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Fortification: Leveraging evidence for improving nutrition

Fill the Nutrient Gap (FNG) and Fortification

Introduction

Poor dietary diversity continues to drive malnutrition in many low and middle income countries. Consumers often lack access to diverse, nutrient-dense diets, particularly if costs of nutritious foods are high, availability is low, or typical dietary practices - for cultural or practical reasons - lack diversity.(1) In the absence of sufficient dietary diversity, fortification presents an important opportunity to address micronutrient deficiencies and prevent their long-term consequences, while efforts to further diversify the diet continue. Context-appropriate fortification measures can be a cost-effective tool to increasing the nutrient density of foods and can reduce non-affordability of a nutritious diet. Many products can be fortified, including: grains and flours like rice, wheat flour, and maize meal; biofortified crops including staple cereals, roots and tubers, pulses, and vegetables; specialized nutritious foods (SNF) such as micronutrient powders and infant cereals; and oils, milk, soy sauce, iodized salt and other processed products. While these many potentially fortifiable foods provide decision-makers with many options, it also leads to inevitable questions. Among the most common are which fortified product is most appropriate for a given setting, which products should target which population groups, which micronutrients to add and at what level, and how the costs and benefits of fortification compare with other options. WFP's Fill the Nutrient Gap (FNG) analysis helps navigate these questions and supports stakeholders as they identify opportunities, understand benefits, and plan fortification.

Objectives

FNG analysis identifies entry points for strengthening food systems by examining the agricultural, economic, geographic, political, environmental and cultural components of a given food system. The comprehensive two-pronged FNG process - comprising an evaluation of existing policies and data alongside diet modelling - can identify which fortification interventions are appropriate or can be improved in a given context. Using Save the Children's Cost of the Diet (CotD) analysis tool, FNG calculates the cost and affordability of nutritious diets for specific countries or regions, taking into account the distinct needs of individual household members.

Based on this cost calculation, CotD is used to model the impacts of specific fortification interventions on the cost a nutritious diet, and how consumption of fortified foods could change the micronutrient intakes of individuals. Models can compare differences in micronutrient contribution between fortified and unfortified foods, and compare the reduction in the cost a nutritious diet with the addition of the respective fortified foods. CotD models can inform the cost-effectiveness of fortification by comparing the cost of the diet in question for two foods, one cheaper unfortified food and one more expensive fortified food, calculating the potential reduction in the overall cost of a nutritious diet when including one or the other food. Where fortification is already in place, FNG can assess the potential benefits of bringing it in line with updated guidance in terms of choice of nutrients, chemical form, and nutrient levels.

Applications

Stakeholders in nutrition often lack the information needed to identify appropriate forms of fortification and may lack sufficient evidence to justify investment in fortification. Evidence generated by FNG analyses can serve as a tool to raise awareness on how fortified foods could increase the intake of essential micronutrients to prevent deficiencies. As fortification is often the product of coordinated multisectoral efforts, evidence highlighting the benefits of fortification can be relevant across sectors such as agriculture, health and education. Results from FNG models and analyses can be used to guide strategic policy planning across these various sectors and provide a basis for multisectoral dialogue on fortification.

The analyses can also inform concrete programming, the design of food assistance packages, and food selection for school meals. As the private sector is a major actor in fortification, the FNG can enhance dialogue for private-public cooperation to improve nutrition outcomes. For defined contexts, analyses can also be tailored to answer specific "what if" questions, such as:

1. What if specific fortified foods were made available in markets?
2. What if fortified foods were offered at subsidized prices, at cost, or at for-profit prices to specific subgroups using specific delivery channels such as a social safety net programme or school meals add?
3. What if the current fortification standard was brought in line with regional or WHO standards?

