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Original Article

# Food products quality and nutrition in relation to public. Balancing health and disease

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**Abstract.** Foods safety as milk and dairy products are inspected as a dedicated quality management tool and a checkpoint to safeguard by detecting microbes, germs, and other unsafe elements. The inspection service is maintaining compliance and safety which ensures that the products are properly labeled and packaged, and to prevent foodborne diseases as recommended by the Food and Drug Administration (FDA). This article discusses microbial and chemical contaminations in some food products, which helps to enhance the health consciousness that is also important for maintaining industrial food hygiene by raising the *awareness* of hazards and alertness to danger. Micronutrient content of some underutilized and lesser-known aquatic plants have numerous potential for contributing to the Sustainable Development Goals, particularly in combating micronutrient deficiencies. Trace elements shortages are due to a number of clinical signs.

**Key words:** Diet, tubercle bacilli, poison, solubility, industrial health conscience

## Health Risk Association with Green Leafy Vegetables of Urban Waterbodies

Bio-fortification of food and crops with mineral dietary sources has been advocated to help avert micronutrient deficiencies, but these strategies involve much higher recurrent costs and are usually expensive or locally unavailable. In many developing countries, the consumption of greens leafy vegetables (GLVs) which are often the most available and affordable among vegetables but underutilized, are being encouraged and popularized. GLVs increase antioxidant capacity through minerals, vitamins, pulp, and phytochemical compounds in their content and protect against oxidative stress. In addition to providing a range of health benefits, GLVs have also been designated as nature's anti-aging wonders as they lower age-related disorders due to their ability to reduce the risk of chronic human ailments like cancer and cardiovascular diseases. A daily serving of leafy greens can also help to slacken the decline in cognitive aptitudes associated with dementia, the prevalence of which has been projected to increase sharply as the oldest age groups continue to grow in numbers worldwide.

With mounting pressures on cultivable land in view of rapid urbanization, renewed research interest is now geared towards the promotion of GLVs, especially uncultivated wild species, which are used in traditional food systems. These traditional diets have received global recognition for their potential to contribute to improved food security and healthier nutritional status. Besides, the adverse impacts of climate change on biodiversity, agricultural production, and food security have made the conservation of food diversity and associated traditional knowledge a global priority.

Edible aquatic plants, naturally occurring in urban freshwaters, constitute a readily available, cheap source of nutrients which can easily be promoted under the urban agriculture concept, which is essentially the production and distribution of food from plant sources growing naturally in and around cities that could meet local needs. Despite the growing

importance and attention given to urban agriculture, the importance and potential of using edible aquatic plants in cities remains largely unknown although the nutritive potential of many such aquatic and semi-aquatic plants for food use have been documented. It is, therefore, important to popularize and make known the micronutrient content of locally available aquatic macrophytes which clearly have an untapped potential to boost dietary diversity and quality to achieve sustainable healthy diets. However, urban waterbodies are subject to much stronger disturbances from human activities than other freshwater ecosystems resulting in more severe eutrophication and pollution. The presence of numerous small scale enterprises near residential areas in cities together with the prevalence of slums contribute to additional pollution and environmental degradation, where elemental contamination is more prevalent due to inefficient food regulatory policies, inadequate environmental laws, monitoring, and enforcement strategies. Thus, aquatic plants growing in such waterbodies can be loaded with heavy metals but are prone to pollution risks from various industrial, domestic and agricultural sources. The green leafy parts of vegetables are generally better accumulator of heavy metals compared to root and fruit vegetables and could be a cause of special concern since they can accumulate toxic elements in their edible parts in quantities high enough to form clinical problems that can lead to potential health risks in human. The major essential macro-elements of importance in human health are **calcium** (Ca) and **phosphorus** (P), which are the structural component of bones and teeth, with deficiencies contributing to the risk for rickets in children and osteoporosis in adult population. Current reports indicate that an increase in dietary P consumption may lead to detrimental effect in bone and mineral metabolism (1, 2), cardiac and skeletal muscle dysfunction, kidney disease and cancer proliferation (3). Dietary P intake is plentiful for humans and deficiencies are rare. However, Ca intake through diets is generally inadequate where green leafy vegetables can contribute greatly since they are considered to be an important plant source of dietary Ca. **Chlorine** (Cl) in chloride form, is the second most abundant electrolyte in serum, that plays a vital role in the regulation of body fluids, electrolyte balance, preservation of electrical neutrality, acid-base status and is an essential factor for the assessment of many pathological conditions. Dietary chloride deficiency is very rare as table salt is the most common source. **Bromine** (Br) is an indispensable element for assembly of Collagen IV Scaffolds in tissue development and also plays role in activation of digestive enzyme αamylase in saliva. However, the physiological role of bromine still has inadequate understanding. **Sulfur** (S) is an important component of the amino acids, methionine and cysteine, and also acts as a cofactor of many enzymes. While methionine cannot be synthesized by the human body and must be obtained from food, the synthesis of cysteine requires a constant flow of sulfur. The trace elements copper, iron, manganese and zinc also contribute to bone mineralization like the macro-elements, but they all have important roles as co-factors for antioxidant enzymes and vitamins, and are often prescribed as health supplements. As each essential trace element is related to many enzyme systems, the deficiency of any of them may be apparent as a combination of various clinical manifestations. **Potassium** (K) is a vital element with multiple health benefits. It acts a role in water, electrolyte and pH balance, cell membrane transfer, and functions as a cofactor for a number of enzymes. Potassium intake is often low when compared to the recommended intake, however, vegetables are one of the major food groups that provide K in diets. **Copper** (Cu) deficiency was considered uncommon, but studies now suggest that insufficient dietary intake can lead to cardiovascular diseases and compromised bone health (4). The principal role of **iron** (Fe) in the human body is oxygen transport and its deficiency leads to anemia, a major public health problem. **Manganese** (Mn) is involved in glucose and lipid metabolism, acceleration of protein, vitamin C, and vitamin B synthesis, catalysis of hematopoiesis, regulation of the endocrine, and immune function improvement and cartilage formation. Mn deficiency as well as its excess are both associated with adverse metabolic and neuropsychiatric effects. Although **Zinc** (Zn) is required by the body in small amounts, its deficiency is a public health problem in almost all the low- and middle-income countries, because of limited access to foods that

