JULY 2024. VOLUME 1 ISSUE. 1

ISSN 3051-5653

FOODIFLASH

IFSTSL
INSTITUTE OF
FOOD SCIENCE & TECHNOLOGY
SRI LANKA

E-MAGAZINE

EXPLORING THE GUT HEALTH REVOLUTION:
THE HEALTH BENEFITS OF PROBIOTICS

IMPACT OF FOODS CONTAINING POLYACETYLENES ON GENE EXPRESSION IN REDUCTION AND PROPHYLAXIS OF CANCER

TOXIC GLYCOALKALOIDS IN POTATOES:
ARE THEY REALLY A CAUSE FOR CONCERN?

A NEW ERA IN FOOD TECHNOLOGY:
PRECISION FERMENTATION

HEAT- INDUCED FOOD TOXICANTS:
ACRYLAMIDES, NITROSAMINES AND POLYCYCLIC AROMATIC HYDROCARBONS

A CRUNCH FOR EVERY PALATE:
DIVING INTO THE DIVERSE WORLD OF ALTERNATIVE SNACK FLAVORS

A biannual publication of the Institute of Food Science and Technology Sri Lanka

FOODIFLASH

Institute of Food Science and Technology Sri Lanka (IFSTSL) is the learned Institute in Sri Lanka to serve as an apex body representing professionals engaged in food science and technology and the processed and aligned industry in Sri Lanka.

Responsibility of the contents of the articles in this publication remains with the individual authors. All articles were published after peer reviewing and editorial corrections for uniformity.

Editorial team encourages readers to make copies and circulate articles in this E magazine with proper acknowledgement.

FoodiFlash is the E-magazine of IFSTSL published biannually

Webpage : www.ifstsl.org

Email : info@ifstsl.org

Address : Institute of Food Science and Technology Sri Lanka (IFSTSL), No. 21D, Vijaya Kumaratunga Mw (Polhengoda Gardens), Colombo-05, Sri Lanka

EDITOR'S NOTE:

WELCOME TO THE LAUNCH OF **FOODIFLASH E-MAGAZINE**

Dear Readers,

It is with great pleasure and excitement that we introduce to you the inaugural issue of FoodiFlash, the first e-Magazine from IFSTSL (International Food Science and Technology Sri Lanka). This marks a significant milestone in our journey to bring you the latest trends, insights, and innovations in the world of food science and technology.

FoodiFlash aims to be your trusted companion in exploring the diverse facets of food—from farm to fork, and beyond. Our dedicated team of writers, researchers, and experts have curated a compelling blend of articles, features, and interviews that promise to inspire, inform, and delight every food enthusiast.

In each edition of FoodiFlash, you can expect to find:

- Thought-provoking articles on food sustainability, innovation in food technology, and global culinary trends.
- Exclusive interviews with industry leaders, scientists, and academics who are shaping the future of food science and technology.
- Insights into the science behind food and food safety and its impact on health and well-being.

As we embark on this journey together, we invite you to immerse yourself in the fascinating world of food science and technology through the pages of FoodiFlash. Whether you are a seasoned professional, a curious consumer, or simply someone who appreciates the art of good food, there is something here for everyone.

We value your feedback and suggestions as we strive to make each issue of FoodiFlash more engaging and informative than the last. Thank you for joining us on this exciting adventure. Together, let's celebrate the magic of food and its endless possibilities.

Happy reading!

Warm regards,

Dr Nimsha Weerakkody

Editor-in-Chief FoodiFlash

CONTENTS

A NEW ERA IN FOOD TECHNOLOGY: **PRECISION FERMENTATION**

> **Precision fermentation" is a term that has recently emerged to signify fermentation processes that are well-optimized using specialized microbial hosts (referred to as "cell factories") for the purpose of generating compounds of interest, such as enzymes, proteins, lipids, carbohydrates, vitamins, and many types of food additives (colorants, preservatives etc.), with a high level of purity and yield**

GIHAN WIJELATH

Department of Agricultural , Food and Nutritional Science, University of Alberta. Canada
wijelath@ualberta.ca

Fermentation is used to preserve foods and enhance their sensory properties and nutritional value and has been utilized for thousands of years with various sources, including fish, meat, milk, vegetables, legumes, cereals, and fruits. This process involves the controlled growth of microorganisms and the conversion of food components through the action of microbial enzymes. A variety of popular fermented food and beverage products are traditionally available across the world, such as yogurt, kimchi, kefir, tempeh, miso, sauerkraut, sourdough bread, cheese, kombucha wine, beer, and natto. Moreover, fermentation is a foundational aspect of modern industrial biotechnology, which provides support for a wide range of applications, including food, medicine, water, environment, and energy.

"Precision fermentation" is a term that has recently emerged to signify fermentation processes that are well-optimized using specialized microbial hosts (referred to as "cell factories") for the purpose of generating compounds of interest, such as enzymes, proteins, lipids, carbohydrates, vitamins, and many types of food additives (colorants, preservatives etc.), with a high level of purity and yield. Typically, the production of these components via conventional agricultural and industrial processes is not sustainable. The growing demand for sustainable food sources has sparked a heightened interest in the creation of cellular products and leveraging microbes as hosts for the manufacturing of acellular products. Therefore, precision fermentation as shown in figure 1 is a significant advancement in food technology, as it is crucial to develop more sustainable food production and processing that uses fewer natural resources to ensure food security in the growing world population.

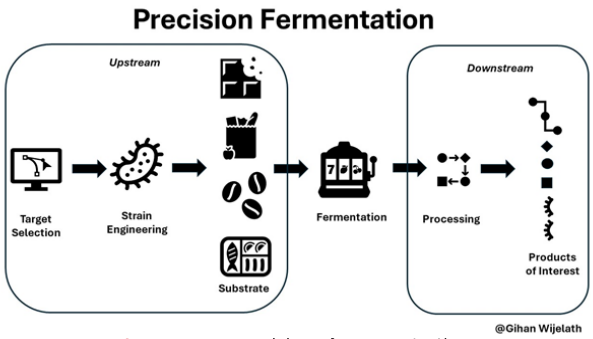


FIGURE 1 : Precision fermentation

While the idea of using native microbial producers for industrial-scale fermentation of food-related products, such as enzymes and additives, is not new, it remains an important area of research and development. The use of this technology has persisted for more than three decades in the production of insulin as a medication for diabetes and industrial enzymes, such as chymosin, for cheese manufacturing. Nonetheless, precision fermentation is generally considered to be comparable to metabolic engineering, a process that entails the genetic modification of microbial hosts for the production of non-native products. Metabolic engineering employs various techniques and strategies, including bioinformatics, next-generation sequencing, library screening, synthetic biology, enzyme engineering, molecular cloning, comparative multi-omics analysis, artificial intelligence (machine learning), and kinetic modelling, to optimize the metabolic pathways and product yields of cell factories, ultimately enabling the scaling up of bioprocesses for the industrial production of high-value products.

In simple terms, the functioning of precision fermentation entails the insertion of a particular molecular sequence into a microorganism, thereby granting instructions to generate the desired molecules during fermentation. These molecular sequences are derived from digital databases rather than being sourced directly from relevant animals or plants. Following the completion of the fermentation process, the resulting compounds are separated from the microorganisms that produced them through a filtration process. Microorganisms, mainly bacteria and fungi with non-harmful status and those that are generally regarded as safe (GRAS), are chosen for use in food applications. Innovation is achieved by employing new strains/species and applying the aforementioned recent advances to optimize the production of the desired product. This can involve improving aspects such as the expression, secretion, substrate conversion, and titer of the product. Novel approaches ensure products with intended properties and a precise and controlled fermentation process instead of being arbitrary/wild.

The newly established National Bioengineered Food Disclosure Standard by the United States Food and Drug Administration (FDA) does not mandate labelling of food products obtained from precision fermentation as genetically modified organisms (GMO), as these organisms are merely involved in the production process and are not present in the final product.

However, the legislation governing the use and consumption of GMOs in food differs across nations and regions. Furthermore, these products may be considered as vegan as they are animal-free. However, they must still carry the same allergen labeling as their animal-based counterparts.

In the future, it is anticipated that conventional fermentation techniques will more frequently incorporate advanced precision methods to generate high-value products with enhanced health benefits, improved sensory profiles, and extended production efficiencies. Although precision fermentation is forecasted to lessen reliance on conventional agriculture and promote sustainable food security, it is confronted with significant obstacles, including challenges in scaling fermentation processes, safety, and extraction efficiencies. Furthermore, the adoption of precision fermentation relies heavily on consumer acceptance, which is a crucial factor in determining its market success.

Considering the applicability of precision fermentation in the local scenario, it has the potential to improve Sri Lanka's local food production, support traditional industries, and provide environmental and sustainability benefits. Precision fermentation can be used to produce dairy and meat alternatives, enhancing local agriculture and reducing dependency on imports. Additionally, it can improve the flavor profiles of tea and spices, or produce high-value compounds, adding value to local produce and creating new market opportunities. Precision fermentation can also be used to produce bioactive compounds for Ayurvedic medicine, ensuring consistency and potency while reducing reliance on wild-harvested plants. Furthermore, it can use agricultural waste products as feedstock for microbial fermentation, helping manage waste and create value-added products like biofuels, enzymes, and bioplastics. By localizing the production of essential food and industrial products, precision fermentation can also help reduce the carbon footprint associated with importation and transportation, contributing to Sri Lanka's environmental sustainability goals.