Case Studies

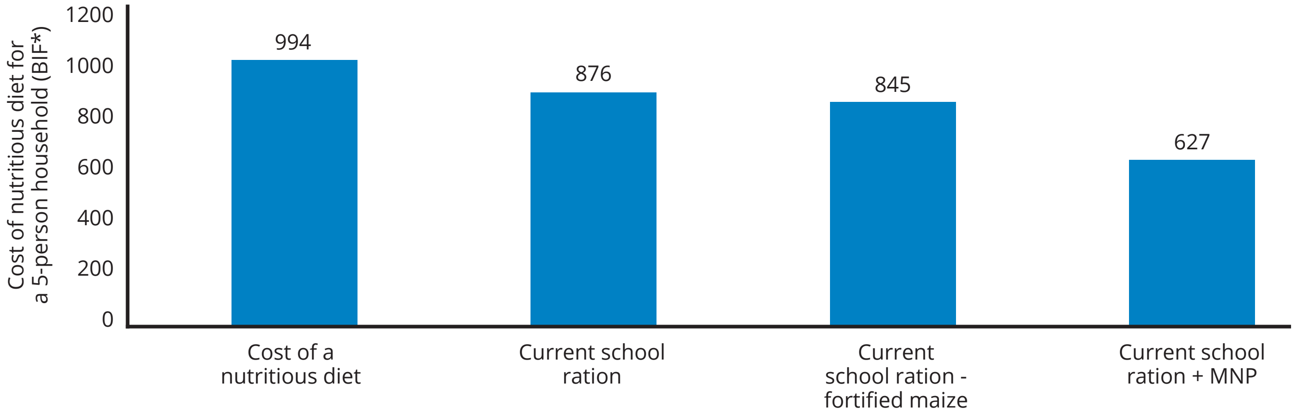
FNG has tailored analyses to address a wide range of fortification questions. The following four case studies are intended to illustrate not only the range of fortification options which may be selected in a given setting, but also to illustrate the evidence generated through the FNG.

Case Study 1: Burundi: Enhancing School Canteen Meals with Fortified Foods

In Burundi, 70 percent of households could not afford to cover the nutrient needs of all family members. School meals were identified as an entry point to significantly improve the daily nutrient intake of children. Existing canteen programmes included some fortified foods - oil and salt, which provide vitamins A, D and iodine - so the FNG examined how additional fortified commodities, specifically maize flour and micronutrient power (MNP), could increase the content of other micronutrients.(2)

Figure 1 shows the potential reduction in the cost a nutritious diet for an adolescent girl under several fortification scenarios. When school meals include fortified maize flour or micronutrient powder, the micronutrient content of the meal increases substantially. Figure 2 illustrates the additional micronutrient coverage provided by fortified maize flour.

Figure 1: Daily cost of a nutritious diet for an adolescent girl (aged 14-15) in three fortification scenarios in Burundi



*BIF = Burundi Frances. 100 BIF is roughly equivalent to USD 0.05

Figure 2: Percentage of recommended micronutrient coverage by current ration with and without fortified flour for a child aged 10–11 in Burundi

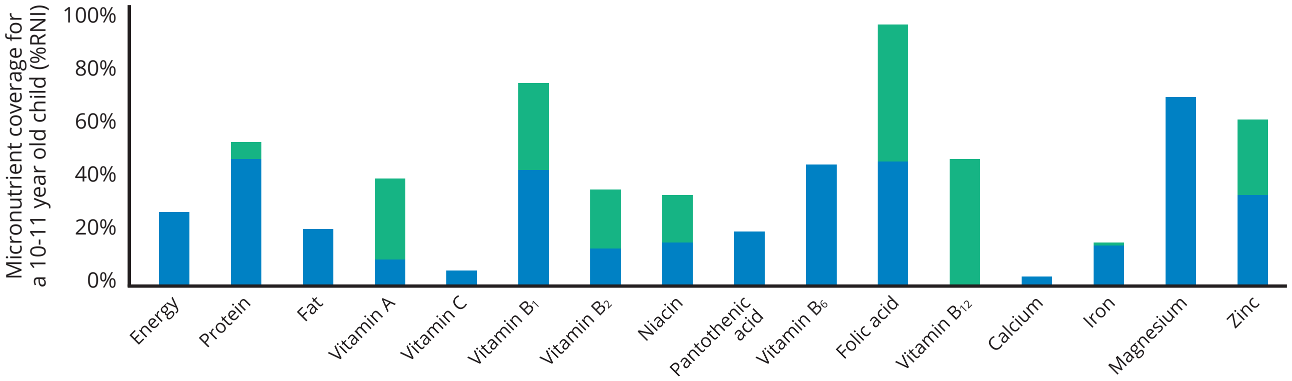


Figure 3: Percentage of recommended micronutrient coverage by current ration with and without MNP for a child aged 10–11 in Burundi