are rich in zinc, such as animal products. Zn deficiency can coexist with Fe deficiency because of the overlap of dietary factors like the presence of phytates and fiber in the diet that bind with both nutrients and inhibit their absorption (5, 6). **Selenium** (Se) acts as an antioxidant, as a cofactor of many enzymes which is involved in immunity, thyroid hormone production and disease prevention. Plants are a major dietary source of Se and plant-derived Se has attracted extensive attention because of its safety and bioavailability**. Chromium** (Cr) has two biologically relevant forms namely, Cr (VI), the carcinogenic and mutagenic form, and Cr (III), which has low toxicity. Cr (III) was considered to be an essential trace element, but its status has been under debate since 2007. Presently, it is not considered to be an essential element but as a possible pharmacological agent. Cr (III) is believed to have a beneficial role in insulin regulation and lipid metabolism (7). Cr in food is primarily present in Cr (III) form and no adverse effects of dietary chromium intake from food or supplements have been convincingly demonstrated. **Cadmium** (Cd) is one of the most toxic elements for humans that can cause chronic diseases and can even be noxious at low levels. This element negatively affects the function of the skeletal system by disturbing the metabolism of calcium, magnesium, zinc, copper and iron ions. It may damage the liver and kidneys, can be a risk factor for osteoporosis and can cause various types of cancer. **Lead** (Pb) is a systemic toxicant which can have adverse effects on the central nervous system, cardiovascular system, kidneys, immune system and can cause cancer. Elevated levels of Pb in the blood, especially in children, may cause changes in the brain which can be manifested by lowering of the IQ level creating problems with proper perception, concentration leading to hyperactivity (5, 6). **Rubidium** (Rb) is an under studied element that may have potential nutritional benefits. Recent studies indicate that Rb may possess unique essential and neurophysiological characteristics in humans. **Strontium** (Sr), a non-essential trace element, is now being considered as an emerging potentially toxic element which can disrupt bone growth and damage bone marrow at high concentration (8). At low concentration, Sr also has some beneficial effect like osteogenesis and prevention of cariogenesis.

The elements variations in plants are influenced by species differences, stage of maturity, genetic variability, environmental and climatic conditions as well as cultural practices. Differences in elemental concentration for the same plant species from different sites as well as those between different plant species from the same site have also been noted by some authors (9, 10). However, there are limited studies on the assessment of possible health risk linked with the consumption of aquatic plants from urban water bodies. Thus, both the health implications of deficiencies in essential trace elements and the toxic consequences of heavy metals in humans necessitate effective monitoring of both essential trace elements and heavy metal concentrations in edible plant sources from urban water resources to ensure public health safety. Thus, we encourage studies undertaken to assess the yield potential of edible aquatic plants that naturally grow in urban small water bodies and analyze their elemental composition in order to promote and popularize their use as a readily available, cheap source of mineral nutrients to supplement the increasing needs of the growing population.

