

## 6. Food Fortification-Concept and Reason

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**Abstract:**

*Globally, over two billion individuals, including women and children, are not receiving the necessary micronutrients for their survival and overall well-being. The consequences of lacking these essential nutrients can be severe, affecting not only individuals and families but also entire nations. Inadequate diet and restricted access to nutritious foods are primary factors contributing to the deficiency of key micronutrients crucial for human development, such as iron, folic acid, vitamin A, and iodine. While food fortification has been successfully implemented in developed countries since the early 20th century, effectively reducing deficiency-related diseases in high-income nations, its impact in low- and middle-income countries remains limited. This is primarily due to obstacles like a lack of political commitment, resulting in insufficient prioritization by governments, inadequate capacity and resources within the food fortification industry, ineffective regulation and enforcement, and a general lack of awareness among consumers regarding the advantages of consuming fortified foods.*

**Keywords:**

*food, fortification.*

**6.1 Introduction:**

Hunger and malnutrition have detrimental effects on human capital, economic productivity, cognitive abilities, and learning skills, as well as school retention rates, ultimately leading to poverty. These effects, although irreversible, can be prevented. Malnutrition starts during pregnancy, affecting both the mother and the unborn child. Malnutrition encompasses undernutrition, overnutrition, and deficiencies in essential micronutrients.

Hidden Hunger specifically refers to the lack of micronutrients, which are crucial for cognitive and mental development. Pregnant and lactating women, as well as young children, are particularly vulnerable to micronutrient deficiencies. To address this issue, micronutrients can be added to food either before harvest through **bio-fortification** or after harvest through **food fortification**. When it comes to implementing cost-effective policies to combat malnutrition, food fortification programs are generally the most effective choice for policymakers.

In India, where a significant portion of the population suffers from micronutrient deficiencies, food fortification has proven successful. The addition of clinically prescribed amounts of micronutrients to food does not alter its taste, texture, or other characteristics, making it an ideal method for intervention. Commonly fortified staples in India include wheat flour, rice, oil, milk, and salt.



The Food Safety and Standards Authority of India (FSSAI) defines fortification as the act of adding essential vitamins and minerals like iron, iodine, zinc, Vitamins A and D to staple foods such as rice, wheat, oil, milk, and salt. This is done to enhance their nutritional value and promote public health, while ensuring minimal health risks. Food fortification has been practiced in India since the 1950s and continues to be implemented. It involves deliberately increasing the levels of one or more micronutrients in a food or condiment to improve its nutritional quality. In addition to boosting the nutritional content of staple foods, fortification can also help replenish the micronutrients lost during processing.



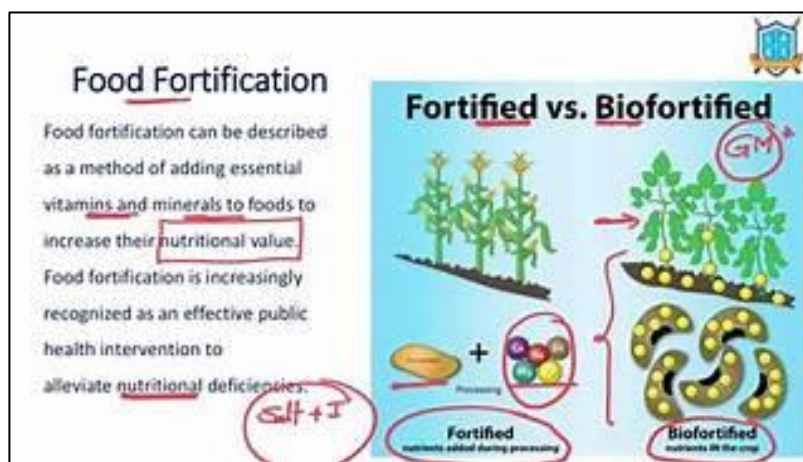
Fortification is an evidence-based intervention that plays a crucial role in preventing, reducing, and controlling micronutrient deficiencies. It can be employed to address demonstrated deficiencies in the general population through mass or large-scale fortification, or in specific groups such as children, pregnant women, and individuals benefiting from social protection programs through targeted fortification. When vitamins and minerals are added to foods just before consumption, either at home, schools, or child-care facilities, it is referred to as point-of-use fortification. Besides addressing micronutrient deficiencies, fortification policies and implementation programs should also take into account alignment with policies aimed at reducing diet-related noncommunicable diseases. An example of this is salt iodization, which is based on sodium consumption and therefore requires strategies to reduce sodium intake.