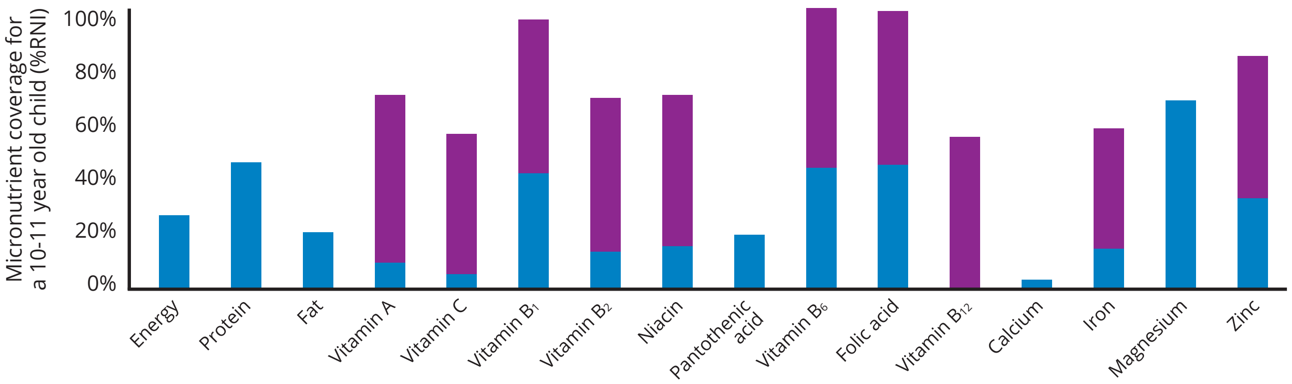


Figure 3 illustrates the composition and added benefits of the addition of 1g of micronutrient powder to a school meal using regular maize flour and hence the cost of meeting the rest of the girl's nutrient requirements reduces by 31 percent when she receives a school meal that has been fortified with MNP. Results are shown for children aged 10-11 years. While both options substantially increase micronutrient content, the MNP is comparatively more effective.

Case Study 2: Philippines: Comparing Non-fortified Rice with Different Kinds of Fortified Rice

In many contexts where staple foods account for the majority of an individual's daily energy intake, fortified staples are a realistic option to reduce the risk of micronutrient deficiencies.(3) In the Philippines, dietary diversity is low with 73 percent of energy coming from staples compared to the 50 percent recommended by

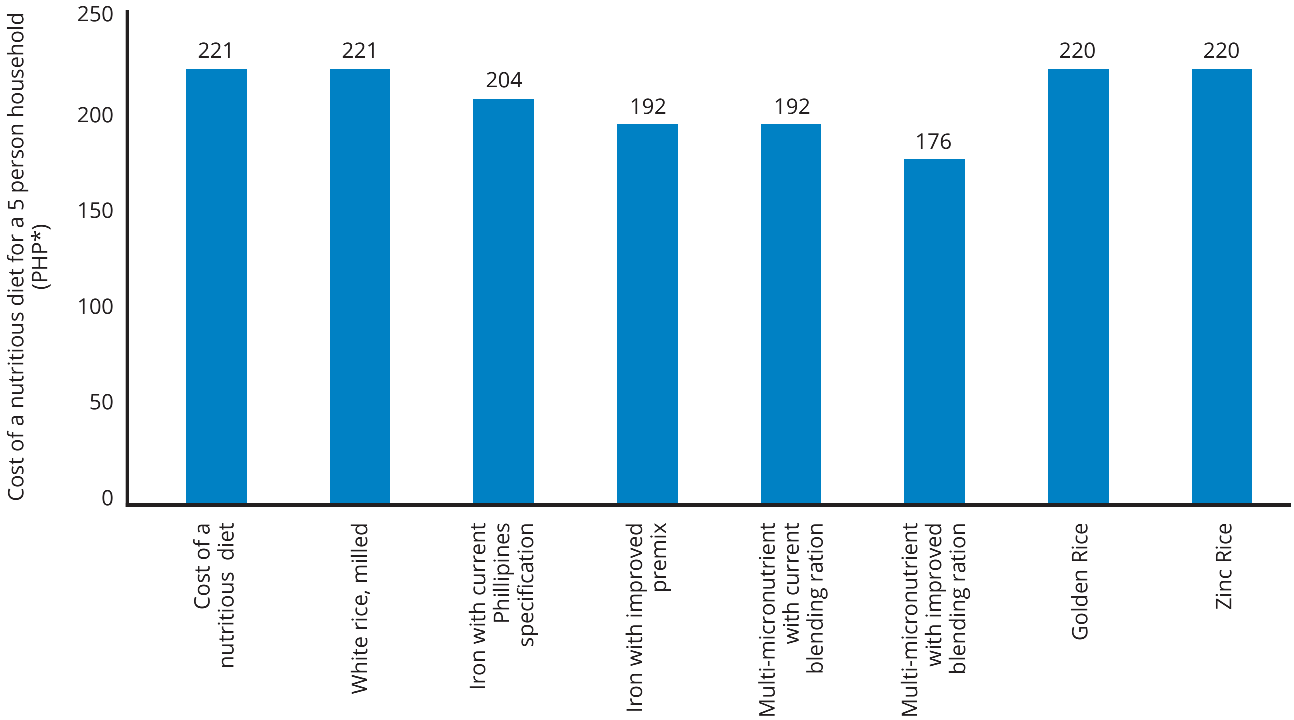
Figure 4: Details of post-harvest and biofortified rice included in CotD modelling in the Philippines