Since urban waterbodies are subject to elemental pollution, the associated health risk in humans from consumption of the edible parts of these plants must be assessed.

## Safety of Milk Production and Distribution Chain

The importance of milk as an article of diet has long been recognized by those concerned in the review of nutritional requirements (11, 12), but of all foodstuffs milk and its products have been the most blamed for the spread of disease on the one hand and have been most often adulterated on the other. Hence the necessity for the very strict control of all that appertains to the dairy. The sanitary authorities have administered regulations for the maintenance of a clean milk-supply, for instance, even now at least 5 per cent. of the milk coming into Damascus (capital of Syria), when sampled at the termini, contains tubercle bacilli. As the importance of milk as a possible source of infection, particularly of tuberculosis, became more and more evident, a scheme of grading the milk according to its purity was introduced in the Milk and Dairies (Amendment) Act, and the Milk (Special Designa-

tions) Order sets forth the principal conditions applying to the various classes of milk. The system of licensing involves the inspection by the Ministry of Agriculture and retail depots. Such inspections include a survey of the methods of milk production by means of the score card, the identification of animals in the herds, the methods of handling, bottling, distribution, and compliance with the regulations for the several grades. The growing interest taken by milk producers, distributors, and consumers in the supply of a milk of special purity is indicated by the steady increase in the number of licenses for which application is made, but at present the amount of this high-grade milk supplied is almost negligible. The production of such milk has a substantial educational advantage and proves the practicability of an improved milk-supply for all consumers.

It is important that the general public should realize the advantages of milk as a food, especially for growing children. In fostering such a movement those concerned will do well to give due consideration to the many factors which account for the relatively small consumption of milk. Amongst these not the least important is the unsatisfactory condition as regards cleanliness of a considerable proportion of our milk-supplies. The importance of obtaining a good name for milk in this respect should not be overlooked. The conversion of our population to a satisfactory standard of milk consumption will depend very largely on the energy displayed by all concerned in raising the whole standard of milk production and distribution to a level such as that which has already been reached by milk produced under the grading scheme. What does this involve? First, clean and healthy milch heads; secondly, clean milking; third, effective cooling of the milk immediately it is obtained; lastly, prompt bottling at the farm, or clean and rapid transit in bulk. These appear to be simple requirements, but their fulfilment demands thorough and continuous attention to detail and good organization. For consumption in industrial towns there is much to be said for the use of pasteurized milk, but pasteurization cannot make dirty milk clean; to be wholesome and to have keeping properties the milk must itself be clean. Notwithstanding the numerous difficulties which present themselves in bringing offences home to milk adulterators, local authorities, as a whole, show commendable zeal in endeavoring to maintain its purity in this respect. The returns furnished by public analysts show that in general milk as sold to the consumer is satisfactory as regards milk-fat and other milk solids.

## Polycyclic Aromatic Hydrocarbons during Deep Frying

Polycyclic aromatic hydrocarbons (PAHs) represent a series of hydrophobic compounds that contain at least two fused aromatic rings. Once undergoing metabolic activation in human body, PAHs could interact with proteins and/or DNA, further leading to cancers, cardiovascular diseases, loss of fertility, and immunotoxic effects. A sum of 16 PAHs has been pointed as priority pollutants by the United States Environmental Protection Agency (USEPA). For non-professional and non-smoke adults, dietary ingestion is the major route to the exposure of PAHs. As lipophilic environmental pollutants, PAHs have the tendency to migrate and accumulate in edible oils. Frying is one of the most popular cooking and oil processing methods worldwide, which produces fried foods with distinctive flavors, taste, texture and appearance. Frying at high temperature between 140 $^{o}$C to 220 $^{o}$C would initiate myriad chemical reactions involving oxidation, hydrolysis and polymerization. Consequently, some toxicants and harmful substances such as polycyclic aromatic hydrocarbons, glycidyl esters and even 3-monochloropropane-1,2-diol esters are generated. The selection of frying oil is essential to ensure low PAH risks and oxidative stability. Palm oils with high levels of saturated fatty acids (SFA) are resistant to oxidation and traditionally preferred as optimum alternative to frying oil. Nowadays, high oleic oils also attracted much attention due to their high contents of relatively stable monounsaturated fatty acids (MUFA). In addition, oils would be blended to improve both oxidative stability and nutritional value of fried products. The formation rate of PAHs in soybean oil slows down when it is blended with palm olein and high oleic sunflower oil. However, the concentrations of PAHs in high oleic acid oils and some commercial blend oils during frying are still unknown and there was lack of comprehensive

evaluation of PAHs levels and their compositions in different frying oils. Frying can promote the generation of PAHs in oil. While there is lack of comprehensive evaluation for PAHs in conventional, high oleic acid and blended oils during frying.