Developing a precision fermentation industry can generate new employment opportunities in biotechnology, research and

development, and manufacturing, stimulating the local economy and fostering technological innovation. Encouraging collaborations between local universities, research institutions, and industries can promote education and training in biotechnology, helping develop a skilled workforce and drive further research and innovation in the field. Furthermore, precision fermentation can be used to produce essential vitamins, minerals, and amino acids, helping address malnutrition and enhance the overall health of the population by providing affordable and locally produced nutritional supplements. Developing functional foods with added health benefits can cater to the growing health-conscious market in Sri Lanka.

The government can offer incentives, grants, and funding to support startups and companies working in precision fermentation. This can help in the initial setup and scaling of operations. Establishing a clear regulatory framework for the production and sale of precision fermentation products can ensure safety, quality, and consumer trust. By harnessing precision fermentation technology, Sri Lanka can tackle several local challenges, from food security and sustainability to economic development and health. These initiatives can contribute to a more resilient and prosperous future for the beautiful island nation.

Declaration of generative AI and AI-assisted technologies in the writing process

During the creation of this work, the author made use of ChatGPT version 3.5 and Paperpal to assist with idea generation and improve its readability. Following that, the author carefully reviewed and revised the content as needed and holds sole responsibility for the accuracy of the information presented in the publication.

EXPLORING THE GUT HEALTH REVOLUTION:

THE HEALTH BENEFITS OF PROBIOTICS

V.L.P. AMARASINGHE

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

Probiotics are defined as live microorganisms that help the host's health when taken in sufficient quantities. They often reside in the human intestines and can withstand harsh conditions like low pH and high bile salt concentrations. The most frequently used probiotic bacterial genera are Lactobacillus and Bifidobacterium genera.

The gut microbiota is a vibrant ecology consisting up of trillions of microorganisms that inhabit the human gut. The presence of microorganisms is essential for preserving the health and vigor of humans through beneficial interactions. Probiotics, or beneficial bacteria, are among these microorganisms that have gained attention due to their possible health advantages. Diet is a major factor in determining the composition and function of the gut microbiome, as scientific research on this complex organism continues to reveal its benefits. In Sri Lankan cuisine, which is known for its diverse use of spices, fermented foods, and

tropical ingredients, the potential for probiotic-rich foods to promote gut health is especially fascinating. By examining the intersection of traditional Sri Lankan cuisine and the science of probiotics, we can gain valuable insights into how cultural dietary practices contribute to overall health and well-being.

Fermented foods have been shown to improve nutritional value and functionality by converting substrates into bioactive and bioavailable end products such as lactic acid, galactose, free amino acids, fatty acids and vitamins

Probiotics are defined as live microorganisms that help the host's health when taken in sufficient quantities. They often reside in the human intestines and can withstand harsh conditions like low pH and high bile salt concentrations. The most frequently used probiotic bacterial genera are Lactobacillus and Bifidobacterium genera. The representative species include L. acidophilus, L. casei, L. plantarum, B. lactis, B. longum, and B. bifidum. Probiotics can be taken as added to meals and beverages in the form of dairy or non-dairy products or supplements. There are active bacteria in fermented foods that are genetically related to probiotic strains. Fermented foods have been shown to improve nutritional value and functionality by converting substrates into bioactive and bioavailable end products such as lactic acid, galactose, free amino acids, fatty acids and vitamins (especially B complex).

For centuries fermented food and drugs have been known to contain probiotics. Among them, fermented dairy products like cheese, yogurt, acidified milk, and drinking yogurt milk are in the market as widely accepted probiotic carriers. One of the first probiotic fermented dairy beverages is Yakult which contains the probiotic Lactobacillus casei Shirota. With increasing demand for probiotic foods, non-dairy products such as fermented meat products and fresh fruit and vegetables with probiotics are introduced to the market to meet the demand. The presence of lactic acid bacteria (LAB) in dairy products and other fermented foods extends the shelf life of fermented foods. Furthermore, LAB improves human health by acting as antimicrobial agent against a variety of pathogens that are present inside the human body. According to Infographics, probiotic products have a growing market and predicted 94.48 billion USD market value by 2024.

Sri Lankan cuisine is renowned for its vibrant flavours and aromatic spices. In addition, it also boasts a variety of probiotic-rich foods that have been staples in local diets for generations. Some examples are listed as traditional probiotic foods available in Sri Lanka.

Kithul Kenda: Made from the sap of the kithul palm tree, this comforting porridge naturally ferments, making it a source of probiotics as well as a comfort food.

Achcharu: A favorite addition to Sri Lankan cuisine, achcharu is a sour and spicy pickle created from a mix of vegetables and vinegar. It's also a fantastic way to add probiotics to your diet.

Coconut Kefir: Sri Lanka is ideally situated to ferment coconut water into kefir, a cooling probiotic beverage that has several health advantages due to its plentiful coconut crop.

Curd: Naturally fermented curd without preservatives is a good source of probiotics. It is made from Buffalo milk and commonly known as Mee-Kiri. Mee-kiri production plays an integral part in the livelihood of Sri Lankan rural farming

Moru: Moru, also known as buttermilk, is a traditional Sri Lankan drink that is both refreshing and healthy. It is typically made by diluting curd with water and adding various seasonings and spices including salt. It helps in digestion and is often enjoyed during hot weather for its cooling properties.

Diya bath: This is a classic Sri Lankan meal that's typically eaten for a nutritious and refreshing breakfast. It involves soaking cooked rice in water, and different condiments and coconut milk are typically used to flavor it. By allowing the rice and water mixture to ferment overnight, it gives a slightly tangy flavor to Diya bath.

Probiotic bacterial associations with green leaves Gotu Kola (Centella asiatica) has been observed in research. Apart from that there are several probiotic rich leafy greens like Lettuce, Broccoli, Curly kale and fruits and vegetables in the market.


Achcharu


Kithul Kenda


Curd

Incorporation of probiotic-rich foods into diet can have a profound impact on health and well-being. The health benefits of probiotics, which include improved gut health, lowering blood cholesterol, prevention of cancer, prevention and management of allergic diseases, irritable bowel syndrome, diarrhea, lactose intolerance and inflammatory bowel disease are documented. Probiotics are highly recommended for boosting human immunity. They do so by providing protection against pathogens, secretion of antimicrobial substances, immunomodulation, production of short-chain fatty acids (SCFA), and competitive action for adhesion and nutritional sources. The mode of action of probiotics can vary on probiotic strain. It can be a single mechanism or a combination of methods. The gut-brain axis, which is widely used to describe the strong relationship between the gut and the brain, is supported by recent studies. Probiotics may help regulate mood and reduce the symptoms and signs of depression and anxiety.

As we continue to unravel the intricate interplay between probiotics, gut health, and overall well-being, it becomes increasingly clear that these beneficial microorganisms hold immense potential in preventive and therapeutic applications. Despite advancements, the exploration of probiotics for human consumption is still in its early stages. It's crucial to conduct more controlled human studies to identify the most effective probiotics, optimal dosages, and specific patient groups that can benefit the most. Additionally, ensuring the safety and limitations of probiotics is paramount. Establishing international regulations regarding the use of probiotics in food products is necessary, with a focus on verifying their efficacy, safety, and the validity of health claims on food labels.

HEAT- INDUCED FOOD TOXICANTS : **ACRYLAMIDES, NITROSAMINES AND POLYCYCLIC AROMATIC HYDROCARBONS**

> **Thermal processing of foods can result in the production of potentially mutagenic and carcinogenic by-products. These by-products encompass acrylamides, N-nitrosamines, polycyclic aromatic hydrocarbons (PAHs), amino acid or protein hydrolysates**

DR. THILINI C. KANANKE

Senior Lecturer
Dept. of Food Science and Technology
Sabaragamuwa University of Sri Lanka

Heat-induced Food Toxicants : Acrylamides, Nitrosamines and Polycyclic Aromatic Hydrocarbons.

The awareness of potential health risks associated with the formation of specific chemical compounds during food processing or preparation has been longstanding. Both industrial and home-cooking methods involve a range of thermal treatments, including baking, frying, cooking, toasting, grilling, roasting, and blanching, among others. These methods are employed to achieve specific food qualities such as enhancing palatability (flavor, aroma, appearance, and texture), increasing the stability of foods, improving gastrointestinal digestion, and eliminating harmful microorganisms while deactivating toxic enzyme inhibitors and other anti-nutritive factors. Despite these benefits, it is well-established that thermal processing of foods can result in the production of potentially mutagenic and carcinogenic by-products. These by-products encompass acrylamides, N-nitrosamines, polycyclic aromatic hydrocarbons (PAHs), amino acid or protein hydrolysates etc. This article specifically delves into the formation of acrylamides, nitrosamines, and PAHs in foods.

ACRYLAMIDES

Acrylamide is a chemical compound that naturally forms when cooking foods rich in starch at high temperatures, such as baking, frying, grilling, toasting, or roasting. It is an intermediate product generated during the Maillard reaction, which is responsible for the development of desirable flavors and colors in cooked foods. The formation of acrylamide in food products is linked to the presence of high levels of reducing sugars (e.g., glucose and fructose) and amino acids, especially those rich in asparagine. Acrylamide tends to develop when these components are heated to temperatures exceeding 120°C.

The highest concerns regarding acrylamide intake are associated with the consumption of specific foods, including potato products such as French fries and chips, cereal-based items like biscuits, crackers, and bread, as well as breakfast cereals and coffee (Table 01).

