



## Fortification, biofortification and fight against malnutrition: where do we stand?

815 million people are undernourished in 2016, i.e. 11% of the global population. Micronutrient deficiencies (vitamins and minerals), known as “hidden hunger”, affects about 2 billion people worldwide. It is part of a triple burden of malnutrition (including undernutrition, micronutrient deficiency and overweight/obesity) that represents a fundamental development problem. The persistent and widespread deficiency of basic micronutrients is both a global food issue and the consequence of the choices made that have shaped our food systems. Malnutrition adversely affects people's opportunities and future and the prospect of achieving sustainable development for all.



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One of the most recent programmatic responses to the level of food insecurity is food fortification<sup>1</sup> (including biofortification), which is currently promoted and supported by many stakeholders: governments, researchers, donors, UN organizations, NGOs, foundations and private sector companies. However, some researchers and NGOs have raised alarm bells regarding

the role given to fortification as a solution to undernutrition and MN deficiencies. This note aims to trigger some reflection on fortification and biofortification. To do so, it summarizes a broad spectrum of opinions illustrating the current debate on their use and opens up the debate to a broader set of considerations, such as the framing of malnutrition and the solutions.

1. According to the Food and Agriculture Organization of the United Nations, the different solutions to fight hunger are fortification and biofortification, food supplementation, and diet diversification.

## Why are fortification and biofortification important issues?

In 2017, hunger is on the rise for the first time in a decade. According to FAO, WFP and UNICEF, 815 million people were suffering from hunger in 2016, a 38 million increase compared to the previous year<sup>2</sup>. Around 155 million children have stunted growth due to poor nutrition. Levels of nutrient deficiencies are also alarmingly high: two billion people suffer from micronutrient deficiencies, also known as “hidden hunger”. Micronutrient deficiencies in particular should therefore continue to be a high priority on the development agenda. Unless urgent and effective action is taken, more than half of the world’s population will suffer from at least one type of malnutrition by 2030<sup>3</sup>.

The persistent and widespread micronutrient deficiency is a global food issue, and results from inadequate agricultural strategies and policies and current unsustainable food systems. The Green Revolution in Asia for instance, has focused on increasing the production of a narrow range of crops, often at the expense of a broader range of nutritious crops for local consumption. Over the past decades, West African agricultural policies have contributed to the prevalence of micronutrient deficiencies by making some nutritious crop less available or relatively less affordable. Agricultural policies mostly considered until recently nutrition as an automatic outcome of an increase of food production. Consequently, West African countries consistently rank at the bottom in making lasting change against malnutrition<sup>4</sup>. Since the 1990s, micronutrient fortifications, along with supplementation programs, have become a focus of national and international health agencies for addressing population-wide micronutrient deficiencies in low and middle-income countries (LMICs)<sup>5</sup>. Since then, they are increasingly promoted by governmental agricultural policies. Food fortification programs have also been especially developed and promoted by United Nations agencies such as FAO, NGOs such as the Micronutrient Initiative, philanthropic organizations such as the Bill and Melinda Gates Foundation or the CIFF Foundation, and more recently by donors like Europaïd.

### Main arguments in favor of food fortification and biofortification:

- the promoters of food fortification and biofortification argue that the already-existing food supply chains allow to reach a large number of consumers and in particular wider-at-risk populations;
- in addition, those approaches are promoted according to the fact that they do not require a change in the existing diets and in the consumers’ existing food consumption patterns;
- food fortification and biofortification are also promoted as a relevant approaches for addressing micronutrient deficiency in situations where existing food supplies fail to provide adequate levels of certain nutrients in the diet (emergencies, lack of infrastructures, low connexion to markets).

### Definition of fortification

Fortification refers to the addition of essential micronutrients (called “fortifiers”) to common foods (called “vehicles foods”), such as oil, salt, flour, in order to increase the nutritional content of the food supply. Four forms of fortification are distinguished:

- mass fortification (fortification of foods widely consumed by the general population);
- targeted fortification (fortification designed for specific population subgroups, such as complementary foods for young children);
- market-driven fortification (voluntary fortification by food manufacturers);
- home fortification (fortification at household or community level).