**Frying Procedure**

The frying procedure is performed to simulate actual fast-food frying conditions. About 15 L vegetable oil is first poured into a stainless-steel deep fryer (Model OFE-28, Yixi, Shanghai, China) and heated to 185 ± 5 ɑto fry 200 g of frozen pre-fried French fries for 3 min. The oil is allowed to heat for another 9 min to return to the set temperature before the subsequent frying cycle. Seven frying cycles is performed hourly across 15 h daily. Oil samples of 500 mL are collected at the end of daily frying operation using an amber bottle and stored at -35 ɑfor subsequent analyses. The used oil in the fryer is filtered after every 8 h of frying, then fresh oil is added to reach its initial level (15 L). Each oil is tested under intermittent frying conditions for ten consecutive days.

**Determination of Fatty Acids Composition**

According to AOCS Official method Ce 1a-13 (2017), fatty acids composition is analyzed in the form of fatty acid methyl esters using an Agilent 7820A gas chromatograph (Agilent Technologies, Shanghai, China) equipped with a flame ionization detector (FID) and polar capillary column model Varian cp 7489 (100 m × 250 μm × 0.20 μm; Varian, Shanghai, China).

**Determination of PAHs**

The PAHs are first extracted from the oil aliquot using a QuEChERS extraction tube and purified by Agilent Bond Elut EMR-Lipid (5982–1010) and EMR-Lipid Polish (5982–0101). Gas chromatography-triple quadrupole mass spectrometry (GC-QqQ-MS; Agilent 7890B-7000D, CA, USA) equipped with a DB-5MS capillary column (5% phenyl methylpolysiloxane, 30 m × 0.25 mm × 0.25 μm) is used to quantify PAHs in the QuEChERS extract.

**Calculation of BaP Equivalent Concentration (BaPeq)**

BaP's toxic equivalency factor (TEF) is defined as 1.0. The BaPeq of frying oils is calculated according to the following equation.

Where C*i* is the measured individual PAHs concentration (μg/kg) for the PAH with the assigned TEF*i*.

**Determination and Discussion of Acid Value (AV) and Total Polar Components (TPC)**

AV and TPC are evaluated based on AOCS Official Methods Cd 3d-63 and Cd 20-91. In detail, TPC is evaluated through the Edible Oil Polar Components (EOPC) flash chromatographic system (Beijing Orienda Instruments Co., Ltd.). The non-polar fractions are eluted using a mixture of petroleum ether and diethyl ether (85:15, v/v) and dried using an R201 vacuum rotating evaporator (Kexing, Shanghai, China). Subtract the weight of the non-polar components from total weights, and then TPC is obtained. High oleic blend oil (HOBO), high oleic sunflower oil (HOSO) and high oleic rapeseed oil (HORO) are characterized by relatively high contents of oleic acids (C18:1) ranging from 54.91% to 91.66%. Palmitic acid (C16:0) is the representative fatty acid for palm oil (PO), palm blended oil 1 (PBO 1) and palm blended oil 2 (PBO 2). The initial relative amounts of saturated fatty acids (SFA) in PO, PBO 1 and PBO 2 are 58.53%, 44.27%, and 38.19, respectively. The majority of the other oils contained high amounts of polyunsaturated fatty acids especially linoleic acid (C18:2). The initial PAHs levels in fresh oils are playing an important role on the PAH risks of frying oils. Specifically, peanut oil is the most susceptible to accumulate PAHs during frying. It can be predicted that PAHs concentrations tended to be more stable in frying oils rich in oleic acids. In short, the above results indicated that blending could increase the changing range

of PAH concentrations for palm oil and high oleic oils. Generally, PAHs with more rings are more toxic. The three-ring PAHs are the dominant components for all frying oils, accounting for 24% in SFO to 66% in PBO 2. The decrease of PAHs could be attributed to transformation to their derivate, such as chlorinated PAHs and oxygenated PAHs, exerting more toxic effects than corresponding parent PAHs. The loss of PAH4 and their conversion into derivates during frying by stable isotope methods are verified. The change of PAHs mainly focuses on the analytes with low molecular weight (2-4 rings). It is clear that the accumulation rate of Ant is the greatest among EPA PAH16 analytes. It can be seen that blending has increased the formation rate of PAHs with low molecular weight especially Ant in high oleic acid oils. The results further confirmed that more saturated fatty acids in frying oils could decrease the risks of PAH accumulation. Hence, Bghip could be the representative PAH analyte in palm oil. Different from Ant, Bghip concentrations decrease at the beginning of frying time, which may be due to their degradation at high temperature. The term TPC refers to any breakdowns and/or newly developed components of relatively higher polarity than that of unaltered triacylglycerols, which include oligomers, dimers, polymerized triacylglycerols, oxidized triacylglycerols, diacylglycerols, monoacylglycerols and free fatty acids. Therefore, PAHs levels could not reflect the oxidative degree of some frying oils especially high oleic and palm blended oils when subjected to frying in fast food chain.

