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An Overview about Food Fortification

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Food fortification is a proven, effective strategy to enhance the nutritional quality of foods and reduce micronutrient deficiencies, particularly in vulnerable populations worldwide. By adding essential vitamins and minerals to staple foods, fortification addresses specific dietary gaps without requiring significant changes to food habits or systems. This approach is cost-effective, scalable, and adaptable, making it a critical public health intervention in regions with limited access to diverse, nutrient-dense foods. Maternal and child undernutrition, exacerbated by deficiencies in nutrients like vitamin A, iron, and iodine, contributes to nearly 45% of deaths in children under five and accounts for 7.3% of the global disease burden. Food fortification, along with disease control measures, nutrition education, and micronutrient supplementation, is among the four strategies recommended by WHO and FAO to combat malnutrition. Although there are ongoing discussions on the effectiveness and safety of various fortification approaches, evidence shows its substantial social, economic, and health benefits. As fortification techniques continue to improve and global collaborations grow, food fortification will remain integral in addressing hidden hunger and advancing global health goals.

Introduction

Maternal and child undernutrition causes nearly 45 % of all deaths in children under five in under developed and developing countries and it will diminishing the physical, mental and cognitive capacity of millions of people. Now a days under and over nutrition associated with micronutrient deficiencies such as vitamin A, Vitamin D, Iodine, Iron etc. It accounts nearly 7.3 % of the global burden of diseases. Micro nutrient deficiency is due to lack of balanced diet, inadequate intake of nutrient dense foods, lack of variety of food groups in the diet, infections, gastro intestinal disorders, blood loss during menstruation (Reproductive age women group). WHO and FAO adopted four most important strategies for improving the dietary intake and reducing the malnutrition and micro nutrient deficiency among the world population: Food fortification , disease control measures, nutrition education and micronutrient supplementation. Malnutrition has become one of the major health problems facing by the developing countries which contribute to infant mortality, poor physical and intellectual development of children which lowers the resistance to diseases. Throughout the developing world, malnutrition affects about 800 million people which approximately accounts for 20 percent of the world population. Food fortification has been proven to have positive effects on social, economic, and health outcomes. Despite ongoing discussions about the effectiveness and safety of food fortification on a global and national level (large-scale food fortification, biofortification, and point-of-use or home fortification), the practice has significant advantages that range from lowering the prevalence of nutritional deficiencies to providing economic advantages to societies and economies.

Food Fortification

According to World Health Organization food fortification defined as the practice of deliberately increasing the content of an essential micronutrient (vitamins and minerals) in food in order to improve the nutritional quality of the food supply and to provide a public health benefit with minimal risk to individuals' health.

Adding iron and iodine nutrient in the edible salt is an example of food fortification. Similar to this, essential foods like rice, wheat flour, oil, and milk can be supplemented with additional micronutrients. To appeal to a bigger population, staple commodities were chosen. Food fortification is a promising strategy to reduce hidden hunger that has been proven effective historically. It is time for us to scale up it so that no Indian suffers as a result of this hidden hunger." Fortification is the process of enhancing the nutritional value of common foods like rice, wheat, oil, milk, and salt by adding essential vitamins and minerals including iron, iodine, zinc, and vitamins A and D. The food may or may not have included these nutrients at first before processing, or they may have been lost during that procedure. Kruger *et al*., (2020). Micronutrient malnutrition or deficiency, which is a significant health risk, must be addressed through fortification. It is essential to have access to healthy food, and sometimes this is hampered by a lack of a balanced diet, a monotonous diet, or an inadequate food availability. Syeda *et al*.,(2017)

The criteria for effective food fortification are:

i) The intake of the nutrient is below the desirable level in the diets of a significant number of people.
ii) The food used to supply the nutrient is likely to be consumed in quantities that will make a significant contribution to the diet of the population in need.
iii) The addition of the nutrient is not likely to create an imbalance of essential nutrients
iv) The nutrient is stable under proper conditions of storage and use.
v) The nutrient is physiologically available from the food.
vi) There is reasonable assurance against excessive intake to a level of toxicity. Venkateshe *et al*., (2023)

Other Criteria For Fortification

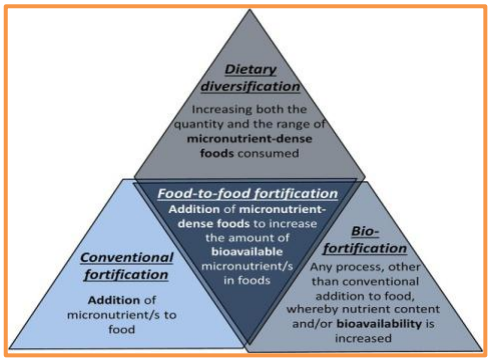
- The food to be fortified should be a palatable/edible thing that is consumed by most of the population.
- There should be no adjustment in the physical properties of the food (consumer acceptability)
- The food should be a low-cost food product that can be purchased by people from every section of the society. Prema and Ramachandran. (2018)

Biofortification

The WHO defines biofortification as "the practice of deliberately increasing the content of an essential micronutrient, that is, vitamins and minerals (including trace elements) in a food crop through agronomic practices, conventional plant breeding, or modern biotechnology, so as to improve the nutritional quality of the food supply and provide a public health benefit with minimal risk to health" Hritik *et al*., (2024).

