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A review of the need for biofortified foods to combat malnutrition

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Abstract

Urbanization has led to increased consumption of industrially produced foods, including in developing countries. Many countries are now addressing micronutrient malnutrition through the use of fortified foods, reaching a larger portion of their population. Poverty has an impact on populations that are essentially deficient in adequate micronutrients. Therefore, it is common practice to include multiple forms of micronutrients. It is often possible to fortify foods with micronutrients. In most cases, adding one or more micronutrients to foods does not significantly increase the cost. In most cases, if the technology is available and the distribution system is appropriate, reinforcement is more cost-effective than other strategies. By consuming fortified foods regularly and frequently, dietary supplements will be more effective in maintaining nutrient reserves than taking supplements intermittently. Adding nutrients to food helps reduce the incidence of undernutrition problems, as well as problems caused by seasonal fluctuations in food supply and bad habits. This will benefit children and pregnant women who need adequate nutrient stores during pregnancy and breastfeeding, as well as pregnant women who need a steady supply of micronutrients for growth and development. Fortification is beneficial for postpartum women and their babies because it raises the vitamin content in breast milk and reduces their nutritional needs. Fortification of widely consumed and widely distributed foods not only improves the nutritional status of large segments of the population, but also serves other purposes. This review is intended to highlight the importance of using fortified foods to effectively combat malnutrition.

Key words biofortified foods, malnutrition, dietary supplements, nutritional needs

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Introduction

Human malnutrition is characterized by an insufficient or excessive supply of macronutrients or micronutrients in the body, or both [1]. At the same time, malnutrition and micronutrient deficiencies persist and negatively impact public health [2]. In fact, poor access to food and low income are important causes of micronutrient deficiencies in rural areas [3]. There are an estimated 2 billion micronutrient deficiencies worldwide [4]. Unfortunately, in developing countries, most people cannot afford these foods in their daily diet. As a result, they suffer from micronutrient deficiencies [5]. Many children worldwide are nutritionally deficient, which negatively affects their physical and mental development and increases their susceptibility to infection. In addition, malnutrition amplifies the impact of all diseases, including measles and malaria [6]. Furthermore, according to [7], women and children are the primary targets of suffering the consequences of micronutrient deficiencies, such as poor pregnancy outcomes and impaired intellectual and physical development of children. In low- and middle-income countries, as many as 3.1 million to 3.5 million children under 5 years of age and women of childbearing age die each year from malnutrition (fetal growth restriction, poor breastfeeding, stunting, wasting, vitamin A, iodine, zinc, iron, vitamin D deficiency, rickets, osteomalacia and thyroid deficiency) [6-8]. Eliminating these deficiencies is therefore critical, not only for improved health, but also for continued economic growth and national development [9]. Fortifying basic foods, seasonings or flavorings by adding trace elements such as vitamins and minerals is an effective way to improve their nutritional value [10]. Food can be fortified by adding synthetic micronutrients to it [11]. The most common fortified foods in developing countries are those that people eat regularly. These include oil, fat, salt, rice, wheat or cornmeal. In terms of the degree of fortification, food fortification has a significant impact on health; Bioavailability of enhancer; And the number of fortified foods consumed [12]. Traditionally, zinc has been added to foods in large amounts (100 mg of zinc per kilogram of zinc is added to wheat flour [13]. In this case, lower levels of zinc fortification are unlikely to affect nutritional value [14]. A very effective food fortification program, especially one that utilizes existing technology and local distribution, would greatly improve the health of the population. Therefore, in developing countries, rice is considered to be a food fortification that can be enforced at the population level [15]. In recent years, attempts have been made to fortify rice flour with iron, zinc and vitamin M to promote expansion and standing ability in children under 5 years of age, and to rapidly absorb iron and zinc [16]. Since the fine-grained nutrients on the market will be successfully mixed into the flour, making the flour easier. Therefore, rice flour is recommended as a suitable fortification tool. Take long-term measures to combat vitamin A and iron deficiencies, starting with adding vitamin A to cotton oil and adding iron, zinc, folic acid and B vitamins to flour. Multisubstance fortification appears to be relatively more useful and would be considered the result of multiple substance defects in several cases. This idea demonstrates why several fortified food programs focus on multi-micronutrient and vehicle selection of fortified foods sufficient for honest acceptance by the target group. Food fortification can take many forms, using many different techniques [17-20].

Herbs and nutrition

There are many ways to classify herbs based on their classification, active ingredients, usage, and life cycle.

Herbs can be divided into four categories based on their use: medicinal herbs, cooking herbs, aromatic herbs, and decorative herbs.

A. Medicinal Herbs: Medical herbs are herbs that are used to make medicines and have curative or healing properties.

B. Culinary Herbs: Culinary herbs are herbs that have a strong flavor and are used in cooking. Examples include mint, parsley, and basil.