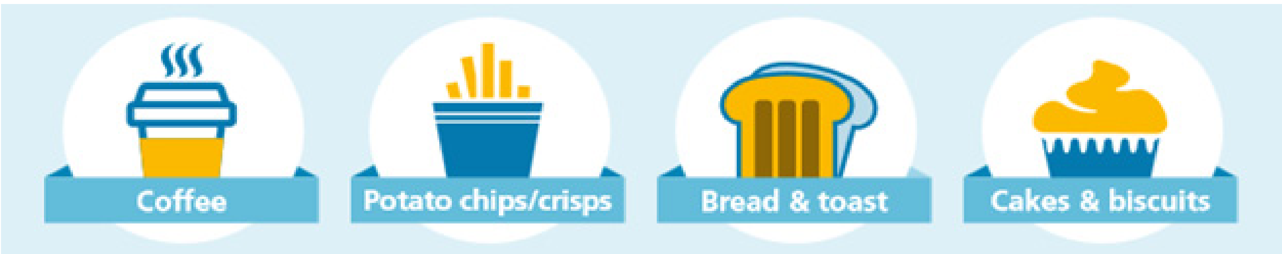
The formation of acrylamide is facilitated by high temperatures and low moisture content, representing primarily a surface reaction. For instance, acrylamide in bread is predominantly found in the crust, with minimal or no presence in the crumb. Potato crisps have elevated acrylamide content due to their structure, comprising essentially two surfaces with minimal substance between them. Research indicates that reducing sugars is the limiting factor for acrylamide formation in potatoes, whereas asparagine seems to be the limiting factor in cereal products. In Sri Lanka, burnt or scorched rice found at the bottom of the cooking pot, commonly referred to as "Dankuda," has the potential to contain harmful compounds, including acrylamide and polycyclic aromatic hydrocarbons (PAHs). These compounds can emerge when rice is exposed to high temperatures during cooking, particularly when it becomes browned or burnt.

Table 01. Acrylamide levels in selected food groups

Food Group	Food Product Group	Minimum Acrylamide, ppm	Maximum Acrylamide, ppm
Potatoes	Potato crisps	117	3770
	Chips / French fries	59	5200
	Potatoes (Raw)	<10	<50
Cereal Products	Corn crisps	120	220
	Bakery products and Biscuits	18	3324
	Bread	<10	<130
	Bread (Toast)	25	1430
	Breakfast cereals	11	1057
Rice & Noodles	Fried noodles	3	581
	Fried rice	<3	67
Fruits & Vegetables	Canned black olives	123	1925
	Fried vegetable	34	34
Nuts	Nuts	28	339
Fish & Meat	Fish & sea food (crumbed / battered)	<2	39
	Meat / poultry (crumbed / battered)	<10	64
Cocoa-based products	Chocolate products	<2	826
	Cocoa powder	<10	909
Coffee	Coffee (roasted)	45	975
	Coffee extract/powder	195	4948

Source: FAO/WHO, 2009

The International Agency for Cancer Research (IARC) categorizes acrylamide as "probably a human carcinogen" based on animal studies. While it is a known human neurotoxin, typical exposure levels from acrylamide-containing foods are believed to be below those causing neurotoxicity. However, concerns arise due to the formation of glycidamide, a genotoxic



metabolite that readily reacts with DNA. WHO estimates average daily acrylamide intake as 0.3 to 0.8 µg/kg/day, but some individuals may exceed this level.

HOW TO MINIMIZE THE FORMATION OF ACRYLAMIDES?

While it may be challenging to completely eliminate acrylamide from our diets, there are several control measures that can be taken to reduce the formation of acrylamide in foods.

- Change the cooking process: The Food Standards Agency (FSA) recommends using cooking methods such as boiling, steaming, or microwaving for foods that are rich in carbohydrates. These methods are less likely to promote acrylamide formation compared to high-temperature cooking.
- Use of asparaginase enzyme: A relatively recent development has been the use of the enzyme asparaginase, which converts asparagine to aspartic acid. The aspartic acid is not forming acrylamide. Asparaginase is commercially produced from Aspergillus niger or Aspergillus oryzae. Both have been approved in several countries for use in reducing acrylamide in selected food products. They are particularly effective in dough products (e.g. cereal products or fabricated chips), and can be applied in soaking (blanching) (e.g. potato strips) where they can reduce asparagine concentrations on the surface.
- Avoid high temperatures and long cooking times: It's advisable to avoid cooking foods at excessively high temperatures for prolonged periods. High heat and extended cooking times can contribute to higher acrylamide levels.
- Monitor color: When toasting, roasting, frying, or baking starchy foods like potatoes and bread at home, consumers should aim for a golden yellow or lighter color rather than allowing them to become overly browned or burnt.
- Agronomic practices: Breeding of cultivars with lower glucose, fructose and/or asparagine content, selection of current cultivars with lower glucose, fructose and/or asparagine contents etc.
- Potato storage: Storing potatoes in the refrigerator before frying or baking is not

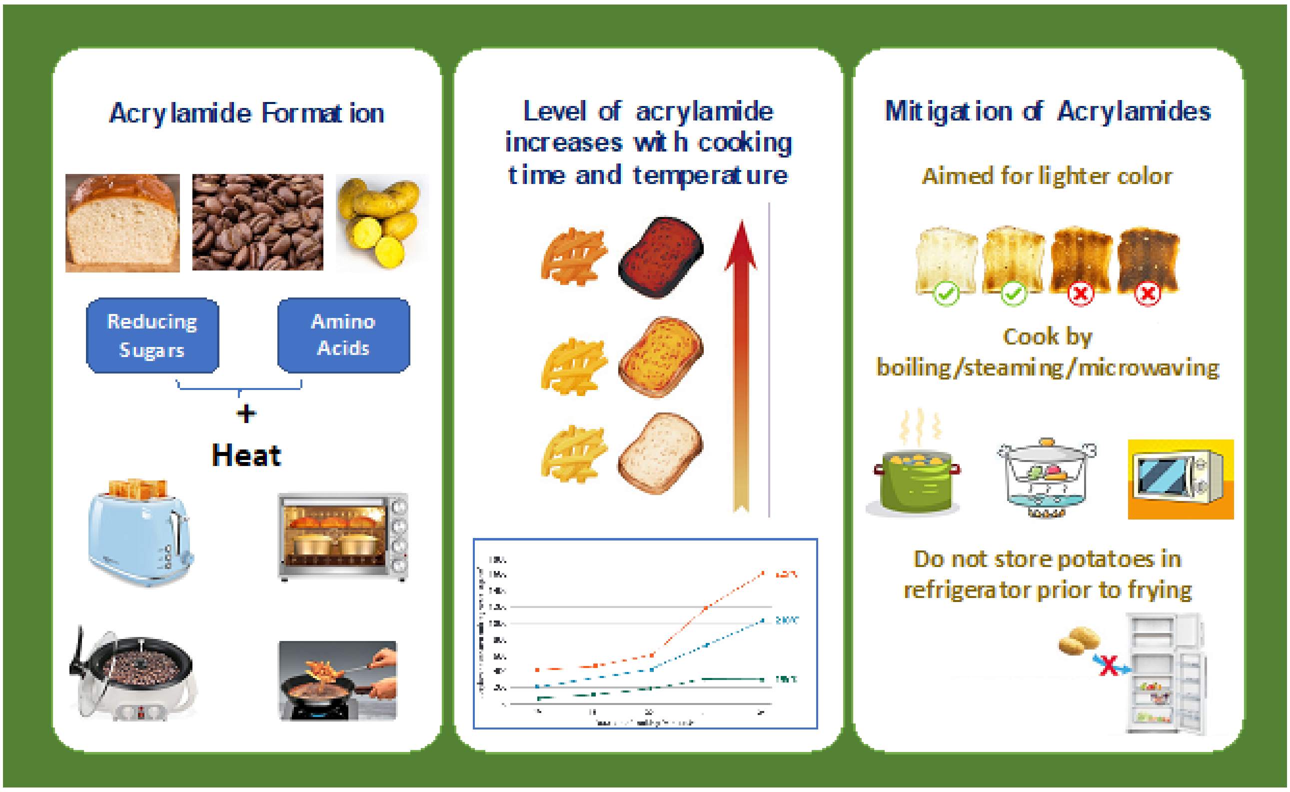


Figure 01: Acrylamide formation, the effect of time/temperature on levels of acrylamide and mitigation of acrylamides

> **Nitrosamines have been identified mostly in cured meat products and also in several other foodstuffs including processed fish, alcoholic beverages, cooked meat, processed vegetables, milk and dairy products, fermented/pickled foods**

recommended. This is because refrigeration can lead to the formation of more reducing sugars in potatoes, which can promote acrylamide formation during subsequent cooking. It is better to store potatoes in a cool, dark, and dry place.

By adopting these control measures and being mindful of cooking methods and temperatures, individuals can take steps to minimize their exposure to acrylamide while still enjoying a variety of delicious foods. The legislation mandates monitoring and disclosure of acrylamide levels, while the EU Code of Practice (COP) provides detailed guidance. The global approach involves the Codex Alimentarius Commission and the US FDA, which is considering issuing guidance.

N-NITROSAMINES

Nitrosamines (or N-Nitrosamines) are chemical compounds that produced in foods as a result of food preparation and processing. Nitrosamines have been identified mostly in cured meat products and also in several other foodstuffs including processed fish, alcoholic beverages, cooked meat, processed vegetables, milk and dairy products, fermented/pickled foods etc. Nitrosamines, may also formed in mouth or stomach if the food carry the nitrosamine precursors. In acidic pH levels prevailing in stomach, nitrite or nitrates added or naturally occurring in foods, have the potential to combine with amines to produce nitrosamines. The predominant form of nitrosamine found in human is N-nitrosodimethylamine (NDMA). Nitrosamines are known as potent carcinogens that may produce cancers in various organs and tissues i.e. brain, lung, kidney, liver, esophagus, stomach, bladder, and nasal sinus.