Type of rice	White rice, milled	Fortified rice: Iron with current Philippines specification	Fortified rice: Increased iron level in premix	Fortified rice: Multi-micronurtient with current blending ratio	Fortified rice: Multi-micronutrient with improved blending ratio	Golden rice	Zinc rice
Micronutrients	N/A	Fortified with iron (2mg/100g)	Fortified with iron (3.5mg/100g)	Fortified with vitamin A, vitamin B_1, niacin, vitamin B_6, folate, vitamin B_{12}, iron and zinc	Fortified with vitamin A, vitamin B_1, niacin, vitamin B_6, folate, vitamin B_{12}, iron and zinc	Biofortified with vitamin A (125 ug RAE retinol/100g)	Biofortified with zinc (2.1mg/100g)
Blend ratio: (fortified kernels: Unfortified rice)	N/A	1:200	1:200	1:200	1:100	N/A	N/A
Price in Philippine PESO (PNP)	Market price (average across modeling areas): 4.5 PHP per 100g	Additional 0.2 PHP per 100g	Additional 0.2 PHP per 100g	Additional 0.2 PHP per 100g	Additional 0.3 PHP per 100g	Market price: 4.5 PHP per 100g	Market price: 4.5 PHP per 100g

WHO. Because rice provides the majority of a household's caloric intake, fortifying it was identified as having potential to significantly improve micronutrient intake.

The FNG team built a model based on two rice-based meals per day per individual. The model was adjusted for seven different types of rice: one non-fortified option and six options with various degrees of fortification. Market prices varied slightly among the different kinds. Details of pricing are shown in Figure 4. Results from analysis, seen in Figure 5, found that multi-micronutrient-fortified rice blended to an improved ratio (1:100 rather than 1:200) reduced the cost of a nutritious diet by 21 percent for the modelled household, the most significant reduction among the rice varieties. Multimicronutrient-fortified rice blended to the current ratio (1:200) and iron-fortified rice with higher iron content, could reduce the cost of a nutritious diet by 13 percent, and iron-fortified rice with the current premix composition could reduce the cost of a nutritious diet by 8 percent. The lower cost does not necessarily mean that households will reduce income spent on food after the consumption of fortified rice. Rather, it illustrates that the risk of micronutrient deficiencies would be lower, as the household would now require less money to meet essential nutrient needs.

