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Fortified foods to fight malnutrition?

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Fighting malnutrition requires diet diversification. This is also a good way to support crop diversity. Yet technical solutions, such as food supplements or (bio)fortification, are still considered more innovative, and these dominate policies tackling the challenges of malnutrition.

The issue of micronutrient deficiencies, particularly in vitamins or minerals such as iron or zinc, was placed on the international agenda in 1992 at the first *International Conference on Nutrition* organized by the FAO and the World Health Organization (WHO). Numerous nutrition studies have shown the effects of these deficiencies ('hidden hunger' or 'silent hunger') on children's growth and health (Golden, 2009). Worldwide, the most common are iron, vitamin A, iodine and zinc deficiencies. According to Allen and colleagues (2006), over two billion people suffer from iron-deficiency anaemia, and one in two pregnant women and about 40 per cent of preschool children in developing countries are anaemic. The authors further estimate that just under two billion people have inadequate iodine intake and that 254 million preschool children are vitamin A deficient (Allen et al., 2006). The FAO and the WHO (1992) identified four main types of strategies to combat micronutrient deficiencies:

- Dietary diversification, through the diversification of crops grown by households for self-consumption or through market mechanisms and the preparation of a broader range of dishes;
- Food fortification, with micronutrients added during processing in the form of additives, an approach promoted by agri-food companies; or, in recent years, biofortification through conventional variety selection or the creation of micronutrient-rich genetically modified organisms – an approach promoted by the seed industries – or through the application of chemical fertilizers, promoted by the fertilizer industries;

– Supplementation, in other words the use of micronutrient-rich medicinal products;
– Infectious or parasitic disease control (vaccination, screening, hygiene, sanitation etc.), contributing to adequate metabolic functioning and nutrient absorption and ensuring good health.

While supplementation and disease control are strategies driven by the healthcare system, diversification and fortification arise directly from the food system. This chapter discusses these two strategies.

Promoting a diversified diet

Dietary diversification has been recognized as an effective strategy for combating malnutrition in both the Global North and the Global South for several decades. A diversified diet particularly helps prevent micronutrient deficiencies and chronic diseases (Hoddinott and Yohannes, 2002; Arimond and Ruel, 2004): the more diverse an individual's diet, the less likely they are to develop a micronutrient deficiency. As the different food groups have complementary nutritional profiles, a diversified diet is the best guarantee of adequate nutrient intake, the required amounts of which are either known or to be determined in the coming years. For instance, eating red meat at a reasonable frequency and in reasonable amounts helps prevent iron, zinc and vitamins A and B deficiencies, while fruit and vegetables provide essential elements such as vitamin C and antioxidants. Dietary diversity scores have therefore been developed and tested to serve as nutritional quality indicators to detect risks of developing nutritional deficiencies (Drescher et al., 2007; Kennedy et al., 2013; FAO, 2021).

Many industrialized countries have strong public policies in place to promote dietary diversity, such as the National Nutrition and Health Programme in France. These policies recommend eating foods from all food groups in moderation and sometimes specify ideal frequencies and portion sizes to better guide consumers. A diversified diet can potentially be achieved across all continents by working with the local products, the preferences of the populations, their identity and their culture. The food diversity strategy does not provide a 'magic bullet'; on the contrary, by encouraging the consumption of foods from all food groups, it tends to support a wide variety of agricultural and food activities and production.

Promoting dietary diversity to combat micronutrient deficiencies thus appears to be compatible with an ecological approach (in the sense of an 'ecology

of food') insofar as it encourages biological diversity on the plate, on farms and in territories. It also seems to contribute to strengthening the ecosystem services of food systems and to provide a way to limit populations' dependence on solutions provided by actors that they cannot control.

The success of technical solutions

In countries of the Global South, public authorities nevertheless tend to prefer technical solutions such as supplementation, fortification and biofortification to address the challenges of micronutrient malnutrition. These solutions are heavily promoted by certain private companies and major funders in the field of nutrition, such as GAIN Foundation and the Bill & Melinda Gates Foundation. Perhaps the old adage 'Vary your diet' is not innovative or compelling enough?

