from the incident which was experienced by the whole world; the COVID 19 pandemic.

With the facts established, with regard to the origin of the COVID 19 pandemic in relation with the consumption of animal products; especially meat, there were lot of doubts arising questioning the potential risk of the origin of zoonotic diseases within a population with the consumption of livestock products.

As a result flexitarianism became a global trend; as people tend to move themselves a little bit away from the animal based products; making it an occasional part of their diet.

This novel conception marked a huge impact on the global market as well making a shift towards the production of plant and myco-protein based protein alternatives to head on with the emerging drift.

Other than the emerging flexitarians; the vegan and vegetarian community has also got benefited from this, by getting a rage of alternatives to quench their thirst in fulfilling the daily requirement of protein.

Though the trend of being in to this particular dietary has been driven by many factors; once a person is into this, it provides a lot of health benefits as an extra advantage; especially for the people who are waiting to lose their weight, who are suffering with risks of heart diseases, Type 2 diabetes as well as pre-diabetic conditions.

This is considered as an approach which could be easily followed by the omnivore population who are not very interested to become vegan or vegetarian but are willing to concern about their health and diet in a different way.

Moreover, this can be considered as a concept of being greener towards achieving sustainable goals in food consumption, as the reduction of the consumption of animal based products reduces one's carbon footprint as well.

By all its' means, it is undeniable that being in an era of finding novel schemes to move towards a greener future; this current and emerging concept of flexitarianism seems to be a spotlight for us to head towards the path we were exploring since generations. So it is high time to think wise, think greener in making both ourselves and our planet fit and fine. What is your opinion? The choice is yours!!!

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INDIGENOUS RECIPE

# ALANGA CURRY

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| | |
|---|---|
| Scientific Name | : ***Ipomoea alba*** |
| Family Name | : **Convolvulaceae** |
| English name | : **Moon vine** |
| Local Name | : **Alanga** |

Alanga can be found in many parts of the country and is used as a vegetable by the ancient Sinhala people. It is a traditional rare vegetable that is now extinct but is gaining popularity again in recent times. It is a semi-perennial crop that can be grown up to 2 inches long and shiny. The nodular part of the flower is located on the top of this pod. It grows well as a large vine. It is a semi-annual crop that can be easily grown without any diseases.

Before the beans came to Sri Lanka from the western countries, Sri Lankans have been cooked Alanga as same the procedure that is used to prepare beans.

Alanga is important to control blood sugar level and cholesterol. It is also used to cure cancer and popular as a herbal plant due to its ability to cure constipation, tapeworms, tumors and snake bites.

## Ingredients

Alanga pods
Onion
Garlic
Maldive Fish
Curry leaves
Chilli powder
Turmeric powder
Curry powder
Salt
Coconut milk

## Procedure

First, wash and clean the Alanga pods. After removing water, cut them into small pieces. Put the sliced alanga in a clay pot and add a portion of finely sliced onion, chopped garlic, maldive fish, curry leaves, chilli powder, turmeric powder, curry powder, mustard seed and salt in it. Place the clay pot on the stove and let it boil slowly. When the alanga is well cooked, add milk and cook on low heat.

(The bud-like part of the pod is not eaten because there are alanga seeds in that part. Also, always use immature young pods.)

# >> HEALTHY KITCHEN FOR HEALTHY LIVING

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Simply put, kitchen is the place that is equipped for preparing and cooking food. Notwithstanding that there are many things to talk about a kitchen's roles like food storage, cooking equipment, cleanliness, etc., this article mostly focuses on proper regulation of consuming salt, sugar and coconut oil.

As high consumption of salt, sugar and coconut oil can increase the risk of getting Non-Communicable Diseases (NCDs) such as cardiovascular diseases, diabetes, etc., recommended levels have been defined by World Health Organization. According to that, recommended levels of salt, sugar and coconut oil for a normal person per day are less than 5 grams, between 5 to 10 grams and about 5 ml respectively.

As high consumption of salt, sugar and coconut oil is related to our lifestyle, it can be considered as one of the main modifiable behavioural risk factors for NCDs. So, let's discuss how this can be addressed at the family level using real scenarios which I encountered during my field work as a part of the study program in the university.