## Herbal Beverage Trace Elements Analysis

For the determination of several elements in a single analysis in basic drinks as tea and coconut water, multielemental analytical techniques such as ICP-OES and ICP-MS are normally preferred. These techniques are highly effective in providing analytical methods with adequate accuracy and precision, and limits of detection that are generally suitable for the determination of essential elements in beverages. However, one of the main limitations of these techniques are the high operating costs of the spectrometers, especially due to the use of argon gas, in flow rates that could reach 18 L min-1 or higher, required for the plasma. The argon used in these techniques must necessarily be purchased from a gas production company. An alternative multi-elemental technique of growing interest is MIP OES, which presents broad application for food analysis. The MIP OES uses a nitrogen plasma, a gas that could be obtained from atmospheric air in the laboratory, saving the costs of gas consumption. Nevertheless, the nitrogen plasma reaches about half of the argon plasma temperature, being less robust and more susceptible to interferences arising from the sample matrix. Thus, when analyzing food samples, which generally contain high quantities of organic matter, an effective sample treatment is required. For this reason, samples are treated by acid decomposition assisted by microwave radiation. The suitability of the analytical method for the determination of metallic elements in beverage samples is evaluated by considering the main analytical performance parameters, such as accuracy, precision, limits of detection (LOD), and limits of quantification (LOQ). MIP OES method exhibits adequate analytical performance for the determination of metals as Al, B, Ca, Cu, Fe, Mg, Mn, Ni, P, and Zn in samples of natural and mature-based samples.

## Food Poisoning

A considerable number of outbreaks of food poisoning were reported. The origin of these outbreaks was investigated by local officers or by means of inquiries made by medical officers of the Ministry. It would be of assistance if the coroners understood that the bacteriological examinations should be made. The causes of food poisoning may be classified as being due to chemical poisoning, to bacterial invasion, or to ingestion of toxins contained in food. Lead, copper, and zinc from vessels employed in the distribution of beer and soda water were responsible for some cases of chemical poisoning (13). A case of zinc poisoning if occurred may cause the local authority to issue a warning to the public against the making of jam in galvanized iron vessels. In this case a sample of home-made jam brought to the local health department as it had been found to have a peculiar flavor. It had been made in a galvanized iron pan. The public analyst found that the jam was contaminated with zinc to a poisonous extent.

A large amount of work has been done in perfecting the electrolytic method of estimating arsenic. An apparatus as atomic absorption spectroscopy (AAS) (Fig. 1) has been evolved which constitutes a great improvement, is likely to be adopted in laboratories in preference to the zinc and acid method. During a year in Syria, arsenic was discovered in samples of cocoa, tea, baking powder, and food wrapping papers, but no poisoning resulted in consequence. Arsenic had gained access to the cocoa, though not in deleterious doses, by means of potassium carbonate, contaminated with this substance which had been used in the preparation of cocoa to increase its solubility.

Bacterial poisoning occurred on a considerable number of occasions in the last 12 months. In some, one person only or one family was attacked and the matter came to notice on account of the holding of an inquest. Other outbreaks, however, were on an extensive scale. The articles of food which came under suspicion as the cause of illness were of the most diverse nature (14). In many instances an organism of the Salmonella group was isolated (Fig. 2). Outbreaks due to cheese are of interest, as in four instances string cheese (can be eaten plain, or mixed with pastries, and may be used as a substitute for Mexican Oaxaqueno cheese) gave rise to poisoning, on two occasions on a considerable scale; analysis of the cheese failed to reveal food poisoning organisms, but a water-soluble toxin was found to be present. Agglutination tests for the presence of members of the Salmonella group gave negative results, but in a small outbreak of food poisoning due to domestic cheese positive results in this respect were obtained. Tyrotoxicon was not found in any of the cheeses.