Figure 5: Daily cost of the nutritious diet for a modelled household with non-fortified rice compared to post-harvest and biofortified rice (averages across modelling regions) in the Philippines



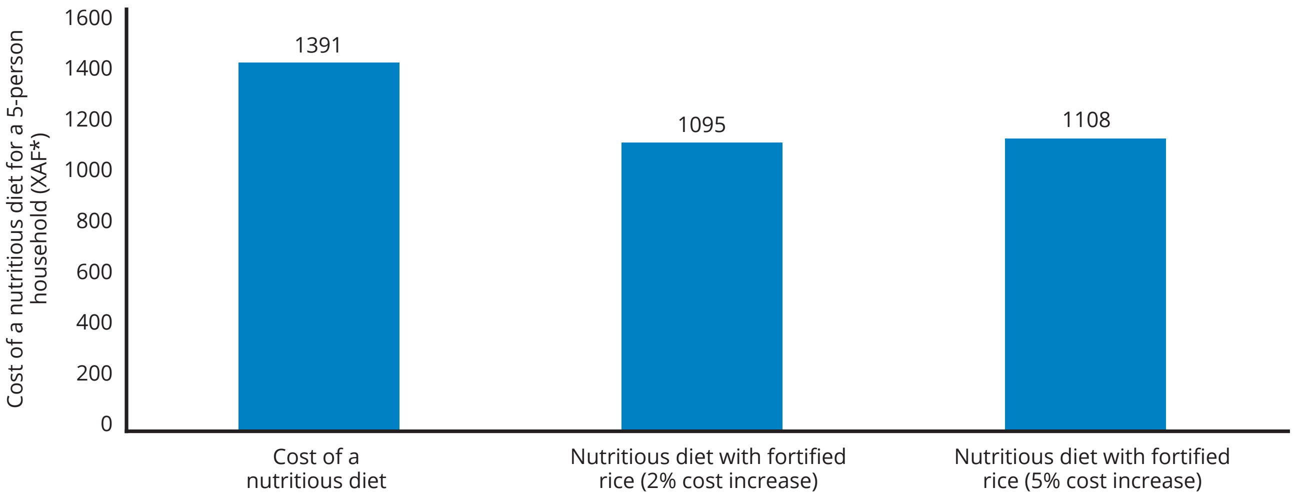
*PHP = Philippino Peso. 100PHP is roughly equivalent to USD 2.04
Note: Current blending ratio = 1:200; improved blending ration = 1:100

In many regions of the Philippines, iron was the limiting nutrient. Without reducing the cost of food sources of iron, reductions to the nutritious diet cost were modest. The relatively inexpensive addition of iron to rice was a cost-effective way to meet iron needs and hence reduce the cost of a nutritious diet. Biofortified Golden Rice and Zinc Rice did not significantly reduce the cost of the nutritious diet because they only add one nutrient each – vitamin A and zinc, respectively. These cost reductions suggest that while post-harvest fortified rice and biofortified rice can increase intake of specific micronutrients, i.e. vitamin A and zinc in these examples, post-harvest fortification is the more cost-effective option in the Philippines.

Case Study 3: Ivory Coast: Comparing the Costs and Benefits of Staple Fortification

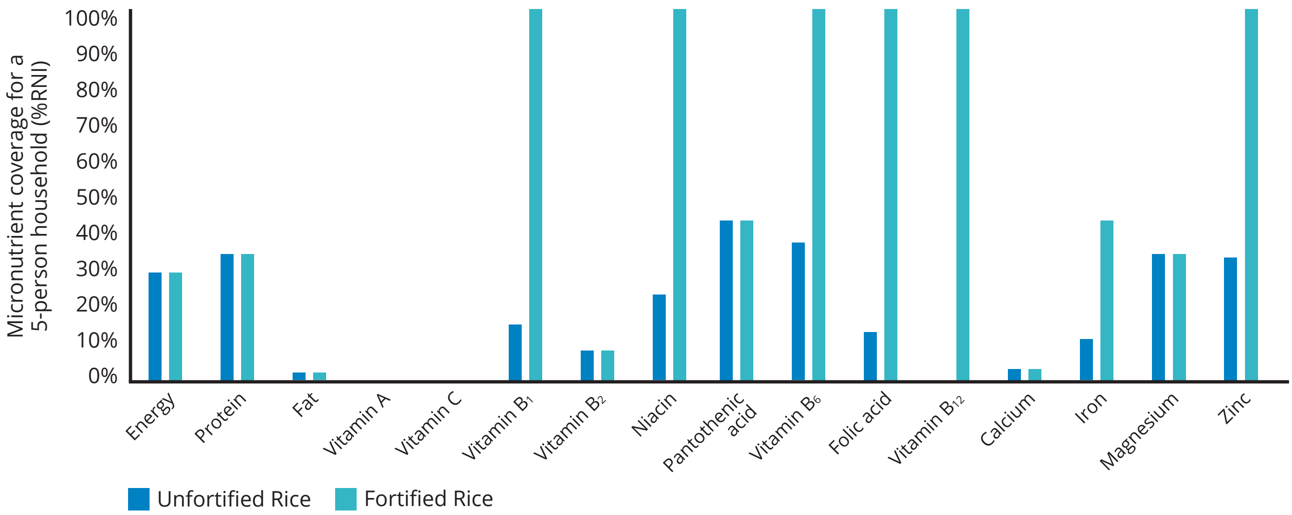
In Ivory Coast, cereal staples make up the majority of the food in a given meal and rice is the preferred cereal. Because it has lower iron and zinc content than other local cereals like millet and maize, it was identified as the potential vehicle for fortification. A typical Ivorian household will spend roughly half of its income on food purchases, so consumer price sensitivity was a crucial consideration. The FNG analysis assessed whether the cost of a nutritious diet would change if rice fortified according to WFP specifications were made available in the marketplace, but at a higher price than unfortified rice. To calculate the cost of a nutritious diet, rice was assumed to be the primary staple consumed by the household and accounted for 60 percent of the daily staple foods included in the CotD software, while maize and wheat flour accounted for the remaining 40 percent.