**"Green Kitchen Appraisal"** is one of effective activities such families developed to properly regulate their consumption of salt, sugar and coconut oil considering kitchen as the centre for increasing NCD risk at home. The steps are as following,

1. **Calculating the recommend amount of salt, sugar and coconut oil per week considering the number of family members.**
   Calculation can be done using a teaspoon. Approximately 1 Teaspoon = 5 g and 1 Teaspoon = 5 ml

2. **Fill your salt, sugar & coconut oil bottles only with the calculated amount of salt, sugar and oil.**
   You can calculate the recommended amounts daily/ weekly/ monthly and fill the bottles based on your convenience

3. **Use salt, sugar and coconut oil in that separate bottles when preparing meals and beverages only for family members.**
   Try not to use salt, sugar and coconut oil in that separate bottles for others

4. **Create criteria as in the following table and select a colour for each criterion based on your preference.**
   You can create these criteria daily/weekly/monthly based on your convenience.
   - If you fill the bottles with daily amount, you should create criteria per day
   - If you fill the bottles with weekly amount, you should create criteria per week
   - If you fill the bottles with monthly amount, you should create criteria per month

5. **Create a symbol for each bottle based on your preference.**

| Criteria / Bottle | Used the whole bottle before the end of the week and refill | Used the whole bottle by the end of the week | Don't used the whole bottle by the end of the week |
|---|---|---|---|
| Salt | | ✓ | ✓ |
| Sugar | ✕ | ✕ | ✕ |
| Coconut oil | ● | ● | ● |

*Creating this table is not mandatory. This is used to ease the marking of kitchen calendar. If you can remember the details in this table, then there's no need to create this table.*

6. **Considering the above table, mark the level of consumption of salt, sugar and coconut oil for your family on the calendar. This calendar is called "Kitchen Calendar"**


7. **If you get all three marks in Green, you can name your kitchen as a "Green Kitchen" and identify that the level of consumption of salt, sugar and coconut oil for your family is in a healthy range.**

**Pros :-**

You can identify and analyse the fluctuations of the level of consumption of salt, sugar and coconut oil for your family using colour changes of the symbols.

For example, by August 01 this family get a red tick and by August 08 this family get a black tick which indicates that their salt consumption is reduced. But, comparing August 22 and 29, tick becomes black to red which indicates that their salt consumption is increased.

**Cons :-**

This does not consider intake of salt, sugar and coconut oil from other foods like rice, fruits, biscuits, etc.