## **6.2 Basic Principles About Food Fortification:**

Fortification is a crucial component of a holistic strategy to address micronutrient deficiencies, with clearly defined and attainable objectives to monitor progress throughout the program's duration and ensure synergy with other initiatives if necessary. The most commonly consumed foods, such as oils and fats, milk, sugar, salt, rice, wheat, or maize flour, serve as the primary vehicles for fortification. Various factors, including the level of fortification, bioavailability of fortificants, and quantity of fortified food ingested, significantly impact health outcomes. Selecting the appropriate vehicle for fortification necessitates an understanding of consumption patterns (or potential patterns) across different demographic groups, particularly the proportion of fortifiable food consumed within each group.

Food fortification can be classified based on the point at which the fortification takes place:

- a. Commercial and industrial fortification (such as wheat flour, corn meal, and cooking oils)
- b. Biofortification (enhancing the nutritional value of crops through breeding, which may involve traditional selective breeding or genetic modification)



- c. Home fortification (for instance, using vitamin D drops)

**Rational:**

Micronutrients play a crucial role in the development and growth of the human body. Insufficient intake of these micronutrients can lead to improper development and even diseases. Numerous internationally recognized organizations, including the WHO and FAO, have acknowledged that more than 2 billion people worldwide suffer from various micronutrient deficiencies. In 1992, during the FAO/WHO International Conference on Nutrition, 159 countries pledged to make concerted efforts in addressing these deficiencies. The focus was on reducing the number of individuals affected by deficiencies in iodine, vitamin A, and iron. A significant finding that prompted these efforts was the realization that approximately one-third of the global population was at risk of experiencing either an iodine, vitamin A, or iron deficiency. While it is acknowledged that food fortification alone cannot fully address this issue, it is a crucial step towards reducing the prevalence of these deficiencies and the associated health conditions.



The Food and Drug Regulations in Canada have established specific criteria for food fortification. These criteria serve various purposes, such as replacing lost nutrients during the manufacturing process, acting as a public health intervention, ensuring nutritional equivalence between substitute foods, and maintaining the appropriate vitamin and mineral composition for special dietary needs.

Additionally, fortifying foods offers advantages over other methods of addressing nutrient deficiencies, including the ability to treat populations without altering their dietary patterns, providing a continuous supply of nutrients, eliminating the need for individual compliance, and potentially improving nutrient storage efficiency when consumed regularly.

### **There Are Several Reasons Why Foods Are Fortified:**

One of the main reasons is to ensure that individuals can easily obtain the necessary nutrients in their diet. These nutrients can be found in other foods such as meat and vegetables. However, factors such as cost, allergies, dietary preferences, and environmental conditions can make it challenging to consume enough of these foods.

In the United States, food producers have been fortifying foods since the 1920s as a preventive measure against nutrition-related illnesses. For instance, vitamin D is added to cow's milk to enhance the absorption of calcium in the milk. This fortification helps to address potential deficiencies and promote overall health.

### Common Fortified Foods:

Most fortified foods are processed and packaged. Common ones include:

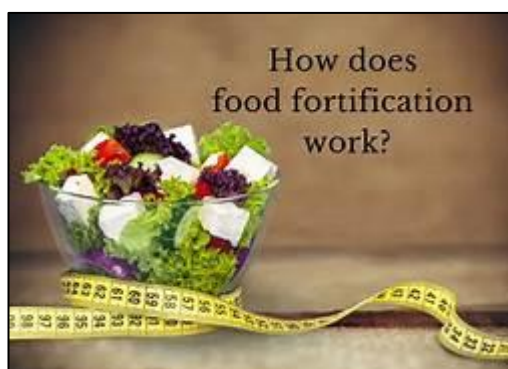
- Breakfast cereals
- Bread
- Eggs
- Fruit juice
- Soy milk and other milk alternatives
- Milk
- Yogurt
- Salt



Nutrients added to fortified foods include:

- Folic acid
- Vitamin A
- Vitamin B6
- Vitamin B12
- Calcium
- Vitamin D
- Vitamin E
- Iron
- Iodine