Figure 6: Daily cost of the nutritious diet for a modelled household consuming fortified rice (averages across modelling regions) in two pricing scenarios in the Ivory Coast



*XAF = Central African CFA. 100 XAF is roughly equivalent to USD 0.18

Figure 7: Comparison between impacts of unfortified and fortified rice on household micronutrient intake in the Ivory Coast



Note: Based on national fortification specifications, rice in Ivory Coast is fortified with iron, zinc, and vitamins B_1 (thiamine), B_3 (niacin), B_6 (pyridoxine), B_9 (folic acid), and B_{12} (cobalamin). WFP[4] recommendations for rice fortification include eight micronutrients—the seven listed here plus vitamin A.

Figure 6 illustrates the reduction in the cost of the nutritious diet in two scenarios: one in which fortified rice cost 2 percent more than unfortified rice and the other in which it cost 5 percent more. Figure 6 shows that while the cost of fortified rice would be 2–5 percent more expensive than unfortified rice in the marketplace, the remaining cost of meeting nutrient needs for the household would be reduced by 20–21 percent. It is important to note that the potential reduction in the cost of the diet does not translate to saved cash for the household. Rather, it means that the household will spend less than before to cover nutrient needs, which lowers the risk of nutritional deficiencies. Social marketing approaches should be used to increase consumer awareness of the benefits of consuming fortified rice. Current purchasing behaviours, particularly among wealthier consumers, already show preferences for certain characteritics (4,5) - like length, fragrance, and breakage - suggesting that appropriate marketing could characterize fortification as a desirable characteristic, effectively shifting preferences towards fortified rice and thereby stimulating demand.