## Exaggerated Dangers

The ingestion of toxins contained in food was exemplified by the outbreak of botulism at Loch Alaree,

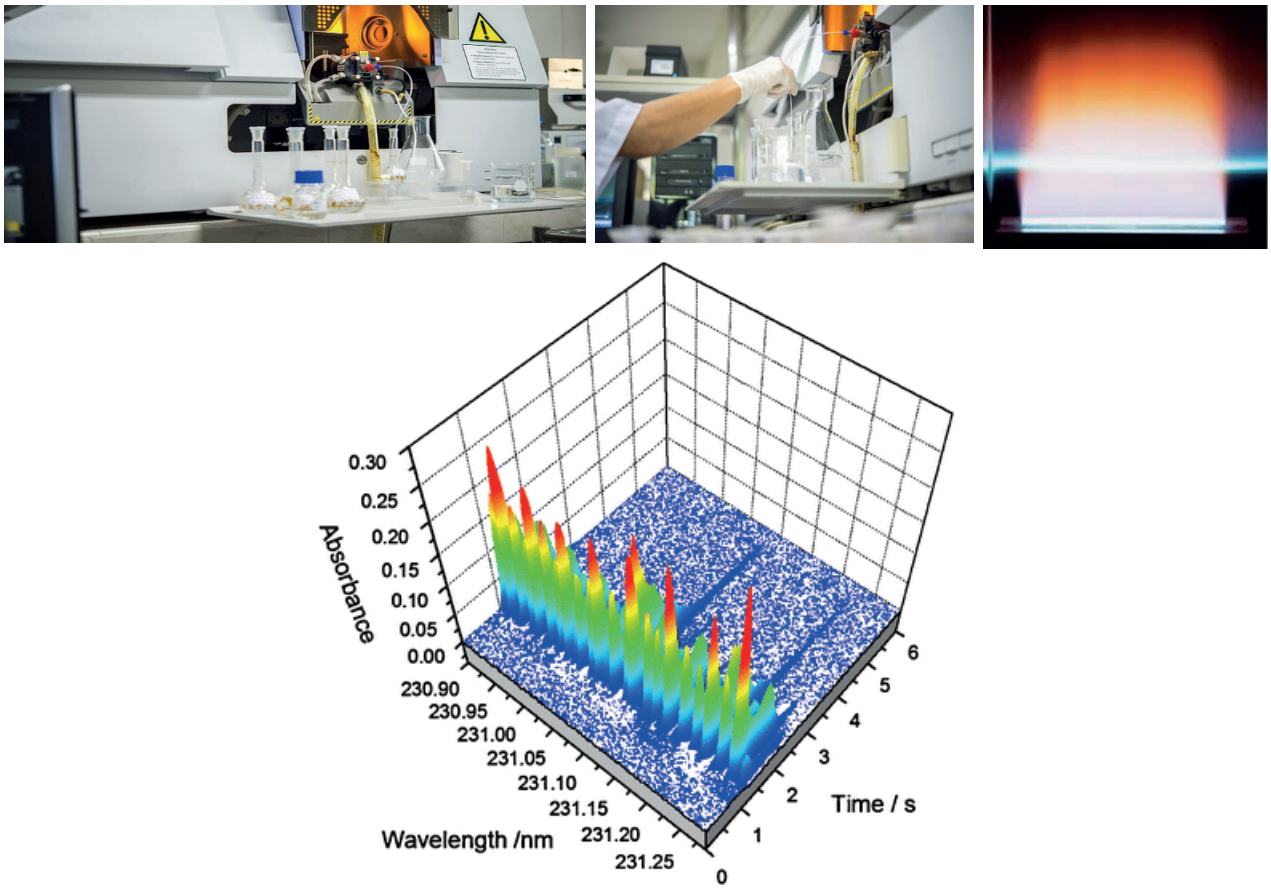


**Figure 1.** The atomic absorption spectroscopy (AAS) used to check food quality evaluation and analyze heavy metals in cocoa

