**ANSWERS**

**TYPES OF FOOD FORTIFICATION**

Food fortification is the addition of one or more essential nutrients to a foodstuff, food, food product, ingredient, or condiment to prevent [micronutrient deficiencies](https://www.spring-nutrition.org/publications/series/understanding-anemia/causes-anemia/micronutrient-deficiencies) of one or more nutrients at the population level. It can be carried out by food manufacturers, or by governments as a [public health](https://en.wikipedia.org/wiki/Public_health) policy which aims to reduce the number of people with dietary deficiencies within a population. The predominant diet within a region can lack particular nutrients due to the local soil or from inherent deficiencies within the staple foods; addition of micronutrients to staples and condiments can prevent large-scale [deficiency diseases](https://en.wikipedia.org/wiki/Deficiency_disease) in these cases.

There are majorly 3 types of food fortification which are:

1. **Industrial food fortification** refers to adding micronutrients and minerals to industrially processed and widely consumed edible products. Common fortified foods, for example, include salt; wheat and maize flours; edible oils; and sugar, but can also include bouillon cubes or soy sauce. Foods fortified with iron will likely have the highest impact on anemia, although foods fortified with other nutrients, such as vitamin A and folic acid, may also be important. One advantage of industrial food fortification is that it requires limited changes in consumer behavior compared to other micronutrient interventions. One should consider the quality and coverage of industrial food fortification in the population, and whether it is reaching those who need it the most. Some other advantages include: it can be made available at a low cost, restores the micronutrients lost during processing; it does not interfere with the natural state of plant and animal species; large populations have the ability to the purchase commercial foods. The disadvantages include: young children may not consume sufficient quantities of industrially fortified foods to meet their micronutrient needs and, thus, additional micronutrient interventions may be needed for this population. In addition, industrial food fortification may not reach populations who do not have access to markets; therefore, one should consider the reach of products to communities in rural or hard-to-reach areas. Also, it may be viewed as unethical to place substances in people’s food without their consent; producers may increase the price and producers of the commercial goods must agree to the terms of fortification.
2. **Biofortification** can be defined as a process to increase the bioavailability and the concentration of nutrients in crops through agronomic practices, conventional plant breeding or modern biotechnology. It may therefore present a way to reach populations where supplementation and conventional fortification activities may be difficult to implement and/or limited. Biofortification differs from [ordinary fortification](https://en.wikipedia.org/wiki/Nutrification) because it focuses on making plant foods more nutritious as the plants are growing, rather than having nutrients added to the foods when they are being processed. Some examples of biofortification are iron-biofortification of rice, beans, sweet potato; zinc-biofortification of wheat, rice, beans; provitamin A carotenoid biofortification of sweet potato, maize, cassava, etc. The advantages include: once introduced, it is highly sustainable and require minimal intervention; it is cost effective; trace mineral can help plants resist disease and environmental stressors; a large population is benefited; increment of nutritional quality in daily diets; it is complimentary to standard interventions (supplementation & fortification). The disadvantages include: many believe that nature shouldn’t be altered; regulation and quality control is strictly needed; farmers and consumers may not accept sensory changes of biofortified crops; lack of awareness regarding the long-term health benefits of these nutrient supplements
3. **Home (point-of-use) fortification** is an innovation aimed at improving diet quality of nutritionally vulnerable groups, such as young children. Vitamin and mineral deficiencies affect more than two million people worldwide. Young children are highly vulnerable because their high nutrient requirements need to be achieved through diet, which is sometimes inadequate in quantity and quality of nutrients, especially in developing countries. Exclusive breastfeeding until six months of age and continued breastfeeding for at least two years are recommended to maintain children's adequate health and nutrition. After six months of age, infants start receiving semi‐solid foods but the amount of vitamins and minerals can be insufficient to fulfil all the requirements of the growing baby. The term Micronutrient Powders (MNP) refers to sachets containing dry powder with micronutrients that can be added to any semi-solid or solid food at home or at any other point of use to increase the content of essential nutrients in the infant's diet during this period. Home fortification with MNP aims to ensure that the diet, i.e. complementary foods and breast milk combined, meets the nutrient needs of young children. Some of its advantages include: it can be distributed as widely and cheaply; it does not disturb the natural state of plant and animal or animal species; it is not forced on any person, it is their choice to utilize the additives; it encourages self-reliance. Some of the disadvantages include; it is not a sustained approach as the supply of additives must be replenished by a producer outside; no changes made in the normal food intake; people may feel uncomfortable adding a substance to their food without knowing what it is; there is no guarantee the targeted population will participate; it requires education program.

**ADVANTAGES AND DISADVANTAGES OF FOOD FORTIFICATION**

Being a food based approach food fortification has several advantages over other interventions as:

* It does not necessitate a change in dietary patterns of the population.
* It can deliver a significant proportion of the recommended dietary allowances for a number of micronutrients on a continuous basis and does not call for individual compliance.
* It could often be dovetailed into the existing food production and distribution system, and therefore, can be sustained over a long period of time.
* If consumed on a regular and frequent basis, fortified foods will maintain body stores of nutrients more efficiently and more effectively than will intermittent supplements.
* Fortified foods are also better at lowering the risk of the multiple deficiencies, an important advantage to growing children who need a sustained supply of micronutrients for growth and development, and to women of fertile age who need to enter periods of pregnancy and lactation with adequate nutrient stores.
* Fortification is one of the most cost effective strategies that can be implemented on a larger scale since the cost of fortification is generally less than other techniques to address nutrition deficiencies.

The disadvantages of food fortification are:

* Food fortification alone cannot correct micronutrient deficiencies when large numbers of the targeted population, either because of poverty or locality, have little or no access to the fortified food, when the level of micronutrient deficiency is too severe, or when the concurrent presence of infections increases the metabolic demand for micronutrients.
* In addition, various safety, technological and cost considerations can also place constraints on food fortification interventions. Thus proper food fortification program planning not only requires assessment of its potential impact on the nutritional status of the population but also of its feasibility in a given context.
* Further, it needs to be controlled by appropriate legislation.
* Fortification of nutrients in foods may deliver excessive amounts of nutrients to some individuals, with consequent side effects. One example is [fluoride](https://en.wikipedia.org/wiki/Fluoride), which can cause irreversible staining to the teeth. Another example is iron, as fortification intended to benefit women may result in too much iron consumption by men.
* More knowledge is required about the impact of interactions among nutrients. For example, the presence of large amounts of calcium can inhibit the absorption of iron from a fortified food; the presence of vitamin C has the opposite effect and increases iron absorption.