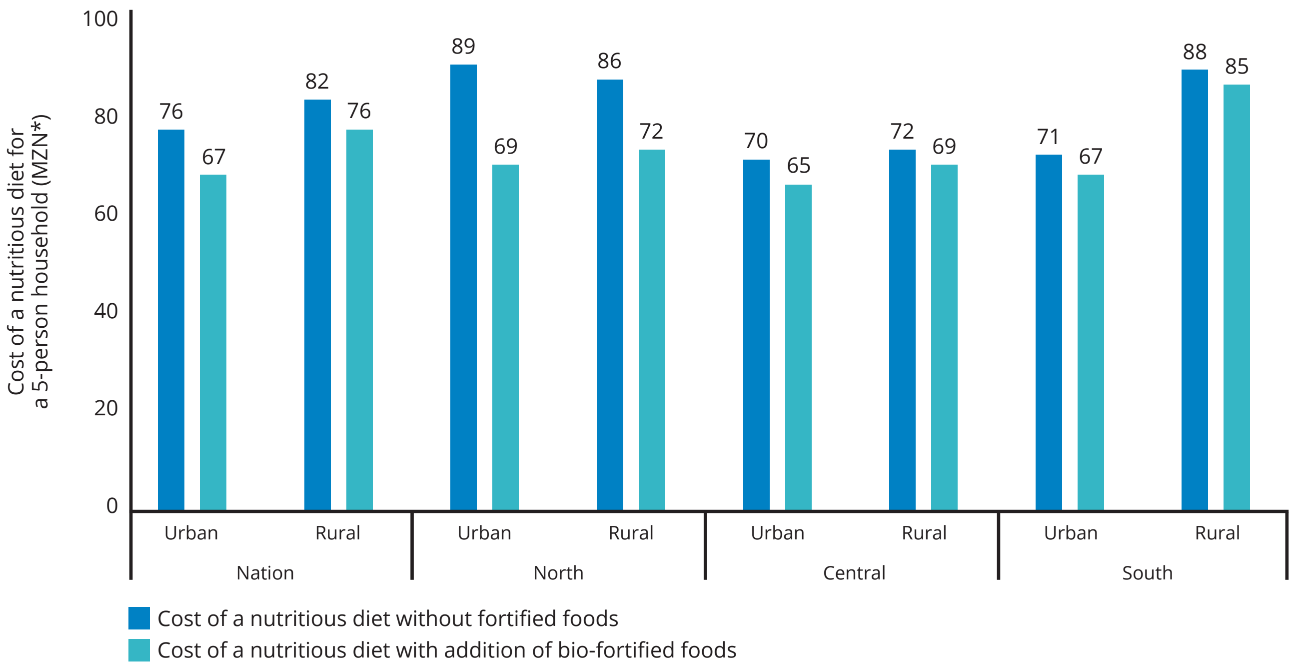
The FNG analysis found that consumption of fortified rice in line with national standards would pointedly improve intake of 7 micronutrients. Figure 7 compares specific micronutrient coverage for the modelled household (5 people) from unfortified and fortified rice, illustrating significant improvements in intake with the consumption of fortified rice.

Case Study 4: Mozambique: Comparing Cost of the Diet Assuming Home Production of Biofortified Crops

In Mozambique, where starchy staples dominate production and consumption, high levels of micronutrient deficiency, such as severe levels of anaemia and vitamin A deficiency, persist throughout the country. Policymakers and producers have increasingly prioritized biofortified crops as a response to low availability of and poor access to micronutrient-rich foods. Because rural households are largely dependent on self-production for food, the FNG analysis examined the effects of home-produced biofortified foods on the cost of the diet. Quantities included in the model are measured for one portion of biofortified orange-fleshed sweet potato, cassava and beans per day. Figure 8 shows the values for cost of the nutritious diet before and after the inclusion of biofortified crops.

Analyses found that, on average, replacing regular crops with their biofortified equivalents could reduce the cost of the diet by 13 percent in rural areas, and by 7 percent in urban areas. These results refer specifically to reductions in the cost of the diet and assume no difference in crop price. Northern zones show larger reductions in the cost of diet with the addition of fortified foods, indicating that the additional nutrients provided by the biofortified foods are comparatively more expensive to cover from existing food sources in the north.

Figure 8: Average modelled household cost of a nutritious diet compared to home production of biofortified foods (cassava, sweet potato and beans) across different regions of Mozambique



*MZN = Mozambican Metical. 100 MZN is roughly equivalent to USD 1.41

Conclusion

A diverse diet with adequate intake of fruit, vegetables, legumes, and animal source foods can meet an individual's micronutrient needs; yet, currently at least 3 billion people around the world are unable to access such a diet.(6) When households are unable to meet micronutrient needs due to physical or financial barriers, it becomes necessary to consider other pathways for prevention and treatment of malnutrition. Fortification is a powerful, low-cost intervention for improving micronutrient intake that can be adapted to many contexts and delivered through many platforms.

Fortified foods can significantly increase the nutritional value of a school meal, fortified specialized nutritious foods can provide lifesaving nutrients during times of crisis, and fortified staples can provide affordable nutrition to the greater population. The FNG analysis is an opportunity to identify entry points for fortification interventions that can have an impact in a certain context. Working with stakeholders, FNG can provide analysis on the benefits of fortification, so that nutrition champions can leverage evidence and data to improve nutrition for all.

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Contributors

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Further reading

For all Fill the Nutrient Gap publications please visit: https://www.wfp.org/fillthenutrientgap

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