A photograph of a woman, Pascaline Bampoky, watering plants in her garden. She is wearing a patterned dress and holding a metal bucket. The garden is lush with green plants, including what appear to be pepper plants. The background shows a rural setting with trees and a building.

Pascaline Bampoky waters pepper plants in the garden she keeps outside her home in Bignona, Senegal. Growing fruit and vegetables is one way to boost a family's intake of vitamins.

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Zero child hunger: breaking the cycle of malnutrition

Policy implications

- Nutrition-focused agricultural interventions alone will not eradicate malnutrition. Such initiatives are short term and cannot address the root causes – longer term inter-generational issues such as chronic poverty and maternal health.
- Capturing detailed information about who vulnerable children are, where they live, their characteristics, how to reach them, and how to ensure they participate in the right programme is essential, if initiatives are to succeed.
- Bio-fortification can help but is not yet a proven solution. More information is needed before scaling up such initiatives. Questions that need to be addressed include: Do farmers accept the new technology? Does bio-fortification increase profitability? Will consumers buy and eat bio-fortified food?
- Increasing overall household income is crucial. Increasing it from one source may result in reduced income from other sources with no change in overall buying power. Nutrition education should aim to improve diet overall since increasing consumption of one food item may lead to reduction in another with no change in overall nutritional content.

Hunger: the killer facts

Hunger is the most serious threat to the world's public health, according to the World Health Organization. Six million children die of hunger every year. Over 40 percent of children under five in countries such as Bangladesh, Ethiopia, India, Nepal, Niger and Nigeria are stunted (have low height for their age). Children that do survive are more likely to get heart disease, diabetes and suffer renal damage. Poor nutrition undermines school performance and later earning capacity and thus has a direct effect on productivity and economic growth. Anemia, in particular, impairs brain development.

Trends are improving in some areas. The proportion of pre-school children stunted and underweight for their age has declined everywhere except in parts of sub-Saharan Africa over the past two decades. Stunting has nearly halved in Latin America since 1990. However, it has increased by 20 percent in Africa overall, where half of child deaths are linked to malnutrition.

Increasing food prices have exacerbated the vulnerability of poor people to malnutrition, particularly where food security is a problem.

Nutrition-focused agricultural interventions have been around since the 1960s and encompass biofortification, home gardens, dairy and livestock development and aquaculture. Then, lack of food was seen as the main issue; without access to food, poor people will still starve. Research in the 1990s found that eating well is also crucial. Projects now encourage households to produce specific highly nutritious food items such as dairy, fish, or meat. Bio-fortification – breeding crops to increase their nutritional value either through conventional selective breeding or genetic engineering – is seen by some as more effective than adding nutrients to food at the processing stage, given that poor people in remote areas rarely have access to commercially fortified foods.

This first issue of Evidence Matters focuses on these types of intervention. Drawing on the findings from a recent systematic review of agricultural interventions aiming to improve the nutritional status of children, this brief asks whether increased household income and better diets can improve children's nutritional status, and if not why not.

Better nutritional status = healthy children

The process of becoming stunted begins at conception and continues for the first two or three years of life. The interventions reviewed are probably better suited to addressing short-term rather than longer-term issues of chronic malnutrition. The studies found a greater impact on short-term indicators of hunger than on the longer-term indicator of stunting. A bio-fortification intervention in Mozambique focusing on agriculture, nutrition education and marketing lead to a reduction in children's wasting (low weight for height) and underweight but not in stunting.

In addition, measuring vitamin intake is not easy and all the projects did it differently. Yet evidence suggests that agricultural interventions can improve vitamin A intake: home gardening projects increased people's consumption of fruit and vegetables; aquaculture and small fisheries projects meant people ate more fish. However, while increasing their consumption of fish, dairy products, or fruit, participants may have reduced their consumption of other protein-rich food, such as meat, with no change overall.

It is difficult to gauge whether agricultural interventions improve the nutritional status of children. Many studies were conducted on small samples. Several animal husbandry and home gardening studies found no change in the nutritional status of the children involved. More importantly, the studies reviewed were statistically unable to identify impact if any existed.



A young girl in the Philippines eats a bowl of rice – a staple food in many parts of the world. Golden rice is a new variety fortified with beta-carotene to combat vitamin A deficiency blindness which causes at least 250,000 children a year to go blind. Other bio-fortified crops soon to come on the market include cassava and maize with added beta-carotene and iron-rich millet seeds. Will genetically modified crops help end malnutrition or is it just a pipe dream?

Reach children most in need

Agricultural interventions to tackle child nutrition are not reaching the very poorest and those most at risk to chronic hunger - orphans and other vulnerable children in particular. Data on participation rates or the socio-economic characteristics of participants – such as poverty levels, family support, housing, or access to services and education – are limited. Little is known about the impact of the interventions or whether the right people are being reached. Most studies described the target population only in general terms such as geographic area, women, poor households, or remoteness. Detailed information concerning the impact and efficiency of the interventions on specific vulnerable groups such as orphans was also not available.

How many children are involved? Where do they live? What support systems and networks are available? Are they in school? If not, why not? Do the programmes reach the most vulnerable? If they don't, why don't they? Why do people participate? Why do they not participate? All these questions, and more, need answers if programmes are to reach the right people with the right, suitably targeted, tailored interventions.

Be cautious using bio-fortified crops

Many mothers in Africa and Asia are malnourished and suffer from hunger. This is made worse by seasonal food shortages, especially in Africa. Iron and vitamin A deficiency are major concerns. Iron deficiency causes at least 50 percent of all anemia and nearly a million deaths a year. Nearly one in two children under five are anemic and in some countries maternal anaemia is over 80 percent. Vitamin A deficiency weakens the immune system and kills around a million children each year.