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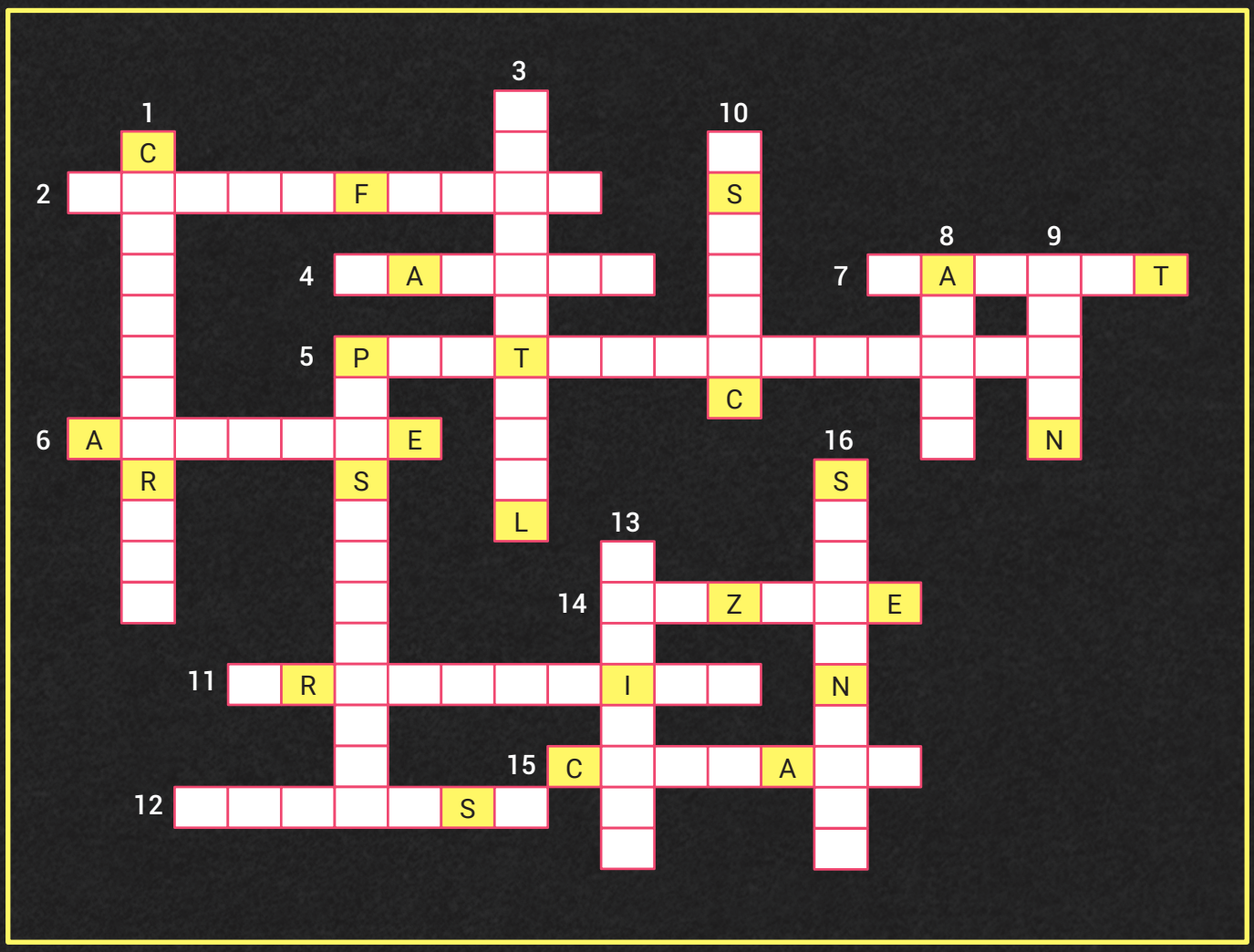
# ACHIEVEMENTS

- 1st Runner up - Team “Eco Guarder” - Category of Food Safety and Quality - Food Techthon’21 (organized by the society of Food Science and technology, University of Peradeniya, in collaboration with EdScale UP)
- Finalist - Team “REVITALIZERS” – Category of Novel Food Product Development - Food Techthon’21 (organized by the society of Food Science and technology, University of Peradeniya, in collaboration with EdScale UP)
- Winner - Team “Tetrad” - Researching and producing nutritional supplements for astronauts using algae - NuForA’21 (organized by SEDS OUSL in collaboration with the Biomedical and Earth Science division of SEDS SL)
- 1st Runner up - Team “Golden Flashes” - Researching and producing nutritional supplements for astronauts using algae - NuForA’21 (organized by SEDS OUSL in collaboration with the Biomedical and Earth Science division of SEDS SL)
- 4th place - Team “Sabra Foodies” - Researching and producing nutritional supplements for astronauts using algae - NuForA’21 (organized by SEDS OUSL in collaboration with the Biomedical and Earth Science division of SEDS SL)


# IT'S PUZZLE TIME!




## Vertical

1. A macronutrient in food.
3. A type of fat, which is inherent to animal
5. Passiflora edulis refers to...
8. A group present in the building block of protein
9. An enzyme secreted by the stomach that coagulates milk
10. These types of packages consist of layer of plastics, paper board and Aluminium foil
13. A disease caused by Thiamine deficiency
16. A common foodborne (micro)biological hazard

## Horizontal

2. Vitamin D is also known as...
4. Principal protein in milk
5. A type of mild heat treatment
6. The fat storage tissue of animals
7. A vegetable which is a great source of Vitamin A
11. Major agricultural practice to fulfill water requirements of crops
12. Principle sugar in milk
14. Biomolecules that catalyze metabolic functions
15. Wheat, rice, rye, oats and barley are examples for...

*Check page no.27 for the answers..*

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