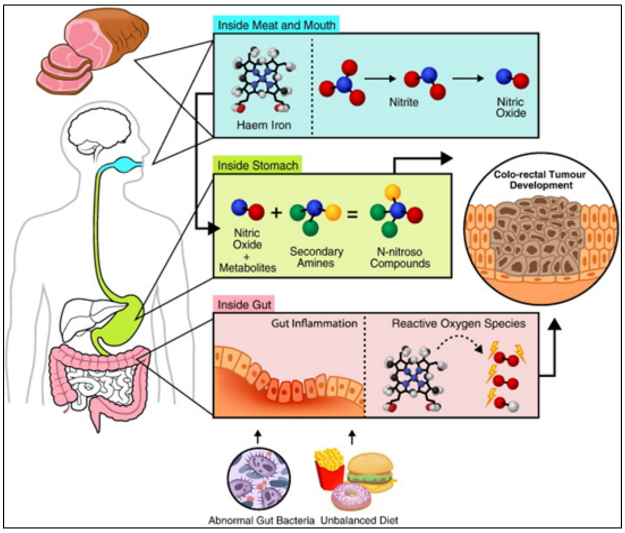


Figure 02: Effects of Nitrosamines exposure on the human body

Source: Habermeyer, M. and Eisenbrand, G., 2009.

WHY DO CURED MEATS HAVE THE POTENTIAL TO MAKE NITROSAMINES?

Nitrite and nitrate salts have been added to cured meats as a preservative to prevent the growth of Clostridium botulinum and its toxin formation. In addition, nitrite reacts with the heme group of myoglobin pigments in meat to form the desirable pink color of cured meats and it prevents the development of off-flavors. However, the negative effect of adding nitrites/ nitrates in cured meat is the ability to form nitrosamines. Nitrite is converted to nitrosating agents which subsequently react with amines in the meat during processing, storage, and cooking to form nitrosamines.

In various fish products like salted, pickled, smoked, fermented, and canned fish, there have been reports of the presence of nitroso-dimethylamine (NDMA). NDMA is formed from dimethylamine and nitrite. In addition, biogenic amines in fish can play a role in nitrosamine formation, particularly under certain conditions. Biogenic amines are naturally occurring compounds in fish, and they are derived from

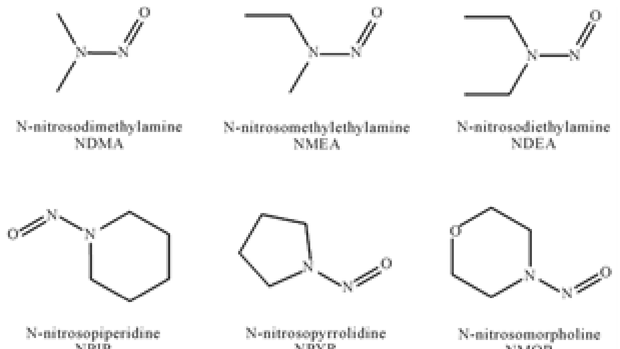


Figure 03: Different types of N-nitrosamines

amino acids. These amines include histamine, tyramine, putrescine, cadaverine, and others. Some primary amines like putrescine and cadaverine can transform into secondary amines like pyrrolidine and piperidine when heated. These secondary amines can react with nitrite to create harmful nitrosamines.

Table 02: Nitrosamine content in typical cured meats

Meat	Nitrosamines	Level (ppb)
Smoked sausages	Dimethy lnitrosamines	<6
	Diethylnitrosamines	<6
Frankfurters	Dimethylnitrosamines	11-84
Salami	Dimethylnitrosamines	1-4
Fried bacon	Dimethylnitrosamines	1-40
	Nitrosoproline	1-40

MITIGATION STRATEGIES FOR NITROSAMINES:

- Ascorbic acid (Vitamin C) and tocopherols (Vitamin E) like natural anti-oxidants prevent formation of nitrosamines in food.
- Use natural nitrite-free meat products.
- Use of gamma irradiation to breakdown residual nitrite in meat products.
- Minimize direct-fire drying process of certain foods to prevent formation of nitrosamines (N-nitrosodimethylamine).

POLYCYCLIC AROMATIC HYDROCARBONS

Polycyclic aromatic hydrocarbons (PAHs) are a group of organic compounds commonly found in food, originating from incomplete combustion or pyrolysis of organic materials. These compounds, characterized by multiple fused benzene rings, can form during the breakdown of fat, protein, and carbohydrates in food. High-temperature cooking methods such as grilling, roasting, frying, and smoking contribute to the formation of PAHs in food. For instance, the smoke and char produced during grilling or barbecuing can contain PAHs, which may adhere to the food surface. Smoked or charred foods, including smoked meats and vegetables, are known to have elevated PAH levels. Industrial food processing methods like drying can also lead to PAH formation in specific products.

PAH deposition on food surfaces primarily occurs in the outer layer. In the case of Maldive-fish (Umbalakada), produced through fish smoke-drying, PAHs are predominantly found in the outer 2 mm layer. Reports from Sri Lanka indicate the contamination of Maldive-fish and fried cutlets by PAHs due to smoke deposition during fish preparations, emphasizing the need for good manufacturing guidelines (Jinadasa et al., 2020). The coconut industry, particularly in coconut-producing countries like Sri Lanka, involves smoke-curing coconut kernels to produce copra and mechanically expelling oil from copra. PAH concentrations in coconut products are influenced by copra curing, oil expulsion, and chemical refining of coconut oil. Studies in Sri Lanka revealed a significant increase in PAHs in mechanically expelled coconut oil, attributed to pyrolysis during oil expulsion at 140-160 °C. Experimental results suggest a gradual increase in PAH formation in coconut oil exposed to temperatures from 40-250 °C. During home preparation of coconut oil, manually extracted coconut milk is boiled at temperatures around 170 °C. The sediment, rich in PAHs, is consumed as a delicacy (Thelka). In the manufacturing process of virgin coconut oil, a cooling water jacket is utilized around the expeller to minimize PAH formation. This precautionary measure ensures that the temperature remains below 55°C, as PAHs typically begin forming around 60 °C during coconut oil heating (Samarajeewa, 2023).

Notably, a high consumption of PAHs has been linked to an increased risk of cancer,

Table 03. Carcinogenic activity of common PAHs

PAH	Number of Rings	Carcinogenicity
Phenanthrene	3	Highly carcinogenic
Anthracene	3	Weak carcinogenic
Fluoranthene	4	Weak carcinogenic
Pyrene	4	Highly carcinogenic
Chrysene	4	Highly carcinogenic
Benzo (a) anthracene	5	Moderately carcinogenic
Benzo (b) fluoranthene	5	Moderately carcinogenic
Benzo (a) pyrene	5	Highly carcinogenic

particularly gastrointestinal and liver cancers. This underscores the importance of understanding and mitigating PAH exposure in food processing and preparation.

MITIGATION:

- Food Selection: Choosing cooking methods that minimize the production of PAHs. For example, steaming, boiling, and microwaving generally produce fewer PAHs than grilling or frying.
- Marinating: Marinating meat before grilling can create a protective barrier that reduces the formation of PAHs. Marinades containing acidic ingredients like vinegar or citrus juice can be particularly effective.
- Grill Cleaning: Cleaning the grill grates and removing charred residues can help reduce the transfer of PAHs to food.
- Avoiding Direct Flames: Keeping food from coming into direct contact with flames or reducing flare-ups during grilling can also help reduce PAH formation.
- Use of Electric or Gas Grills: Electric and gas grills typically produce fewer PAHs than charcoal or wood-burning grills.
- Trimming Fat: Trimming excess fat from meat before cooking can reduce the formation of PAHs since they often form when fat drips onto hot surfaces.

Thermal treatments occupy a major role in food processing to enhance the sensory appeal of foods while ensuring microbial safety. However, it paves the way for the formation of some food toxicants. Even though the exposure and the health effects of these food toxicants are tested with animal experiments, more research is required to determine the extent of health hazards caused by these toxicants to the human population.

IMPACT OF FOODS CONTAINING POLYACETYLENES ON GENE EXPRESSION IN REDUCTION AND PROPHYLAXIS OF CANCER

> Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other parts of the body (metastasis) due to gene mutation or changes in gene regulation.

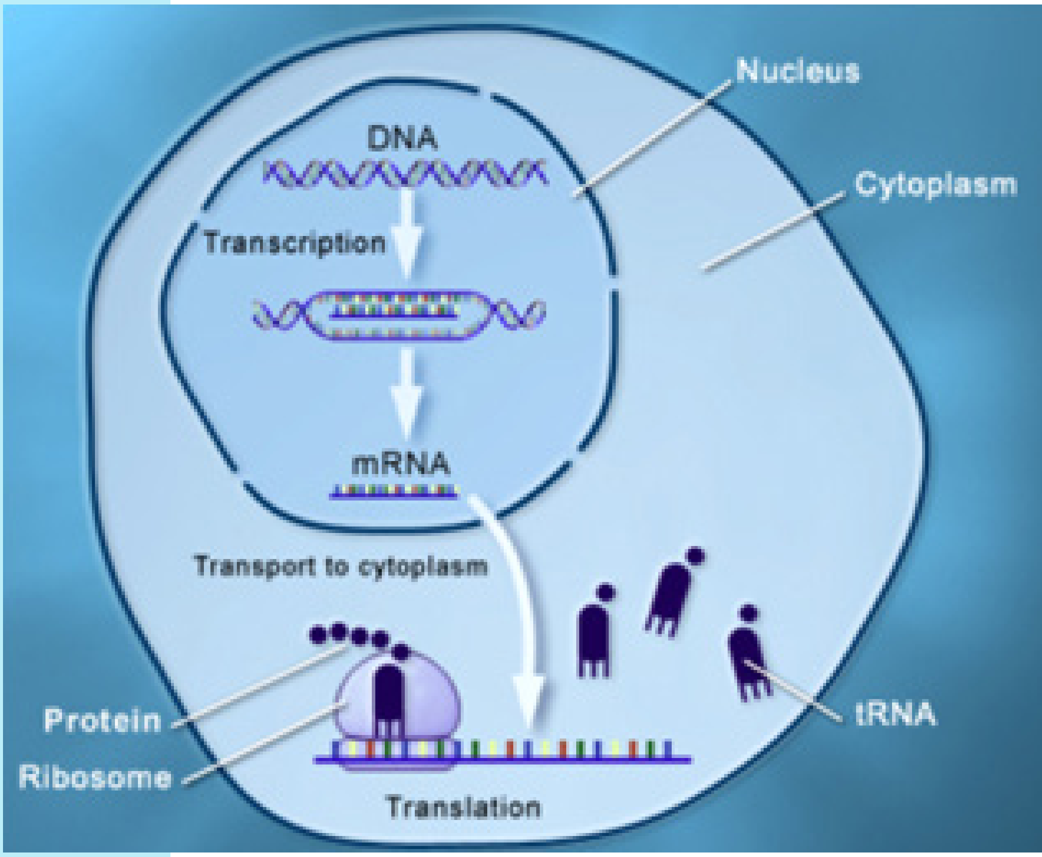


Figure 1: Gene expression and protein synthesis
[Source – US National Library of Medicine]