Fortification and biofortification raise a number of economic, scientific and political issues. First, these 'targeted' interventions are developed by private actors (in the agri-food, chemical and seed industries) who have a financial interest in promoting their use to combat micronutrient malnutrition. Numerous studies – particularly financed by these companies, which use their results – support the effectiveness of these solutions.

Second, in the scientific world, publication and funding strategies encourage researchers to focus their efforts on technical solutions. Eating a diversified diet is not seen as a 'modern' and innovative strategy. Moreover, while much research has demonstrated the value of dietary diversity in preventing deficiencies, it is often based on statistical correlation studies rather than controlled clinical trials, which are very popular at present. This difference in methodology has led to the gradual marginalization of dietary diversity in the debate on public policies. The scientific evidence supporting technical solutions (fortified foods, biofortified varieties, supplements) tends to saturate the scientific literature and create a smokescreen that overshadows dietary diversity as an effective solution (Delisle, 2004). It is also important to note that studies on dietary diversification receive less backing from the economic actors in the food system, as they tend to emphasize a cross-cutting and comprehensive approach to the ideal diet rather than support for a few supply chains.

Finally, politicians – especially in the Global South – prefer short-term solutions, as these can yield quick results to enhance indicators that are more compatible with their electoral mandate, as well as donors' and international organizations' progress requirements. Technological solutions are especially well perceived, as

many actors – whether in the scientific world or among consumers, supply chain operators or decision-makers – associate them with modernity and innovation. Moreover, agricultural policies are generally approached from a sectoral perspective, by supply chain, and are therefore more difficult to tailor to the promotion of a diversified diet.

Taking into account the multidimensionality of food

Evaluating strategies to combat micronutrient deficiencies solely through the prism of nutritional efficiency isolates the issue of nutrition from the other dimensions of food. Yet nutritional deficiencies cannot be tackled independently of everything that food represents for eaters, nor can they be treated as a priority, treating the psychological, social, cultural, economic and political dimensions of food as secondary. At best, nutritional interventions integrate these other dimensions by considering that they can facilitate or hinder the achievement of the overarching health objective.

The first issue to consider in the fight against malnutrition is thus the multidimensional nature of food. Food cannot be reduced to bundles of nutrients: it incorporates the environmental, economic and social conditions of its production, as well as symbolic, cultural and even religious values, which cannot be overlooked. Emphasizing the nutritional dimension of foods by labelling them as fortified can have the perverse effect of discrediting traditional foods that do not have such labelling. It may even lead consumers, especially mothers with very low purchasing power, to feel guilty about not being able to buy such foods, which are promoted as good for their children's health (Kimura, 2013). Aggressively advertising these fortified products can therefore contribute to devaluing traditional food. Beyond the issue of combating micronutrient deficiencies, the nutrition labelling of fortified foods therefore raises questions regarding their guilt-inducing effects. While this system indeed informs consumers and can help them make better-informed choices from a nutritional perspective, it emphasizes the weight of the nutritional dimension of food at the expense of its other dimensions.

How nutritionally beneficial is (bio)fortification?

Another issue surrounding the mode of intervention for combating micronutrient malnutrition is the scale of the intervention. While dietary diversity is guided by

the principle that the nutrients provided by one's diet combine over time (Mason and Lang, 2017), fortification uses a food vehicle to target one or more specific nutritional needs. The identification of nutritional or pharmaceutical properties specific to certain foods and their prescription for health reasons is not new. These practices exist in all societies and involve both wild and farmed plants and animals. These natural medicinal foods are known, and their properties are identified through knowledge accumulated via traditional practices in particular ecological, health and cultural contexts. This empirical knowledge has been little studied or evaluated and has not informed the development of fortified foods: the latter are the product of a representation of nutrition that reduces it to the satisfaction of independent nutrient needs.

While such a strategy may have some effectiveness, it has several limitations. First, it overlooks the effects of interactions between nutrients within food matrices (Chapter 9). A well-known example is the interaction between iron intake and that of vitamin C or tannin-rich products. While the former facilitates iron uptake, the latter reduces it. Moreover, depending on the way in which fortified products are made and commercialized, there may be a long distance and time lag between their production and their consumption by the target groups. Many products are manufactured in Europe, stored in exporters' storage facilities, shipped to target countries by boat in containers, stored again in ports and only then distributed in the target territories and sold by local retailers. Several studies have shown that the sensitive fraction of fortified foods (polyunsaturated fatty acids, vitamins) may degrade during shipping in these long supply chains (Hemery et al., 2015; Moustiès et al., 2019). The nutritional claims made are therefore not always verified.