## Major concerns regarding the generalization of fortified and biofortified foods

### The generalization of misinformed consumers

One can say that the terms “food fortification” and “biofortification” lead people into thinking that conventional crops are inadequate and need to be enhanced through fortification to make it stronger (“fortis” in Latina), thus implying that non-fortified foods would be weak or be missing something. This is actually not the case as many native species may contain more nutrients than the “fortified” ones. Moreover, consumers should be informed of the possible negative impacts of fortified products (possible excess in term of micro-nutrients leading to additional obesity risks for instance).

### The dead-loss of considering diet only as a package of nutrients

Another concern is that those approach present malnutrition and micronutrient deficiency as if they were only a question of lack of nutrients. The problem of under-and over-nutrition and micronutrient deficiencies need to be framed differently. Deficiencies of specific micronutrients are the results of unbalanced diets based on a narrow range of affordable, cheap and nutrient-poor staple foods. This reductive focus on nutrients, also reflected under the appellation of “nutritionism”, is more and more popular among humanitarian, development and governmental actors. This approach legitimize the generalization of fortified and biofortified foods as a viable solution of under-nutrition. Some NGOs or social

2. FAO, IFAD, WFP, *The state of food insecurity in the world 2017*, 2017

3. *Ibid.*

4. IFPRI, *Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030*, 2016

5. Aya Hirata Kimura, *Hidden Hunger, Gender and the Politics of Smarter Foods*, Cornell University Press, 2013

movements argue that the current focus on fortification and biofortification may undermine dietary diversity, since it aims at concentrating more nutrients in a few staples and further simplifies diets already dependent on a limited number of carbohydrates.

### **A quick fix that might hinder an holistic approach for a complex problem**

Addressing the challenge of malnutrition in all its forms thus requires a holistic and multidisciplinary approach and implies to move away from a "silo approach". Nutrition cannot be discussed in isolation from the multiple dimensions of food systems. The risk of the generalization of fortified and bio-fortified foods is that it will oversimplify the debate.

During the recent "Regional symposium on Sustainable Food Systems for Healthy Diets and Improved Nutrition in Africa" one of the West African health minister for instance stated that *"the generalization of fortified and biofortified foods is the most promising contribution of the agricultural sector to the reduction of malnutrition"*. We need to develop a holistic approach that would take into consideration not only the nutritional dimension, but also the cultural, social, economic and environmental dimensions of food systems. Fortification and bio-fortification approaches are seen by governments and inter-governmental agencies as a way of addressing malnutrition without having to completely rethink or change food systems and to address the real roots causes of hunger and malnutrition. It might justify inaction in the future or give the illusion we are fixing the hidden hunger problem. Furthermore, the promotion of fortified and biofortified foods can have negative impacts on the other channels through which food systems affect health and nutrition. Fortified and biofortified foods have for instance negative impacts on the ecological dimension of food systems, since they contribute to undermining biodiversity by narrowing the number and varieties of crops cultivated. In the case of golden rice for instance, cultivated throughout many parts of the world, particularly Asia, if any seed gets mixed up, or cross-pollination causes contamination, it will be difficult to stop. Thus, the spread of genes to landraces and wild varieties of rice is likely to happen over time. This could lead to genetic contamination of wild populations as well as cultivated seed supply.

### **The funding allocation problem**

A vast majority of donors or stakeholders involved in fortification and biofortification argue that those approaches are only a part of the solution and are complementary with other solutions like food diversification. They make the point that considering the time one needs to switch from one (broken) food system to another, bio fortification could serve as a good intermediate solution. In the same time, they also argue that they would like bio-fortified crop to represent 25% of the total crop production by 2050<sup>6</sup>. However, we know for a fact that the nutrition ODA is shrinking and that there won't be sufficient funding for all the solution. Even the promoters of fortified and biofortified foods state that *"As there*

*is currently insufficient funding available for both types of investments. Very difficult decisions are being made (implicitly or explicitly) in choosing between short and long-term welfare. In front of such a dilemma, states and donors are often tempted to choose what they consider to be the best solution on the short term"*<sup>7</sup>.

Moreover, the current ODA context regarding private sector investments might also be in favor of the generalization of fortified and biofortified foods. Most of the UN agencies, international donors and governments are currently heavily trying to attract private companies in investing against malnutrition. Private actors need an environment that is safe and where their return on investments can be assured. Of all the solutions currently available to tackle malnutrition through a food system approach, the generalization of fortified and biofortified foods seem to be one of the most attractive for private sector investments.