DR. S.N.L. NARATHOTA
Faculty of Indigenous Medicine
University of Colombo, Sri Lanka

Gene expression is the process by which the information encoded in a gene is used to produce important molecules known as proteins which play an important role in structural and functional changes in the body. This has two main steps as Transcription and Translation. In transcription, information stored in a gene's DNA is passed to mRNA (Messenger Ribonucleic Acid) in the cell nucleus. Translation takes place in the cytoplasm and mRNA interacts with ribosomes which reads the sequence of mRNA nucleotides. Then transfer RNA (tRNA) assembles the protein, one amino acid at a time as shown in Figure 1.

This process of synthesizing proteins using information in a gene inside a cell is thought as an on/off switch to control when and where RNA molecules and proteins are made and as a volume control to determine how much of those products are made (Robb and Campton, 2021). The process of gene expression is carefully regulated, changing substantially under different conditions and cell types. The RNA and protein products of many genes serve to regulate the expression of other genes.

Defects of gene expression can result in disease formation and cancers are one of the main examples. Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other parts of the body (metastasis) due to gene mutation or changes in gene regulation. Depending on the place of occurrence, duration, types of cells involved, condition of the patient, the severity and prognosis of the disease varies. Changes in epigenetic regulation, transcription, RNA stability, protein translation and post-translational control can be detected in cancer .

Genetic changes that contribute to cancer tend to affect three main types of genes i.e., Proto-oncogenes, Tumor suppressor genes and DNA repair genes. These changes are sometimes called "drivers" of cancer. Proto-oncogenes are involved in normal cell growth, division and when these are altered, they may become cancer causing genes (Oncogenes) allowing cells to grow and survive when they should not. Tumour suppressor genes are also involved in controlling cell growth and division. Cells with certain alterations in tumour suppressor genes may divide in an uncontrolled manner. DNA repair genes are involved in fixing damaged DNA. Cells with mutations

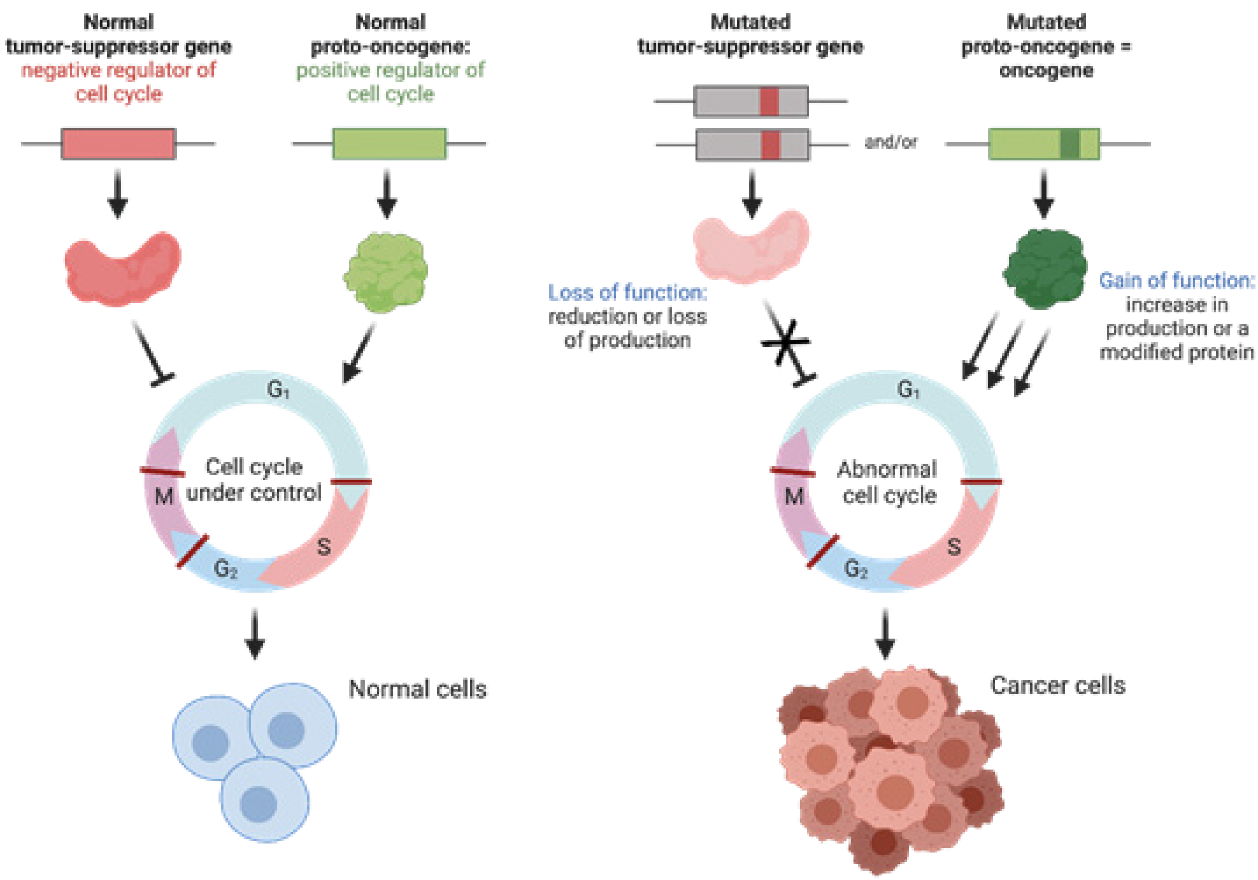


Figure 2: Cancer and the cell cycle (Hardy, 2023)

in these genes tend to develop additional mutations in other genes and changes in their chromosomes, such as duplications and deletions of chromosome parts. Together, these mutations may cause the cells to become cancerous (National Cancer Institute, 2021). Treatment should base on controlling these mechanisms and that will help in the prevention and reducing the risk of Cancer as well.

Genes are regulated by complex arrays of response elements that influence the rate of transcription. Nutrients and hormones either act directly to influence these rates or act indirectly through specialized signaling pathways. Metabolites of vitamins A and D, fatty acids, some sterols and zinc are among the nutrients that influence transcription directly. Components of dietary fiber may influence gene expression indirectly through changes in hormonal signaling, mechanical stimuli and metabolites produced by the intestinal microflora.

Modern research findings, has shown that dietary patterns and nutrients can impact on gene expression through several mechanisms. They may directly act as ligands for transcription factors and change gene expression. Nutrients may be metabolized by different pathways, thereby modifying the concentration of substrates or intermediates that affect gene expression. Alternatively, the substrates or intermediates may act on or alter cell signaling pathways involved in gene expression. Most chronic diseases whose etiology and pathogenesis are influenced by nutritional factors have genetic determinants. Diseases like high blood pressure, obesity, hyperlipidemia, atherosclerosis and various cancers appear to aggregate in families for genetic reasons (National Library of Medicine, 2017). Certain dietary compounds bind to transcription factors and regulate their activity such as polyunsaturated fatty acids (PUFA) with peroxisome proliferator-activated receptors (PPARs).

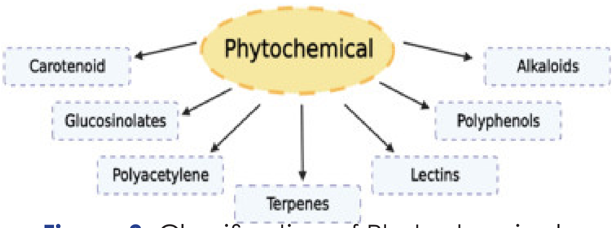


Figure 3: Classification of Phytochemicals (Pawase et al., 2023)

Polyacetylenes are a kind of small active compounds with carbon-carbon triple bond with vast occurrence in plants. The term "Polyacetylenes" is also often used interchangeably to describe natural products containing a single acetylenic bond if they are formed from polyacetylene precursors . Some polyacetylenes are known to be potent skin sensitizers, and to be neurotoxic in high concentrations, but are also highly bioactive compounds with potential health-promoting properties. Polyacetylenes are important bioactive components of herbal medicine and examples for some polyacetylenes are mentioned below.