C. Aromatic Herbs: Herbs with pleasing smelling flowers or foliage that are commonly used for some purposes. Perfumes, toilet water, and other aromas can be made with the oils obtained from these herbs. Examples are basil , mint, rosemary etc.

D. Ornamental herbs: Ornamental herbs can be used as decorations due to their colorful flowers and foliage. Examples include chives and lavender.

There are five categories of herbs based on active constituents they contain: Aromatic (volatile oils), Astringents (tannins), Bitter (phenol compounds, saponins, and alkaloids), Mucilaginous (polysaccharides) and Nutritive (food stuffs).

A. Aromatic Herbs: Many aromatic herbal products have pleasant fragrances and are used both for therapeutic purposes and as spices. Aromatic herbs can also be divided into two categories: stimulants and neurostimulants. (1) Stimulants: In the human body, stimulant herbs have a positive effect on the digestive, respiratory and circulatory systems, increasing energy levels and activity levels. Like garlic, fennel, ginger, lemongrass. (2) Nervines: Nerve herbs are commonly used to soothe and treat the nervous system, as well as the digestive, respiratory, and circulatory systems. The herbs are usually brewed into tea or taken in capsules. Like catnip, ginger.

B. Astringent Herbs: In astringent herbs, tannins precipitate proteins, shrinking or conditioning substances, and these properties ultimately help stop excretion. Herbs like these have effects on the digestive system, circulatory system, and urinary system. The liver is severely affected by large doses of spicy herbs. Examples include bayberry, mint, red sage, and red raspberry.

C. Bitter Herbs: Bitter herbs were classified as saponin-containing herbs, laxative herbs and diuretic herbs due to their presence of phenols and phenol glycosides or alkaloids, hence they are called bitter plants. (1) Saponin-containing Herbs: Saponin-containing herbs combine with water to create bubbles or bubbles. They emulsify fat-soluble molecules during digestion, thereby enhancing the body's absorption of other active compounds. These plants have properties such as alteration, anti-angina, anti-spasticity, aphrodisiac, heart excitation and prolonged life. Such as alfalfa, talon, ginseng, schisandra, yam root, yucca, etc. (2) Laxative Herbs: Laxative herbs have properties like anticatarrhal, febrifuge, cholagogue, purgative, hypotonic, ptyalagogue, anthelmintic and also purify the blood. Examples of laxative bitter herbs include aloe, pumpkin, senna, cascara, liquorice, yellow dock, barberry, gentian, safflowers etc. (3) Diuretic Herbs: Diuretic herbs, due to their ability to induce fluid loss through the urinary system, help cleanse the vascular system, kidneys, and liver. Besides being antibiotics, antiseptics, febrifuges, febrifuges, and febrifuges, these herbs are lithotripters and blood purifiers. Examples include sparrowgrass, chickweed, corn silk, dandelion, parsley, grapevine etc.

D. Mucilaginous Herbs: The polysaccharides of the mucous herb give it a sweet, mild taste. Their smooth properties are attributed to their polysaccharides. Mucus herbs reduce transit time in the gut, eliminate toxins, and reduce gut health problems. These plants have antibiotic, antacids, analgesics, antidotes, emollients and vulnerable properties. Some examples include aloe vera, dandelion, fenugreek, kelp, plantain, Irish moss, etc.

E. Nutritive Herbs: These herbs in the diet provide nutrients. The fiber, mucus, and diuretic properties of these foods make them real food. Their healthy nutritional properties include providing adequate amounts of protein, carbohydrates and fats, as well as

vitamin and mineral content. Nutritious herbs include asparagus, banana, barley grass, broccoli, grapefruit, hibiscus, lemon, oat straw, onion, spirulina, etc.

Dairy industry

It has been reported that many herbs have been successfully incorporated into dairy products (e.g. powder form, fresh form, extracts and essential oils). The following is a summary of the herbs and spices used in various dairy products.