Furthermore, promoting a fortified food without taking into account the diet of the target population overlooks the possibility of meeting micronutrient needs through the more or less frequent consumption of foods already found in local dishes. For example, researchers have shown that the vitamin A needs of populations deficient in this nutrient can easily be met through a slightly more frequent use of unrefined palm oil, which is rich in ß-carotene and familiar to these populations (Zeba et al., 2006). Finally, dietary diversification involves a more comprehensive approach to the nutritional situation of a population, as it allows for the simultaneous improving of intakes of many nutrients, not just micronutrients.

This diet-based approach, which therefore takes into account the combination of foods in dishes, of dishes in meals, of meals in a day and of daily food consumption over a series of weeks or months, accounts for the effects of

interaction between foods over time, factoring in digestion and assimilation speeds. From a nutritional point of view, eating one kilogram of a food per week is not necessarily equivalent to eating 150 grams every day. Pamela Mason and Tim Lang (2017) thus prefer the term 'sustainable diet' to 'sustainable food': rather than seeking a solution based on a single universal food product, the focus here is on dietary diversification, if possible working with local resources or solutions tailored to the local context. There may of course be situations where these resources are lacking locally, which call for sourcing resources from other places or even adopting more 'universal' solutions.

Building on local solutions can also change the way data from food and nutrition surveys are processed. Such surveys generally seek to shed light on the determinants of nutritional situations: they compare rich and poor, male and female, young and old and other social groups in order to identify what determines the nutritional status of individuals. Yet these surveys can be approached in a completely different way by characterizing the practices of subjects with a good nutritional status within a population, including and especially in the category that is on average most at risk. This 'positive deviance' approach (Marsh et al., 2004) focuses on the ways in which individuals or households achieve satisfactory nutritional status in adverse conditions. The solutions are therefore not extraneous; on the contrary, they stem from the practices of the target populations themselves. This approach allows for identifying endogenous resources specific to a given context.

Identifying the risks of dependence

Adopting a more ecological approach to the issue of nutrition calls for taking into account the very modalities of intervention and their effects. The endogenous or exogenous nature of the proposed solutions raises questions of sovereignty and dependence. Using fortified industrial foods or biofortified varieties entails a risk of dependence on the chemical or pharmaceutical industry (for the production of additives) or on seed manufacturers, a risk further compounded by the high concentration of activities in the hands of a few major players. The COVID-19 crisis revealed the challenges surrounding this dependence on a limited number of actors with the resources to tackle urgent problems. While specializing in certain food activities based on comparative advantages reduces costs, it carries risks regarding autonomy in strategic decision-making.

Conclusion

One of the strategies applied by companies to remain competitive and conquer new markets is to add new attributes to their products, relating to taste, sustainability, ethical practices and related product values. Nutrition has not escaped this trend, with the development of the market for medicinal or health foods – either enriched or low-content foods. This strategy has led to a proliferation of products within the same range, resulting in an abundance of choice (Schwartz, 2005). As a consequence, foods tend to be considered merely as a sum of attributes. Certain marketing tools, such as conjoint analysis, thus measure the relative weight of these attributes in purchase decisions (Rao, 2014). But eaters do not necessarily perceive a food item as an assemblage of discernible attributes. On the contrary, it forms an integrated and indivisible whole; only during the preparation of dishes does the combination of ingredients come into play. Through this assembly process in the kitchen, the ingredients eventually fuse or even 'materialize', as the philosopher Gilbert Simondon (1958) theorized regarding the mode of existence of technical objects: through the addition of initially distinct functions – flavour, rheological attributes, colouring and so on – the dish (or the technical object) ultimately incorporates these functions through the interactions between them, making them inseparable. In bread, through fermentation and baking, the mixture of flour, yeast and water generates a holistic product that is more than the sum of its parts. This is where the magical character of cooking lies: going beyond a conception of food reduced to a simple nutritional function.

The authors would like to thank Damien Conaré, Mathilde Coudray and Marie Walser for proofreading this chapter and for their suggested improvements.

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