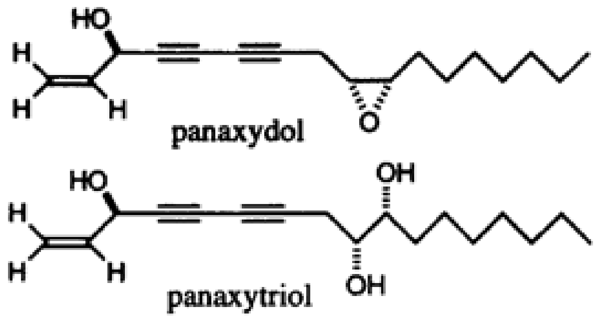


Figure 4: Two polyacetylene constituents found in Ginseng Radix Rubra (Kobayashi et al., 2017)

Polyacetylenes have attracted considerable attention owing to their diverse biofunctions like tumour suppression, immunity regulation, depression resistance and neural protection. Modern pharmacological studies have also showed that polyacetylenes possess other biological activities including neuroprotective, anti-depression, anti-obesity, hypoglycemic, antiviral, antibacterial, antifungal, hepatoprotective and reno-protective activities as well.

Polyacetylenes is an important bioactive component of herbal medicine, indicated for curative and preventive care in alternative medical systems like Ayurveda. Polyacetylenes have been well-known against carcinomas, inflammatory responses, diseases of central nervous system, endocrine disorders and microbial infections. Medicines like Zingiber officinale (Ginger), Centella asiatica (Gotukola), Panax ginseng (Ginseng) have been reported to have the presence of bioactive

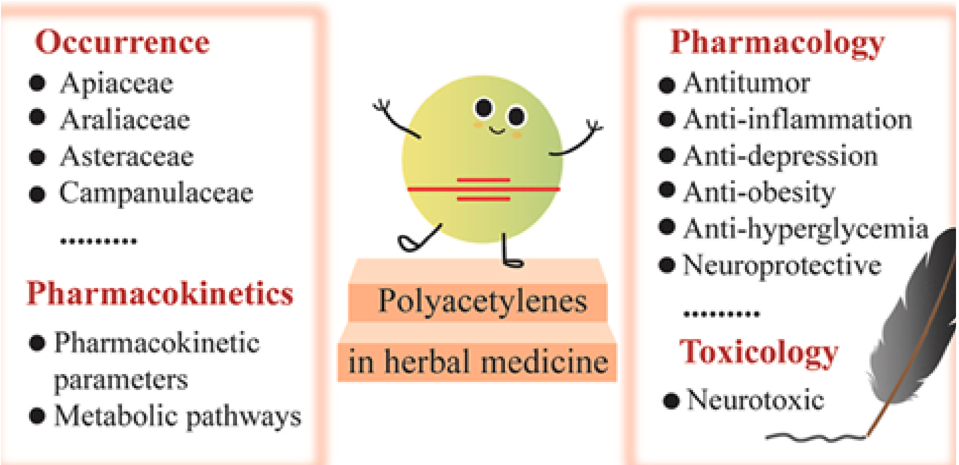


Figure 5: Polyacetylene found in herbal medicines and their actions (Xie and Wang, 2022)

carrot (Daucus Carota L.) metabolites can induce powerful cytotoxic effects specifically in cancer cells by interfering with important cellular pathways.

Polyacetylenes in their composition. These are used as food as well.

Classification of Polyacetylenes include Falcarinol, Falcarindiol, Panaxydiol, Oenantheto, Crepenycic and Stearolic. Food plants of the APIACEAE family such as carrots, celery and parsley, contain this bioactive aliphatic C17-polyacetylenes. These polyacetylenes are highly toxic towards fungi, bacteria, and some mammalian cells displaying neurotoxic, anti-inflammatory, anti-platelet-aggregatory effects and are responsible for allergic skin reactions. Effect of these polyacetylenes towards human cancer cells, is mainly toward human bioavailability and their ability to reduce tumour formation in a mammalian cell. In vivo model indicates that they may also provide benefits for health.

Several studies have shown that some carrot (Daucus Carota L.) metabolites can induce powerful cytotoxic effects specifically in cancer cells by interfering with important cellular pathways. Acetylenic oxylipins, such as falcarinol (FaOH) and falcarindiol (FaDOH), are upregulated in response to fungal diseases, acting as natural pesticides in carrots. FaOH was found to be the most cytotoxic compound towards leukemic cells. Due to their alkylating properties, FaOH and FaDOH can induce cell cycle arrest and apoptosis of tumor cells through their covalent binding to proteins/ factors involved in these processes.

There are many examples to show the importance of polyacetylenes in the medical, food and nutrition field. Polyacetylene compound methyl 5-[(E)-9-hydroxy-1-(1-hydroxyhexyl)-2-methoxyundeca-3,10-diene-5,7-diynyloxy] pentanoate (cadiyenol) isolated from Centella asiatica is an example. It has reported that this compound induces apoptosis (63%) independent of cell cycle regimen in mouse lymphoma cells and also reduces nitric oxide (NO) production in lipopolysaccharide-activated mouse macrophages with no measurable cytotoxicity.

The beneficial effects of most bioactive polyacetylenes from higher plants/ vascular plants occur at non-toxic concentrations. Polyacetylenes appear to be an important group of nutraceuticals in vegetable foods that are obvious targets for the development of healthier foods and food products. From this literature analysis, it was clear that foods containing polyacetylenes have shown multiple health benefits mainly concerning reduction and prophylaxis of Cancer by affecting gene expression mechanisms of the human body.

Figure 6: D. Carota L. subsp. Sativus (domestic yellow and orange carrot) (Mandrich et al., 2023)

A CRUNCH FOR EVERY PALATE: DIVING INTO THE DIVERSE WORLD OF ALTERNATIVE SNACK FLAVORS

Two significant trends emerged: "Mindful snacking" and "Functional snacking." Mindful snacking encourages greater awareness of eating habits as part of overall health. Functional snacking involves snacks fortified with beneficial nutrients like protein, fiber, and omega-3s, offering a guilt-free snacking experience.

MIFRA SARAP

Department of Applied Nutrition,
Wayamba University of Sri Lanka

The global snack food market experienced a significant 18% increase in sales during 2020, largely driven by the pandemic. As people spent more time at home, they turned to familiar comfort foods like chips, pretzels, and popcorn to satisfy their hunger. However, changes in daily schedules disrupted established eating routines, making snack times more unpredictable.

Simultaneously, the Better For You (BFY) trend began to reshape the snack food sector, with consumers increasingly favoring lighter, clean-label options. During the pandemic, there was a noticeable shift towards healthier eating habits, with 63% of consumers reporting an increased awareness of their health. Despite this health consciousness, the desire to snack remained strong, but it evolved towards healthier choices.

Two significant trends emerged: "Mindful snacking" and "Functional snacking." Mindful snacking encourages greater awareness of eating habits as part of overall health. Functional snacking involves snacks fortified with beneficial nutrients like protein, fiber, and omega-3s, offering a guilt-free snacking experience. These trends have spurred innovation in the snack food industry, meeting modern consumer demands for healthy, sustainable, and enriched snack options.

In this dynamic market, alternative crunches have become prominent, showcasing flavor, creativity, and nutritional benefits.

KALE CHIPS

Kale chips, made from baked or dehydrated kale leaves, are a low-calorie snack rich in vitamins, minerals, and antioxidants. They come in various flavors, from classic sea salt to tangy ranch, satisfying both cravings and nutritional needs. Kale chips, once exclusive to health food stores, are now a staple in supermarket snack aisles.

Source: (https://www.excaliburdehydrator-recipes.com/recipe/pizza-kale-chips/)

BEETROOT CHIPS

Beetroot chips offer a vibrant color and a slightly sweet taste. Packed with essential nutrients such as fiber, vitamins, and minerals, they provide a nutritious and visually appealing snack option. The natural sweetness and crisp texture make them a favorite among health-conscious snackers.

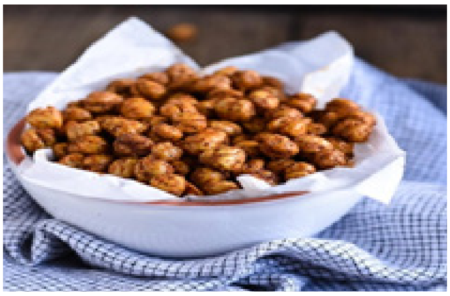
Source: (https://www.rebootwithjoe.com/healthy-snack-chili-roasted-beet-chips/)

SORGHUM POPCORN

Sorghum, a lesser-known grain, pops like popcorn but on a smaller scale, producing tiny, crunchy snacks. Naturally gluten-free and high in fiber containing sorghum is an excellent choice for those with dietary restrictions. These miniature pops are perfect on their own or mixed with nuts and dried fruits for a homemade trail mix.

Source: (https://www.sorghumcheckoff.com/recipes/popped-sorghum-microwave-recipe/)

BEETROOT CHIPS



Roasted chickpeas, seasoned and roasted to perfection, provide a protein-rich, fiber-filled snack. Available in exciting flavors like sriracha, tangy barbecue, and classic salt and pepper, they offer a tasty and nutritious alternative to traditional snacks. Chickpeas' satisfying crunch and nutritional benefits make them a popular choice.

Source: (https://feastingnotfasting.com/spicy-roasted-chickpeas/)

SEAWEED SNACKS

Roasted chickpeas, seasoned and roasted to perfection, provide a protein-rich, fiber-filled snack. Available in exciting flavors like sriracha, tangy barbecue, and classic salt and pepper, they offer a tasty and nutritious alternative to traditional snacks. Chickpeas' satisfying crunch and nutritional benefits make them a popular choice.