### **6.3 Fortified Foods Offer Several Advantages:**



- a. **They are economically advantageous.** Certain nutrient-rich foods can be quite pricey. Take fish, for instance, which is an excellent source of omega-3 fatty acids but may be too expensive for some individuals to afford on a regular basis. On the other hand, eggs, milk, and other products can be fortified with omega-3 fatty acids. These fortified alternatives often come at a lower cost while still providing comparable nutritional benefits.
- b. **Proper nutrition is essential to prevent illnesses related to nutrient deficiencies.** Fortified foods play a crucial role in decreasing the occurrence of diseases such as rickets caused by lack of nutrients. However, despite these advancements, many individuals still experience nutrient inadequacies, consuming just enough to avoid severe deficiencies but not meeting the recommended intake levels. This can lead to health issues like iron deficiency anaemia, type 2 diabetes, osteoporosis, and fatigue.
- c. **Fortified foods play a crucial role in various stages of life.** Pregnant women require additional nutrients to support the growth of their baby, and fortified products can help bridge the gap in their diet.
- d. **For older adults,** fortified foods aid in maintaining optimal vitamin and mineral levels, promoting bone health, aiding digestion, and reducing the risk of heart problems. Children, who are more susceptible to nutritional deficiencies, benefit from fortified foods to support their growth and development.
- e. Additionally, **individuals with dietary restrictions,** such as vegetarians or those with lactose intolerance, can rely on fortified foods to ensure they receive essential nutrients that may be lacking in their diet.

## **6.4 Limits of Fortified Foods:**

Fortified foods have their limitations in terms of improving and safeguarding your health.

- a. **Incorporated into unhealthy foods.** It is important to note that the mere fortification of a food product does not automatically make it healthy. Fortified foods often contain excessive amounts of sugars, fats, sodium, and other ingredients that can contribute to health issues such as obesity.
- b. **Risk of excessive vitamin intake.** There is a possibility of consuming an excessive number of vitamins and minerals through your diet, which can have detrimental effects on your health. This risk is higher when taking supplements in the form of pills rather than consuming fortified foods.
- c. **Importance of checking product labels.** It is advisable to avoid consuming foods that contain more than 200 times the daily recommended amount of any particular nutrient. While fortified foods can play a role in promoting good health, they should be considered as just one component of an overall healthy lifestyle. It is recommended to obtain nutrients from unprocessed foods like fruits and vegetables whenever possible.

## **What Are the Reasons for Food Fortification?**



- a. The lack of synchronization between the decisions made by the central government and the actions taken at the state level contributes to the challenges faced in ensuring compliance. Additionally, there is a lack of coordination among the different departments involved in the food fortification process.



- b. The food fortification process requires expensive machinery, which poses a significant financial burden. This cost makes it difficult for small millers to access these machines, with prices ranging from 5 to 15 lacs for rice fortification and 1.3 lakhs for wheat fortification.
- c. The oil and salt industries have been well-established since the 1950s, leading to consolidation. However, the industries involved in fortifying rice, milk, and wheat flour are predominantly small-scale and informal producers. This presents challenges in increasing fortification due to the high cost and the difficulty in capacity building for these producers.
- d. Despite government efforts, there is a lack of awareness among the general population regarding the benefits of consuming fortified food items. Furthermore, misinformation about the use of fortified products also contributes to the existing challenges.
- e. Occasionally, fortified products may alter the visual appeal of food, such as when double fortified soil salt leads to discoloration, resulting in decreased demand for such items. What factors contribute to this phenomenon?
- f. The disconnect between decisions made by the central government and the actions taken at the state level creates a situation where the latter lacks sufficient authority to enforce compliance. Additionally, a lack of coordination among the various departments involved in food fortification exacerbates the issue.
- g. The food fortification process requires machinery with a high capital cost, rendering these machines inaccessible to small millers. The price of such machinery can range from 5 to 15 lakhs for rice fortification and 1.3 lakhs for wheat fortification.
- h. The oil and salt industries have been well-established since the 1950s, enjoying a high level of consolidation. Conversely, the industries involved in fortifying rice, milk, and wheat flour operate on a much smaller scale, primarily consisting of informal producers. This poses challenges in scaling up fortification efforts due to the associated costs and the limited capacity building of these informal producers.
- i. Despite government initiatives, there remains a lack of awareness among the general population regarding the benefits of consuming fortified items. Moreover, misinformation surrounding the use of fortified products further complicates efforts to promote their consumption.

- j. At times, fortified products can impact the visual appeal of food, such as when double fortified soil salt causes discoloration, leading to a decrease in demand for such items.