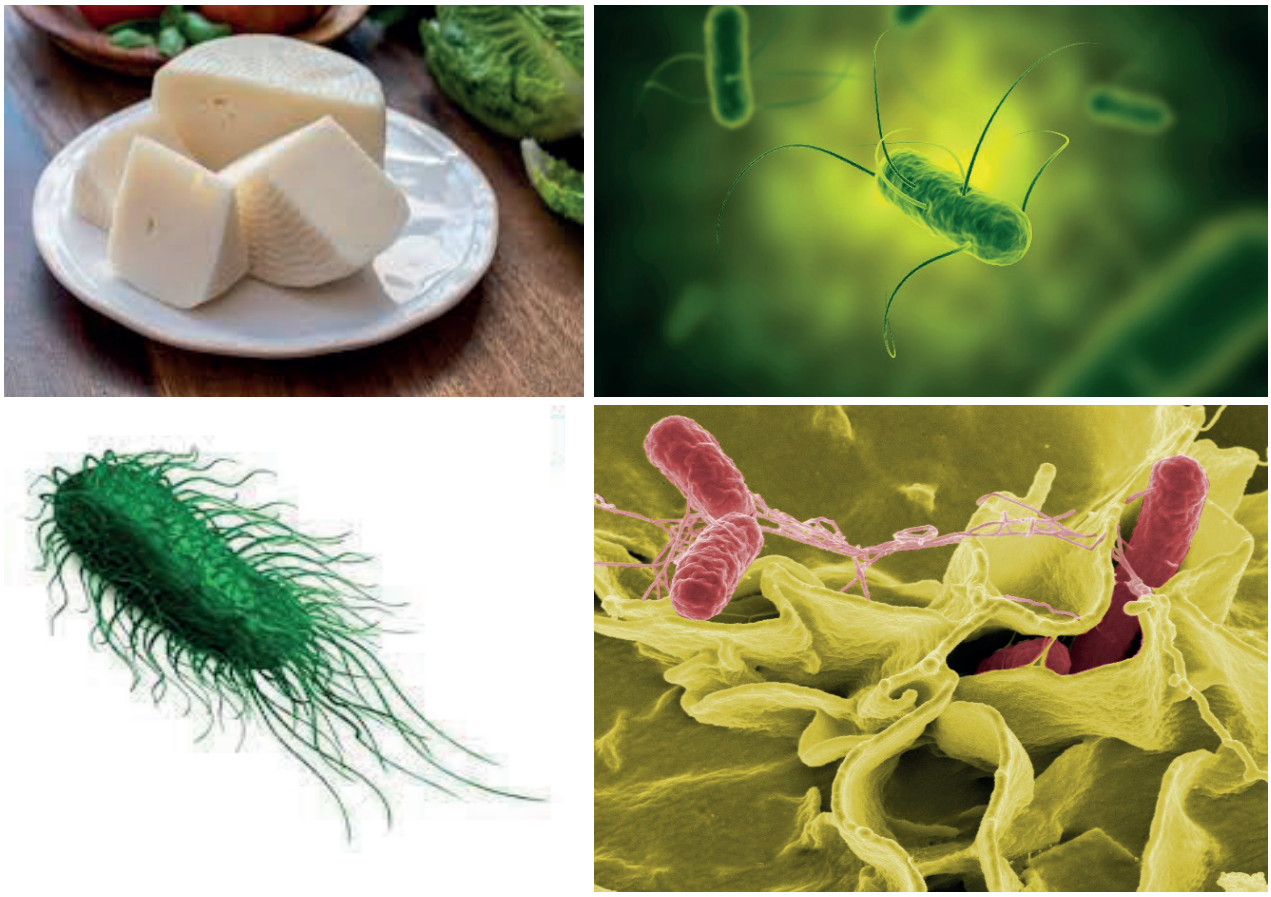

**Figure 2.** Salmonella typhimurium isolated from cheese

Scotland in August, 1922. The dramatic circumstances of the case directed public attention to possible dangers of poisoning which, though alarming in themselves, are less so when viewed in their relative proportions. A wholesale condemnation of preserved meats through fear of botulism or any other disease is both rationally and economically unsound. Of necessity, canned and prepared foods now enter largely into the dietary of the public, and form an important and valuable part of the food-supply. That illness of one sort or another should occasionally result from their use, as it does from other forms of food, is well-nigh inevitable. Having regard, however, to the enormous quantities of canned and prepared foods consumed, the remarkable fact is, not that accidents should occasionally occur from their use, but that these accidents should have been so few and far between. The illness was attributed to the consumption of wild duck paste, prepared and put up in small jars in one of the best equipped and managed factories. A very large number of jars were all prepared at the same time and in exactly the same manner, yet only one jar out of a total of many thousands gave rise to botulism, the contents of the others apparently having been consumed without ill-effect of any kind. Alarm in respect of water-supply, milk, and food, may sometimes be justifiable and salutary, but unless the circumstances are quite exceptional such alarm may prove to be extremely damaging both to the national health and to national industry.

Apart from deep frying, flour, cheese, milk, tea, coffee, cocoa, meat, herbals and herbal beverage, and prepared foods form staple and universal articles of dietary, and sporadic or accidental contamination here and there should not so disturb the public mind as to lead to widespread condemnation or discarding of these foods. An accident, tragic and regrettable in it-

self, affecting a single household or a dozen persons may in these days of ready intercommunication be so widely announced and amplified as to lead to the deprivation of millions of people of their usual food and to irreparable damage to great industries, resulting in extensive unemployment and serious financial loss.