Yogurt

The modern equivalent to curd is yogurt. As bacteria ferment milk, lactose becomes lactic acid as a result yogurt is formed.When lactic acid reacts with milk proteins, the The modern curd is yogurt. When bacteria ferment milk, the lactose turns into lactic acid, which forms yogurt. When lactic acid reacts with milk protein, the result is a white and soft substance [20]. The word yogurt is derived from the Turkish yogurt, meaning "dense" or "gooey." Armenian immigrants brought yogurt to the United States, where commercial production began in 1929. According to [21], organic ingredients in yogurt include organic fruit, organic raw sucrose juice, citric acid, vegetable coloring and vegetable flavor. Mango and soybeans are also added to yogurt to increase the content of iron and calcium [22]. This proves that imaginative food technologists can try to fortify yogurt with herbal extracts. Soy products and phytosterols have been proposed as ways to fortify yogurt. Using rats as experimental subjects, lactic acid fermented soy milk was studied to determine if it could reduce cholesterol levels and convert part of the soy milk into soy yogurt [23]. It was found that soybean yogurt could inhibit the accumulation of lipid in the liver of rats. A number of clinical studies have shown that yogurt rich in plant sterols can reduce many common lipid parameters [24]. Using pomegranate juice and pomegranate concentrate (pomegranate juice), [25] a probiotic yogurt was prepared. Studies have found that adding up to 20% pomegranate juice and 6% pomegranate concentrate after heat treatment can maintain probiotic properties without affecting the product's color index or total phenolic compound content (more than 37%) [26]. Flavor the yogurt with burdock. At low concentrations, clove seeds have similar sensory qualities to strawberry and vanilla. In addition, the product is excellent in terms of appearance, texture, consistency, taste and palatability.

Cheese

Cheese is a protein - and fat-rich product made from the milk of cows, buffaloes, goats and sheep. The milk curdled when rennet was added. The solidified parts are collected and pressed into the desired shape [27]. Cheese is a good medium for carrying oil-soluble natural colorants and phytochemicals. Carotenoids and bizine are widely used in this regard [28]. The performance of corn-derived lutein in cheddar cheese was evaluated. Recovered a lot of lutein. Although no disintegration products such as lutein 5, 6 epoxides were detected, the color of the cheese changed, but the pH remained unchanged and no pathogenic bacteria were detected. Therefore, it is suggested that cheese is a good medium for transferring lutein. There is strong evidence that lutein can prevent the occurrence of age-related macular degeneration in humans [29-31]. Attempts were made to develop functional cheese products containing polyphenol compounds [32]. Some phenolic compounds such as catechins, EGCG, tannins, isovanillic acid, hesperidin, flavonoids and grape extracts are added to cheese as functional components. Cheese curds react differently to these ingredients. By adding polyphenols at a concentration of 0.5 mg/mL, dairy products such as milkshakes and yogurts can be fortified using this technique.

Baking industry

In some baked products, many herbs have been successfully used in multiple forms (e.g. powders, fresh herbs, extracts, essential oils, etc.). Listed below are some ways to use herbs and spices in baking.

Biscuits

Cookies are usually made up of wheat flour, starch, sugar, syrup and seasonings. They are usually small, flat and brittle. The biscuit, originally written as bisket, comes from the Old French bescuit and Medieval Latin biscoctum, both meaning "baked twice." Because cookies are often full of sugar and fat, they are often considered unhealthy foods. On the other hand, biscuits can deliver many beneficial nutrients. According to [33, 34], cookies can be fortified in several ways. Consumption of biscuits containing fresh corn husks can improve stool parameters in patients with constipation [35]. Van Stuijvenberg et al. (2001) proposed that red palm oil could be used as A substitute for dietary vitamin A fortification. [36] shows that rice bran oil can be used in place of shortening in recipes for making quality cookies. In the [37] study, biscuits were fortified with chickpea meal, broad bean meal, and soy protein. According to their research, these ingredients can be combined to produce high-protein biscuits. Maltodextrin and glycerin monostearate or guar gum can significantly improve the texture of cookies [38]. According to research conducted in India, 30% soy flour can provide higher nutritional value without damaging the physical properties of cookies [39]. The effects of 0.5% sucralose and different levels of maltodextrin on dough properties and biscuit quality when replacing 30% sugar were investigated. The results showed that sucralose and maltodextrin could replace sugar in biscuits. The konjac plant produces glucomannan, a polysaccharide extracted from its tuber roots. Glucomannan is extracted [40] and added to cookie dough. The researchers concluded that cookies rich in other sticky and starchy foods could replace snacks with a high glycemic index. Using a mixture of navy blue beans, lentils, green lentils, and yellow pea flour, [41] it is possible to produce biscuits with acceptable physical properties and improved nutritional composition [42, 43]. Make fortified cookies with green tea extract. These cookies are fairly stable in the presence of catechins.

Bread

Nowadays, many different kinds of breads are available with different shapes, sizes, textures, crusts, colors, elasticity, eating qualities, and flavors. The Egyptians refined the process and started adding yeast to the flour [44]. Bread dough is a versatile matrix; therefore, attempts have been made to fortify flour with herb powders. It established that enriched bread with phytosterols had beneficial effects on people who had mild hypercholesterolemia [45]. Sitosterol and campesterol levels in the blood rose by 23% and 52%, respectively, following consumption. Low-density lipoprotein cholesterol levels were significantly reduced. Bread containing 50, 100, or 150 mg of green tea extract per 100 grams of flour was tested. Despite 4 days of storage at room temperature, there was no loss of tea catechins in the bread [46]. It found that lemon flavonoids can also be used to fortify bread [47]. Approximately 30% of the flavonoid extract prepared from lemon peel is eriocitrin, an antioxidant of great potency. As a result of hyperargininemic renal failure, [48] tested the protective effect of green tea-fortified bread with 2% and 4% content. It may

be beneficial to eat green tea-fortified bread in order to reduce the effects of urea nitrogen, uric acid, and creatinine on kidney enzymes. Phytochemicals have been used as a means of fortifying bread [49].