Conventional fortification

Define fortification/enrichment as "the addition of one or more essential nutrients to a food whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups." conventional fortification increase the micronutrient contents of formulated foods through the addition of micronutrients. Das *et al*., (2013)



Dietary diversification

Dietary diversification as increasing both the quantity and the range of micronutrient-rich foods consumed through diet selection and through traditional food preservation and processing methods improve the content and bioavailability of specific nutrient/s by using the technique of improving the food recipe/formulation, rather than to generally increase the diversity of food groups included in the diet. Bechoff *et al.*, (2023)

Food Fortification Resource Centre (FFRC)

The Food Fortification Resource Center was established as a resource centre to serve as a platform for all major players in the food, nutrition, and health sectors to collaborate on efforts to reduce hidden hunger. These actors include government divisions, development organisations, academic institutions, the food sector, consumer advocacy groups, and ordinary people. This centre offers technical assistance for advocacy at the federal and state levels, as well as training and capacity building for food safety officers, lab workers, the food business, and quality assurance and control of fortified foods. It also supports the sector's regulatory needs. It provides information through a variety of resources, including technical manuals and educational materials, for all stakeholders, including information on equipment and premix manufacturers, testing procedures for fortificants, and the health advantages of fortified foods. Thakur *et al.*, (2023)

Advantages of food fortification

- It can be introduced quickly and can produce nutritional benefits for populations in a short period of time.
- Fortification supplies micronutrients in amounts that are appropriate. Hence, safer than supplements. When properly regulated, fortification carries a minimal risk of chronic toxicity.
- Fortification of widely distributed and widely consumed foods has potential to improve the nutritional status of a large population, covering both poor and wealthy.
- Fortification does not require changes in existing food patterns, nor individual compliance – which are very difficult to achieve.
- It is feasible to fortify foods with several micronutrients simultaneously, to treat multiple micronutrient deficiencies that often coexist in a population that has a poor diet.
- Fortification is often more cost-effective than other strategies, especially in case the technology already exists and an appropriate food distribution system is already in place (like in India).

- Fortification helps to minimize or decrease the potential occurrence of micro-nutrient deficiency.
- Fortification helps to improve dietary intake and nutritional status of an individual.
- Fortification is one of the most cost-effective procedures that can be executed on a bigger scale.
- Fortified foods are better at bringing down the danger of different insufficiency that can result from shortfalls in the nutrition supply or a low-quality eating routine.
- It doesn't require an adjustment in the individual and utilization design.
- The amount of micro-nutrients added to the food is little and all-around managed. Thus, the probability of an overdose is far-fetched.
- Fortification is planned in such a way that the intrinsic characteristics of the food such as the taste, the appearance and the texture are not altered. Neufeld and Friesen (2018).

Limitation of Fortification

- A specific fortified foodstuff might not be consumed by all members of a target population. While, everyone in the population is exposed to the increased levels of micronutrients in food, whether they need it or not.
- Infants and young children, who consume relatively small amounts of food, are less likely to fulfil their recommended micronutrients from universally fortified staples alone.
- Fortified foods often fail to reach the poorest segments of the general population due to their low purchasing power and an underdeveloped distribution channel. Availability, access and consumption of adequate quantities and a variety of micro nutrient-rich foods, such as animal foods and fruits and vegetables, is limited.
- Very low-income population groups are known to have coexisting multiple micronutrient deficiencies. Although multiple micronutrient fortification is technically possible, the poor will be unable to obtain recommended intakes of all micronutrients from fortified foods alone.
- Nature of the food vehicle or the fortificant, sometimes limit the amount of fortificantion. For example, some iron fortificants change the colour and flavour of many foods, and can cause the *destruction of fortificant vitamin A and iodine*.
- Although more cost-effective than other strategies, there are nevertheless significant costs associated with the food fortification process, which might limit the implementation and effectiveness of food fortification programmes in developing country like India.
- Food fortification may overshadow the importance of dietary diversity if it is considered as a long-term solution to micro-nutrient deficiency.
- Food fortification involves extensive expenses in the process. These may extend from beginning up expenses and the expenses of leading preliminaries for micro-nutrient levels, physical characteristics, and taste, to a practical investigation of the acquiring intensity of the plausible recipients.

Food fortification in India

Food Safety and Standards Authority of India (FSSAI) has formulated a comprehensive regulation on fortification of foods namely 'Food Safety and Standards (Fortification of Foods) Regulations, 2016'. These regulations set the standards for food fortification and encourage the production, manufacture, distribution, sale and consumption of fortified foods. The regulations also provide for specific role of FSSAI in promotion for food fortification and to make fortification mandatory. This sets the premise for the national summit on fortification of food.

FORTIFIED
SAMPOORNA POSHAN
SWASTH JEEVAN

Food Fortification Logo by FSSAI

Conclusion

In summary, food fortification remains one of the most effective strategies for enhancing the nutritional quality of foods and combating micronutrient deficiencies, particularly in vulnerable populations. By adding essential vitamins and minerals to staple foods, fortification can address specific dietary gaps without requiring major changes to eating habits or food systems. Moreover, it is cost-effective, scalable, and adaptable, making it a crucial intervention in public health, especially in regions with limited access to diverse, nutrient-rich foods. As scientific advances continue to refine fortification techniques and as global partnerships strengthen their implementation, food fortification stands to play an essential role in the fight against malnutrition, contributing significantly to the goal of improved global health and well-being.

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