The immediate result of this outbreak was an investigation of the methods employed by a certain great food manufacturing firm in securing sterilization of their products. The measures usually adopted are stringent and the habitual practice of them involves a thorough, sound, and comprehensive health administration of a factory. But experience shows that such an administration is practicable and business-like. If the custom and confidence of the consumer are to be secured and retained, such an administration, a sort of " industrial health conscience," is necessary. To be efficacious, and free from hazard and chance, such a health administration must be a partnership between four parties-(*i*) the manufacturer, (*ii*) the central health authority, (*iii*) the local sanitary authority, and (*iv*) the public, as consumer. The consumer has his own responsibility in the domestic preparation or purchase of food. He is represented by public opinion and by the press. Both are of the utmost value in affording information, providing education, and raising the standard of the food-supply, and, as a corollary, the health and efficiency of the nation.

## Conclusions

The UN-SDG2 of ending all forms of hunger and malnutrition by 2030 needs inclusion of cheaper and locally available food options. In tune with this, the study contributes towards broadening the knowledge on the content of selected macro and trace elements in locally available GLVs from aquatic edible plants. In view of their toxicity status, it is recommended that periodic assessment of contaminated sites can be conducted for early signs of elemental contamination and ecological risk in urban waterbodies. Innovative approaches to establish a change in dietary patterns aimed at improving GLV intake in the urban populace through consumption of these micro-nutrient rich aquatic plants are much needed. These naturally growing plants in urban waterbodies have the potential to provide economical mineral sources to mitigate hidden hunger without investing in any additional land or fertilizer requirement.

On the other hand, the distribution of PAHs in cooking oils have been verified at an industrial condition. Based on fatty acids compositions, palm oil had highest frying stability and blending decreased its stability. The initial PAHs levels in fresh oils played an important role on the PAHs risks of frying oils. Palm oil and its blended oils contain low PAHs contents. In addition, peanut oil is the most susceptible to accumulate PAHs during frying. While there are minimal changes in PAHs levels for high oleic sunflower oil and high oleic rapeseed oil. Hence, PAHs concentrations and related risks are lower in frying oils rich in saturated or monounsaturated fatty acids. Furthermore, blending increased the generation rate of PAHs especially low molecular weights for palm oil and high oleic oils. Three-ring PAHs are the dominant components in frying oils. Generally, TPC and AV of all frying oils increased with prolonged frying time. PAHs levels could not reflect the oxidative degree of some frying oils especially high oleic and palm blended oils when subjected to frying in fast-food chain. In short, this study provides a scientific basis for monitoring and ensuring the safety of frying oils in fast food chains.

Farm milk production increases to a total of hundreds million tons of milk and dairies products, 98 % of which is cows' milk. Several factors contributed to this increase, such as good weather conditions, increasing quotas and favorable farm-gate milk prices. Milk products worth billion dollars and accounted for more than 10% of the value of community agricultural output. However, consumption should be assured hygiene. Therefore, from frozen *foods* to canned goods, food inspection requires rigorous research, analysis and investigation throughout production by dedicated and impartial food. It is also important to give more attention to the hygiene education and keep up-to-date with food surveillance reports.

**Glossary: Food and Drug Administration (FDA):** A federal agency of the Department of Health and Human Services, is responsible for protecting and promoting public health through the control and supervision of food safety. **Tubercle bacilli:** A

bacterium that causes tuberculosis. **Tuberculosis:** A bacterial infection spread through inhaling tiny droplets from the coughs or sneezes of an infected person. It mainly affects the lungs, but it can affect any part of the body, including the tummy (abdomen), glands, bones and nervous system. **Electrolytic method:** Uses direct electric current (DC) *to* separate bonded elements and compounds by driving an otherwise non-spontaneous chemical reaction. **Atomic absorption spectroscopy:** *A* well-established and reliable technique for the analysis of trace elements in *food* stuffs. **Salmonella:** A genus of rod-shaped Gram-negative bacteria of the family Enterobacteriaceae, occurs mainly in the intestine, especially a serotype causing food poisoning. **Tyrotoxicon:** A ptomaïne produced in milk or cheese, the cause of the symptoms of poisoning occasionally observed to follow the eating of ice-cream **Botulism:** A rare but serious illness caused by a toxin that attacks the body's nerves and causes difficulty breathing, muscle paralysis, and even death. This toxin is made by Clostridium botulinum and sometimes Clostridium butyricum and Clostridium baratii bacteria.

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