The fortification of foods with the following ingredients has been a great success: Amaranth [50]; Sorghum flour [51]; Potato [52]; Chempedak (Artocarpus integer), chickpea flour [53]; Ground onion skin [55, 56].

A randomized clinical trial [57] was conducted to investigate the effect of acute consumption of beetroot bread on vascular endothelium-independent dilation rate. The researchers studied 23 healthy men and fed them 200 grams of bread with 100 grams of beetroot. Their findings suggest that beetroot fortified bread causes microvascular dilation and reduced diastolic blood pressure after acute consumption. Yellow pepper powder is mixed with durum wheat flour to make fortified bread [58-59]. According to the analysis of carotenoid content, blood glucose response and texture characteristics, adding 25% hydrated yellow pepper powder to bread is an effective way to increase the antioxidant content of bread.

Need for biofortification

Technical issues related to fortification have not been fully resolved, particularly in terms of nutrient levels, stability of fortifications, nutrient interactions, physical properties, and consumer acceptability, including taste and cooking characteristics. Depending on the food carrier and/or reinforcer, a limited number of reinforcers can be added. There is no problem adding a mixture of vitamins and minerals to a relatively inert and dry food such as grains, but sometimes the interaction between fortified nutrients can adversely affect the sensory quality of the food or the stability of the added nutrients. The interactions in which nutrients combine in the mixture and are absorbed by the body are still largely unknown. Because of this, estimating the amount of each nutrient added can be complicated.

Reinforcement is more cost-effective than most other strategies, but the costs associated with the process remain significant, which can limit the implementation and effectiveness of reinforcement. For food fortification programs to be successful and sustainable, especially in resource-poor countries, they should be implemented in conjunction with poverty reduction programs, as well as agricultural, healthcare, educational, and social interventions to promote adequate consumption and consumption of quality nutritious foods by nutritionally vulnerable populations.

Conclusion and future perspectives

It does not require changing our existing eating habits - which is notoriously difficult to achieve, especially in the short term - nor does it require individual compliance to implement reinforcement. While fortified foods are formulated with higher levels of specific micronutrients, they are not a substitute for a quality diet designed to provide at least adequate energy supply, protein, essential fats, and other nutrients. Not all members of the target population can consume a particular fortified food. In contrast, food is fortified whether or not the individual benefits from it. Increased micronutrient levels in food are good for everyone. For young people who consume relatively little food, generally fortified staple foods or flavorings may not be sufficient to provide an adequate intake of all micronutrients. When fortified foods are introduced, the poor, who are most vulnerable to micronutrient deficiencies, are often overlooked. As a result, these groups often lack the purchasing power and distribution channels to buy fortified foods. Malnutrition is common among poor groups who rely on local or home-grown food. Complementary foods may be a more appropriate choice: foods that contain fortified supplements. In addition, fortified foods may not provide sufficient amounts of certain micronutrients, such as iron required by pregnant women, in which case supplements may still be necessary to meet the needs of certain populations. Foods such as animal foods, fruits and vegetables are difficult to obtain and difficult to consume in a variety of micronutrient-rich forms. Again, these populations do not have access to the food distribution system and will only buy small amounts of processed food. Like corn, rice production is largely domestic. In populations that rely on these staples, it may be difficult to find appropriate foods to fortify. Some countries can alleviate this problem by adding sugar, sauces, seasonings and other condiments to their staple foods, provided that the target group consumes them in sufficient quantities. The traditional diets of low-income people do not provide adequate nutrition for multiple micronutrients, leading to co-existing deficiencies. Poor people may be able to get all their recommended intakes of micronutrients from fortified foods, but they are unlikely to get these nutrients from fortified foods alone. Therefore, fortified foods should be considered as a complementary strategy to improve micronutrient status. With the current need for global food security and sustainability, there is a lot of room for exploration in this area. This requires research and development in policy implementation to make it universally beneficial to the wider community.

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Ethics approval and consent to participate

The review did not involve any ethic.

Data availability

The authors have nothing to declare as availability of data upon request.

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Author contributions

Eric Johnson, and Armugam Suresh collected, analysed and entered data. Jerrine Joseph conceptualized, supervised the study.

Competing interests

The authors have declared no conflict of interests.

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