Source: (https://www.walderwellness.com/tuna-seaweed-snacks/)

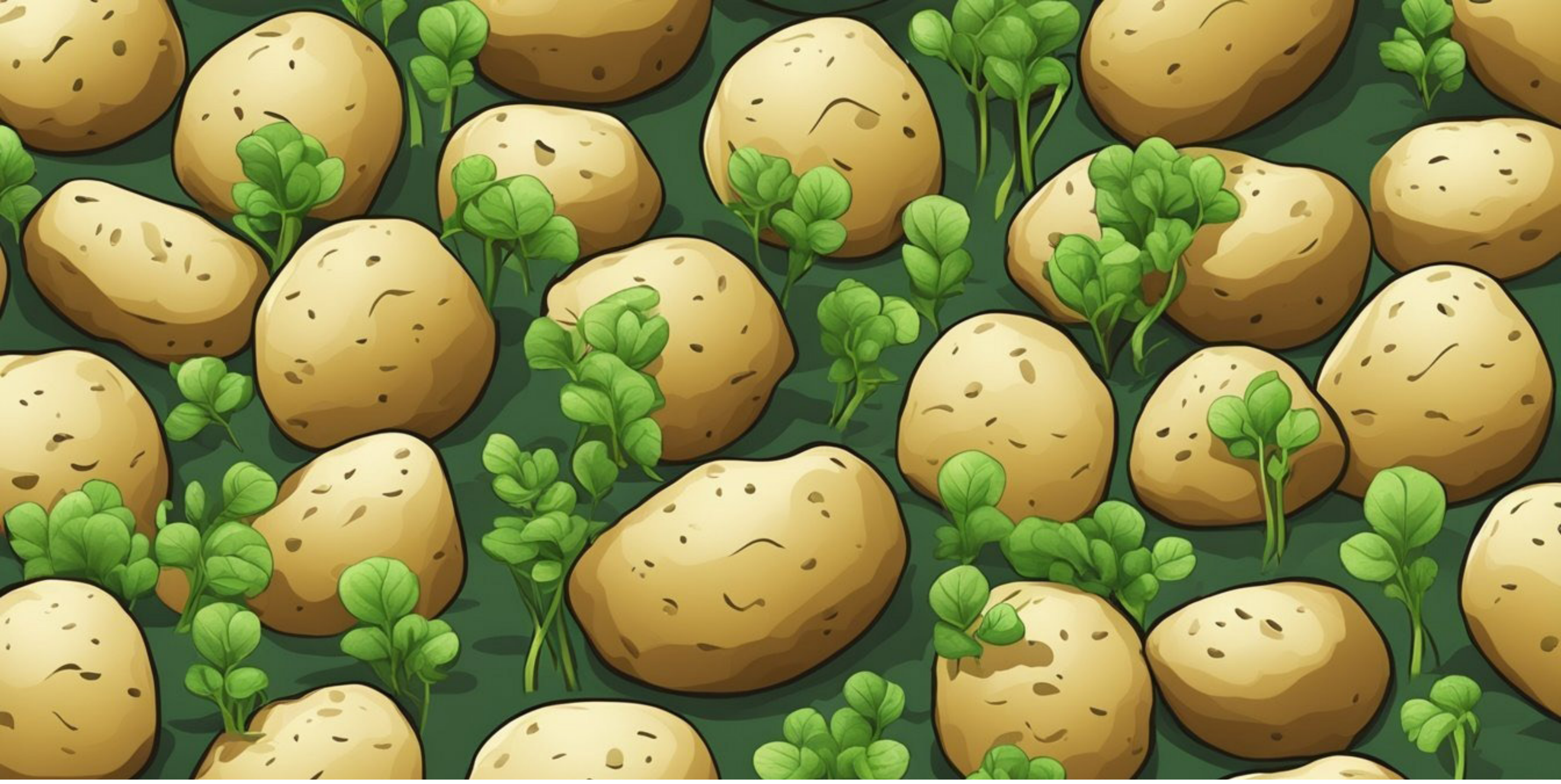
SEAWEED SNACKS

Roasted edamame, young soybeans seasoned and roasted until crispy, offer a protein-rich snack that is high in fiber and trace minerals. Edamame snacks can be enjoyed alone or added to salads and stir-fries for extra crunch and nutrition. Their satisfying texture and health benefits make them an excellent choice for mindful snackers.

Source: (https://www.slenderkitchen.com/recipe/roasted-garlic-edamame)

The rise of these alternative crunches reflects a growing trend towards healthier, environmentally responsible snacks. As consumers become more aware of their health and the environmental impact of their food choices, they seek snack products that offer both taste and nutrition while promoting sustainable agriculture. Whether it is kale chips, roasted chickpeas, or other innovative snacks, these options provide a healthful indulgence, allowing consumers to enjoy snacking without guilt.

Alternative crunches are a testament to the endless possibilities in the snack world, combining flavor, creativity, and nutrition to meet the evolving demands of today's health-conscious consumers. In a market where traditional choices like chips and pretzels no longer reign supreme, these innovative snacks offer a delightful and wholesome alternative, ensuring that snacking can be both enjoyable and beneficial.



TOXIC GLYCOALKALOIDS IN POTATOES: ARE THEY REALLY A CAUSE FOR CONCERN?

> **Glycoalkaloids found in potatoes, the possible health hazards when ingested in significant amounts**

DR. THILINI C. KANANKE

Senior Lecturer
Dept. of Food Science and Technology
Sabaragamuwa University of Sri Lanka

The potato is globally recognized as a leading non-grain food commodity, ranking fourth among staple food crops worldwide after rice, maize, and wheat. In Sri Lanka, potatoes are extensively cultivated in the Nuwara Eliya and Badulla districts, and to a lesser extent in Jaffna district. The country's annual potato requirement is around 230,000 MT, with per capita consumption of fresh and processed potatoes estimated at 7.70 kg/year as of 2022. Despite a slight increase in local production, approximately 65% of Sri Lanka's potato demand is met through imports.

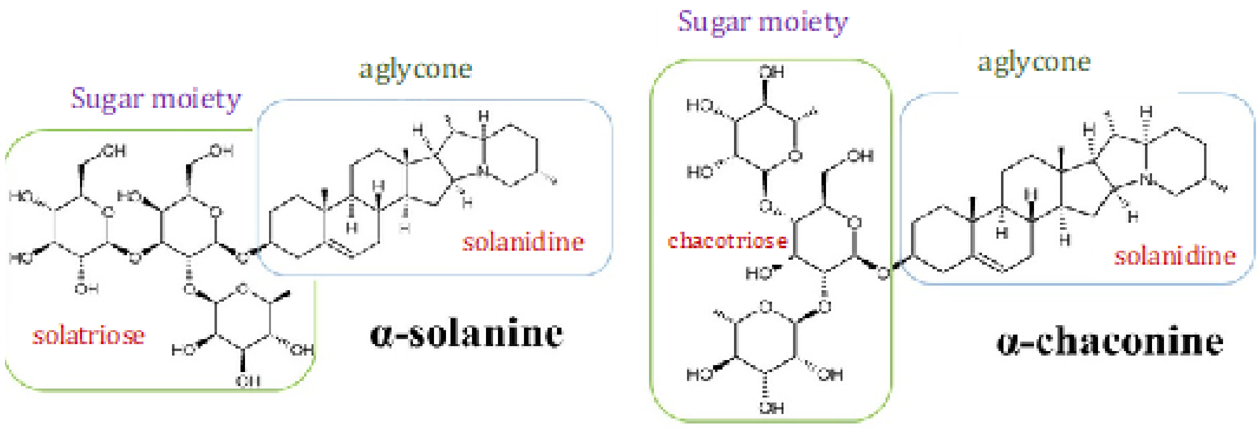


Figure 1. Chemical structures of a -solanine and a -chaconine in potato

Source: https://www.researchgate.net/publication/378387334_Development_of_a_Green_Quick_and_Efficient_Method_Based_on_ Ultrasound-Assisted_Extraction_Followed_by_HPLC-DAD_for_the_Analysis_of_Bioactive_Glycoalkaloids_in_Potato_Peel_Waste/figures?lo=1

Various potato varieties are cultivated in Sri Lanka, including Granola, Golden Star, Sassy, Red La Sodaa, Connect, Laperla, and Masai. Potatoes consist mainly of carbohydrates, specifically starch, with a small amount of protein. Additionally, it is rich in vitamin C and vitamin B6, and important minerals like potassium, iron, and magnesium. Potatoes play a dual role as both a staple food for household consumption and a cash crop in the country. Furthermore, there is a growing demand in the food processing sector for value-added potato products, driven by the popularity of fast foods and snacks.

Given the importance of potatoes as a staple in Sri Lanka, it's necessary to find information on any naturally occurring harmful compounds to assess potential health effects and ensure safe consumption practices. Accordingly, this article explores the nature of glycoalkaloids found in potatoes, the possible health hazards when ingested in significant amounts, and effective strategies to reduce exposure.

Glycoalkaloids in the Solanaceae Family

Plants within the family of Solanaceae, i.e. potatoes (Solanum tuberosum L.), eggplant (Solanum melongena) and tomatoes (Solanum lycopersicum), generate glycoalkaloids. These substances function as protective agents against fungi, pests and pathogens. The primary glycoalkaloids produced in potatoes include a-solanine and a -chaconine, comprising 95% of the overall glycoalkaloid content. Among the two types, a-chaconine is deemed more toxic, yet overall toxicity depends on their quantities and ratios.

Alpha-Solanine:

Chemical Structure: An aglycone (solanidine) with a sugar moiety (solatriose) attached.

Function: Protects the plant from fungi, bacteria, and insects.