### **Definition of biofortification**

Biofortification is a relatively "new strategy" that uses conventional breeding techniques and biotechnologies to reduce "anti-nutrient" or increase the micronutrient quantity of staple. As such, the innovation is seen as an opportunity to deliver "naturally" – vs processed – fortified foods to people living in rural areas with limited access to marketed fortified foods, more readily available in urban areas.

Biofortification is currently associated with 3 methods:

- conventional biofortification introduces a desired genetic trait through cross breeding of two vegetal varieties (eg. orange-fleshed sweet potato results from the cross-breeding of a variety with high level of Vitamin A and local varieties);
- agronomic biofortification is done through direct fertilization of the soil (e.g. usual NPK<sup>8</sup> fertilizer enriched with Zinc) or through pulverization on the crop leaves (e.g. pesticides enriched with Zinc and sprayed on leaves);
- transgenic biofortification aims at directly introducing desired genes, and related micronutrient dense traits, into a host genetic code, thus modifying it (e.g. introducing a gene from daffodil into a rice variety to increase its level of beta-carotene).

6. Harvestplus speech at the plenary on "CFS and Nutrition" of the 44th Session of the Committee on World Food Security, October 10, 2017

7. Howarth Earle Bouis, *The role of agriculture and bio-fortification in the UN decade for action on nutrition*, UNSCN 42, 2017

8. NPK fertilizers are composed of three macronutrients: nitrogen (N), phosphorus (P) and potassium (K)



## The loss of micronutrients bioavailability

Technical issues regarding fortified food also exist: all the steps of the food chains influence their nutrients bioavailability (the amount of nutrients present in the food). The raw materials that will be fortified need to be of good quality which is not always the case in LMICs. Shipping and storage conditions are also problematic: fortified foods are not always handled in a proper way that would ensure stability of micronutrients. Due to exposure to light, high temperatures or high humidity, nutrient bioavailability can for instance be dramatically reduced. In general, the longer a fortified food is stored, the less nutrients it contains according to *Avallone et al.*<sup>9</sup> Fortified soybean oils can for instance lose up to 68% of their added vitamin A and D3 if they are exposed to natural light during their storage and up to 44% in semi dark condition<sup>10</sup>. Inappropriate cooking practices may also destroy all the remaining nutrients. To be effective, the shipping, storage and consumption of fortified food need to respect a certain number of standards and norms which are not currently guaranteed in the LMICs.

## Consumers vs citizens

It is striking that in developed countries recommendations to improve nutrition are focusing on increasing the consumption of fruits and vegetables and therefore promoting a diversified diet, whereas in LMICs the current trend of agricultural and development policies keeps vulnerable people dependent to major staples food whether they are

fortified, biofortified or not. Food fortification and biofortification considers people suffering from under-nutrition more as consumers than as citizens entitled with the Right to food.

## Looking beyond nutrition: the fundamental act of eating

Fortification and bio fortification can be effective mid-term intervention for micronutrient deficiencies. They can have positives impacts if and only if they are implemented together with poverty reduction initiatives and other agricultural, health, education and social intervention strategies that promote the consumption and utilization of adequate quantities of nutritious and diversified foods. Different types of fortification could for instance form part of an integrated strategy to address micronutrient malnutrition, but with a number of safeguards in order to ensure their impact and sustainability. States and donors need to invest in priority in long-term solution of supporting people to diversify their diets with food grown in a system of agro-ecological farming. Offering a single-factor solution to social, economic and cultural determinants fails to recognize the need to reform drastically food systems. The risk ending up as a short-term technical fix to the multi-faceted problem of hidden hunger is high. The key to good nutrition is a healthy, balanced diet, requiring access to a variety of foods and the implementation of the right to food.

9. Sylvie Avallone, Jacques Berger, Laura Fontan, Youna M. Hemery, Vincent Jallier, Arnaud Laillou, Regina Moench-Pfanner, *Storage conditions and packaging greatly affects the stability of fortified wheat flour: Influence on vitamin A, iron, zinc, and oxidation*, 2018

10. Sylvie Avallone, Jacques Berger, Laura Fontan, Youna M. Hemery, Arnaud Laillou, Regina Moench-Pfanner, Cécile Renaud, *Influence of light exposure and oxidative status on the stability of vitamins A and D3 during the storage of fortified soybean oil*, 2015

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