### **6.5 Advantages of Food Fortification:**

- a. **Enhanced Nutritional Value:** The biofortified crops exhibit significantly higher levels of protein, vitamins, minerals, and amino acids compared to traditional varieties, with a range of 1.5 to 3 times more.
- b. **Safe Fortification Method:** It is important to note that these varieties are not genetically modified. They have been developed using conventional crop breeding techniques by scientists.
- c. **Minimal Health Risks:** The addition of micronutrients to food does not pose any health risks to individuals. The quantity added is carefully regulated according to prescribed standards, ensuring that the likelihood of nutrient overdose is highly unlikely.
- d. **Improved Nutritional Security:** By adding nutrients to staple foods that are widely consumed, food fortification becomes an excellent method to enhance the health of a large portion of the population simultaneously.
- e. **No Need for Behaviour Change:** Food fortification does not require individuals to make any changes in their food habits or patterns. It is a socially and culturally acceptable approach to delivering essential nutrients to people.
- f. **Preserves Food Characteristics:** Importantly, food fortification does not alter the taste, texture, or appearance of the food being fortified.
- g. **Rapid Results:** This method can be implemented swiftly and demonstrates noticeable improvements in health within a relatively short period of time.
- h. **Cost-Effective:** Food fortification proves to be a cost-effective approach, especially when existing technology and delivery platforms are utilized.
- i. **Economic Benefits:** According to the Copenhagen Consensus, every 1 Rupee spent on fortification yields 9 Rupees in economic benefits.
- j. **Low Overall Costs:** While an initial investment is required to acquire the necessary equipment and vitamin and mineral premix, the overall costs of fortification remain remarkably low. Even when program costs are passed on to consumers, the resulting price increase is only around 1-2%, which is less than the normal price variation. Thus, the benefit-to-cost ratio of food fortification is high.

## **6.6 Indian Scenario:**

The current situation in India reveals that 15.3% of the population is undernourished, with the highest percentage of "stunted" (30%) and "wasted" (17.3%) children under five years old, according to the recent FAO report, 'The State of Food Security and Nutrition in the World, 2021'. These statistics highlight a critical phase in India's nutritional security, making it unlikely to achieve the UN's Sustainable Development Goal of eradicating all forms of malnutrition by 2030 under the current circumstances. Factors contributing to this nutritional insecurity include not only access to nutritious food but also issues such as inadequate access to safe drinking water and sanitation, low levels of immunization and education, particularly among women.

The Indian Council of Agricultural Research (ICAR) has reported the development of 21 biofortified staple varieties by 2019-20, including wheat, rice, maize, millets, mustard, and groundnut. Additionally, a team at the National Agri-Food Biotechnology Institute in Mohali has created biofortified coloured wheat (black, blue, purple) rich in zinc and anthocyanins. Farmers from Punjab and Haryana have been enlisted to increase the production of this wheat variety, signalling a shift from food security to nutritional security.

## **6.7 Negative Effects of Food Fortification:**

- a. **Not a Replacement for Proper Nutrition:** Despite containing higher levels of specific micronutrients, fortified foods cannot replace a well-balanced diet that provides sufficient energy, protein, essential fats, and other essential nutrients for overall health.
- b. **Neglects the Poorest Population Segment:** The poorest members of society often lack access to fortified foods in the market due to limited purchasing power and an inadequate distribution system.
- c. **Insufficient Evidence:** - The evidence supporting fortification is inconclusive and insufficient to justify widespread national policies. Many studies supporting fortification are funded by food companies with vested interests, leading to potential conflicts of interest.
- d. **Potential Harmful Effects:** Simply adding synthetic vitamins and minerals may not address the root issue and could lead to adverse effects, especially in undernourished

populations. For example, a study found that iron fortification caused gut inflammation and altered gut microbiota in undernourished children.

- e. **Diminishes the Value of Natural Foods:** Promoting iron-fortified rice as a solution for anemia may overshadow the importance and variety of naturally iron-rich foods like millets, leafy greens, meats, and liver, ultimately reducing dietary diversity.

### **6.8 Path Ahead:**

The education level of mothers directly impacts the health of children. Children whose mothers lack education tend to have less diverse diets, leading to issues like stunting, wasting, and anaemia. Therefore, efforts should focus on enhancing girls' education and reducing school dropout rates, especially at the secondary and higher levels. This will help improve overall nutrition and well-being. The Global Nutrition Report suggests that investing in nutrition programs can yield significant returns, with every dollar invested offering benefits worth 16 dollars. Increasing Investment in Agri-R&D: Scaling up innovations in biofortified food to combat malnutrition requires increased investment in agricultural research and development. Farmers should be incentivized to connect their products to profitable markets through sustainable value chains and distribution channels.

Private Sector Involvement: The government can collaborate with the private sector to create a market for high-quality biofortified foods targeting premium consumers. For example, trusts supported by the TATA group are assisting states in fortifying milk with essential vitamins. Encouraging other private dairies to expand milk fortification nationwide is crucial.



**National-Level Initiatives:** A nationwide campaign similar to the “Salt Iodisation Programme” can raise awareness and drive action at individual and community levels to achieve the nutrition goals for all. Branding, awareness campaigns, and social initiatives like community counselling and media engagement can promote the consumption of nutrient-rich, locally available foods among vulnerable populations. Adopting a **Comprehensive Approach:** It is essential to acknowledge that a multi-pronged strategy is necessary for long-term success in addressing nutrition challenges in India.

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