Alpha-Chaconine:

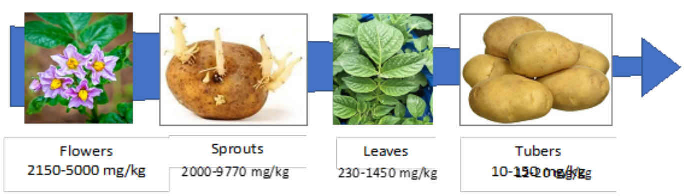
Chemical Structure: Similar to solanine, an aglycone (solanidine) with a sugar moiety attached (chacotriose) with slight variations.

Function: Works synergistically with solanine to protect the plant.

Glycoalkaloid levels in different plant parts of potato

The glycoalkaloid levels in different parts of the plant are ranked from highest to lowest as follows: blossoms, sprouts, stems, leaves, and tubers. Generally, the glycoalkaloid levels of fresh potato tubers vary from 12 to 20 mg/kg.

Figure 2. Glycoalkaloid concentrations of potato plant parts, from the highest (flowers) to the lowest (tubers)



In potato tubers, high glycoalkaloid levels are found in the sprouts, peel, and the vicinity of the potato 'eyes'. The peel of tubers contains glycoalkaloid levels ranging from 30% to 80%, and removing the peel significantly decreases their glycoalkaloid content.

Figure 3. Areas in which glycoalkaloids are concentrated in potato

Source: https://www.quora.com/Are-sprouted-potatoes-safe-for-consumption-Are-there-toxins-in-sprouted-potatoes-Can-this-sprouting-be-prevented-in-potatoes

Factors influencing glycoalkaloid production

The production of glycoalkaloids in potatoes is influenced by various factors during cultivation and postharvest handling. The type of the cultivar and growing conditions such as soil type, temperature, humidity, and watering practices can stress the plant and increase glycoalkaloid synthesis. Effective farming practices, particularly hilling potato rows to shield the tubers from excessive exposure to light, are important in reducing glycoalkaloid levels. Postharvest handling, including proper storage conditions (cool, dark, and humid environments) and careful transportation to minimize mechanical damage, also plays a significant role. Exposure to light, physical harm, and extended storage that causes sprouting can increase the quantities of glycoalkaloids. Tubers that are not entirely mature have higher concentrations of glycoalkaloids compared to fully mature tubers. Additionally, when immature tubers are exposed to light, they produce elevated quantities of glycoalkaloids. The majority of tuber types reach maturity during a span of 118 days. Smaller tubers contain a greater amount of glycoalkaloids compared to larger ones due to the concentration of glycoalkaloids in the skin. This is because smaller tubers have a higher proportion of peel in relation to their overall size.

Figure 4. Greening in potato tubers

Source: http://ephytia.inra.fr/en/C/21121/Potato-Greening

Potato greening and its impact on glycoalkaloid levels Extended exposure of potato tubers to light induces the development of a green hue. The greening is a result of chlorophyll production, which takes place concurrently with an augmentation in glycoalkaloid synthesis. While both chlorophyll and glycoalkaloid production are initiated by light, they occur through different metabolic pathways. An ordinary, unilluminated potato tuber usually has approximately 12–20 mg/kg of glycoalkaloids, but a green tuber can have 250–280 mg/kg. Removing the green color parts from potato tubers can significantly reduce the glycoalkaloids. Further, it is recommended to refrain from cleaning the tubers before to storage. Dirt on potato tubers offers a degree of shielding against light exposure and the formation of greening. Previous studies have shown that washed potatoes are more susceptible to greening in comparison to unwashed potatoes.

Potential Health Risks

Glycoalkaloids exhibit toxicity in humans when consumed in quantities more than 2 mg/kg of body weight. Levels of glycoalkaloids exceeding 140 mg/kg result in bitterness, while concentrations surpassing 200 mg/kg might elicit a burning sensation in the throat and tongue. Consequently, fresh potatoes with glycoalkaloid levels beyond 200 mg/kg are considered dangerous. In Sri Lanka, any documented literature regarding glycoalkaloid levels in locally cultivated potato varieties was not evident. The Joint FAO/WHO Expert Committee on Food Additives considers glycoalkaloid levels below 100 mg/kg in fresh potatoes to be non-concerning. Common symptoms caused by glycoalkaloids include abdominal discomfort, diarrhea, perspiration, bronchospasm, vomiting, and various gastrointestinal problems. Elevated doses can result in acute toxicity, characterized by pronounced symptoms such as neurological impairments, accelerated heart rate, hypotension, loss of consciousness, or, in exceptional instances, fatality, particularly in those with heightened sensitivity. Glycoalkaloids can persist in our bodies for over 24 hours following consumption.

Although there are potential health risks associated with glycoalkaloids, potatoes are quite safe for consumption when properly handled and prepared.

Safe Cultivation Practices

Minimizing glycoalkaloids in potatoes through proper agricultural practices involves selecting low-glycoalkaloid varieties and using certified, disease-free seed potatoes stored in dark, cool, and well-ventilated conditions to prevent sprouting and greening. Modern cultivars (Russet Burbank, Yukon Gold, Kennebec, Desiree, Maris Piper, etc.) exhibit significantly reduced amounts of glycoalkaloids compared to its wild progenitors, making this information valuable for potato breeders in the commercial sector. Balanced fertilization, particularly with potassium, and maintaining soil pH around 5.0-5.5 can reduce plant stress and glycoalkaloid production. Adequate spacing, consistent irrigation, and protecting plants from excessive sunlight are crucial during growth to prevent stress-induced glycoalkaloid synthesis. Implementing integrated pest management (IPM) practices and using disease-resistant varieties can control pests and diseases without over-reliance on chemical pesticides. Timely harvesting at the right maturity stage and careful handling to avoid bruising are also important. Post-harvest, potatoes should be stored in cool, dark, and well-ventilated conditions to prevent sprouting and greening, with ideal storage temperatures between 4-10°C.

Safe Consumption Practices

Previous studies have investigated the stability of glycoalkaloids during common cooking practices used for potatoes, including frying in oil, baking, microwaving, and boiling. These studies found a substantial reduction in glycoalkaloids during deep oil frying, whereas the reduction was not significant in other cooking methods. According to research findings, boiling and microwaving have been observed to have minimal effects on glycoalkaloid content. Frying is considered the most efficient cooking method for reducing glycoalkaloid levels. According to literature, frying in deep oil at 150°C–180°C causes little change, whereas frying at 210°C results in a significant reduction (40%) in glycoalkaloid levels. Generally, glycoalkaloids are heat-stable, and their decomposition requires temperatures exceeding 170°C. Even at these high temperatures, decomposition is not complete, and considerable levels of glycoalkaloids can remain.

Educating consumers to peel and remove green or damaged parts before cooking, and to use proper cooking methods, further reduces glycoalkaloid levels. Previous research indicates that peeling can remove around 60% of glycoalkaloids from potatoes. In typical Sri Lankan households, potatoes are usually peeled after boiling, which may reduce the quality and impart some bitterness to the flesh. According to reports, potatoes that are boiled with their peel may develop a bitter taste in the flesh, as contrasted to those boiled without the peel. This bitterness is caused by the migration of glycoalkaloids to the cortex of the potato during the cooking process. Further, the European Food Safety Authority (EFSA) advises against reusing potato cooking water and recommends regularly changing the frying oil used for potato products to minimize the exposure to glycoalkaloids.

In conclusion, glycoalkaloids found in potatoes have the potential to be toxic; however, the likelihood of poisoning is minimal as long as potatoes are produced, stored, handled, and prepared correctly. Being aware of these techniques can enable consumers to obtain the nutritional advantages of potatoes without excessive worry.

BECOMING A MEMBER OF IFSTSL

IFSTSL membership is open to all those who are engaged in the food industry. The following membership categories are available for individual applicants and corporate bodies: Fellow members, Associate members, Student members, Corporate members, Associate corporate members, Interim members. Duly completed applications should be submitted to the IFSTSL office with hard copies of the required documents to the Institute of Food Science and Technology Sri Lanka (IFSTSL), No.21D, Vijaya Kumaratunga Mw (Polhengoda Gardens), Colombo-05, Sri Lanka. Postal submissions should be done only through registered post

A cheque should be drawn in favor of "Institute of Food Science & Technology Sri Lanka", and cross A/P only or deposit money into the following bank account and send the bank payment slip through registered post with the membership application form.

Bank	:	National Development Bank (NDB), Havelock Town (Jawatta)
Account Number	:	101-000151786

FOR ANY CLARIFICATION, PLEASE CONTACT:

Mrs. Sandhya Fernando

Phone : +94 117 548 770 **Fax :** +94 117 548 771

Email : info@ifstsl.org

For additional information about IFSTSL,
please visit www.ifstsl.org

FOODIFLASH

FoodiFlash is a bi-annual online magazine published by IFSTSL

We are happy to inform you that we have created an e-platform to gather and share knowledge on novel technologies in the food sector among the members and public.

WE INVITE TO WRITERS FROM

- Industry
- Universities
- Research Institutions
- Entrepreneurs

to share what's happening in your labs or any other place in this world to combat the future food demand by the diverse group of consumers while addressing green consumerism and food safety to ensure good nutrition and health.

PLEASE SHARE YOUR

- Writeups
- Interviews
- crossword puzzles
- cartoons or any other creative work

Write your article with a concise, attention-grabbing title

Limit to 1500 words

Enriched with labelled table, figures and or pictures for enhanced clarity and impact

Images (photos, charts, graphics, etc.,)

Each image must include

• a short caption

• image credits (a specific URL, a reference, or if it is the author's own work, mention as 'The Author')

12 font Times New Roman

Enter names and e-mail addresses of authors and author affiliations/photographs of authors

Provide contact information for the corresponding author, including full name, complete mailing address, phone, and e-mail address.

Acknowledgments (optional)

Email : To the editor

Dr N S Weerakkody

editorifstsl@gmail.com