Iron, zinc and vitamin A supplements are one solution. Another (see diagramme below) is to add vitamins and minerals to staple food crops. Bio-fortified seeds are particularly useful in remote areas where people can't buy fortified food. They also do better in poor soils and can be more resistant to disease than ordinary seeds.

Figure 1: How bio-fortification interventions are expected to work
Evidence on impact of bio-fortification interventions along the programme theory



Consumers are happy to eat bio-fortified food and are willing to pay more for food with a higher micronutrient content. The time required for preparing food and its shelf life are also important factors. Farmers too need to see that bio-fortified crops are at least as productive as traditional ones, yet only one study assessed this. Although only two studies assessed the impact of bio-fortified crops on nutritional status, the results were positive. In drought-prone areas of Mozambique, where orange potatoes rich in vitamin A were promoted, children increased their vitamin A intake eight times more than the control group after two years. Wasting and underweight rates were also lower in the project areas. Techniques for fortifying staple crops are in their infancy and little is known about the mechanisms controlling micronutrient accumulation in plants. Although the World Bank believes that fortifying foods with vitamins and minerals is a cost- and time-effective way to fight malnutrition, the findings from this systematic review show that more studies with a positive impact on nutritional status are needed before spending time, money and effort on scaling up bio-fortified crops for small farmers.

Income growth alone is not enough

Aiming to increase overall household income is essential, rather than increasing it from one source which may result in reduced income from other sources. There is little evidence that such interventions have positive impact on total household income. Only one study tested for impact on household income. Others showed impact on income from a particular source. Earnings among dairy farmers in Kenya are 40 percent higher than among non-dairy farmers. Households with home gardens in Bangladesh have slightly higher incomes than those without, whilst in Thailand, the figure is 60 percent higher. However, selling more of one product may mean selling less of something else making it difficult to measure overall impact, if any, on household income and food expenditure. The programmes studied were successful in themselves by promoting the uptake of a particular food item, but do not represent an overall increase in household resources. Importantly, higher income does not necessarily lead to better food or calorie intake.

Methodology

This systematic review examined published and unpublished literature in English after 1990. Of over 7,000 studies, 23 qualified for inclusion. Five outcome indicators were used to assess their effectiveness:

- Characteristics of target population and participation rates
- Total household income
- Changes to people's diet
- Micronutrient intake (Vitamin A and iron)
- Children's nutritional status (rates of stunting, underweight and wasting among under fives)

Figure 2: Pathways of impact

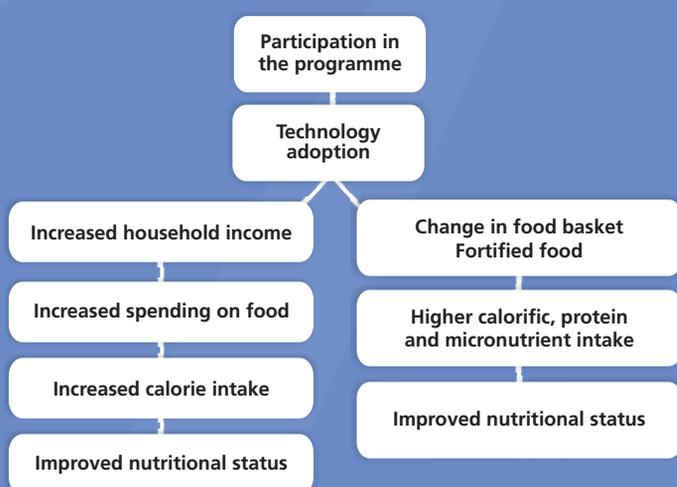


Figure 2 shows the programme theory and how an intervention is expected to improve children's nutritional status. Farmers participate in a programme and adopt a new technology such as rearing livestock or growing new crop varieties. This should increase household income or change either what people eat or the nutritional content of what they eat. Higher earnings and better diets lead to improved nutritional status.

Where are the gaps?

- More rigorous, better designed impact studies are needed to deal effectively with the extremely serious issue of child malnutrition. Which interventions will improve a child's nutritional status? Measuring children's height and weight is vital to determine whether progress is being made and what initiatives, if any, it can be attributed to. And conclusions are hard to draw because measurements were taken and reported in different ways.
- Many studies lacked adequate resources resulting in small sample sizes unable to detect positive or negative impact. Adequate investment in research is needed before reliable, confident answers and solutions can be offered to policymakers.
- It is crucial to measure how impact varies across programme participants with different socioeconomic characteristics in order to extrapolate results to other countries, regions or groups. Understanding people's characteristics, who participates and why will help interventions reach the poorest, neediest people.
- The data used to assess impact—such as total household income, expenditure, or consumption data—need refining, so that they are more easily comparable. Studies assessed impact on income from one activity or consumption of single food items. It is important to measure total household income and examine the whole food basket rather than individual items or micronutrients.
- More data concerning farmers' and consumers' views on bio-fortified crops are needed before programmes can be scaled up.



A Systematic Review of Agricultural Interventions that aim to Improve the Nutritional Status of Children.

Viewpoint

It seems obvious that actions to support the production of nutritious foods will lead to improvements in nutrition. But the evidence, as reviewed in Masset et. al. 2011, suggests that this kind of “nutrition-focused” agriculture does not automatically improve nutrition.

Whether we are talking about homestead gardening (the majority of the interventions reviewed), poultry development, small scale fisheries, dairy development, animal husbandry, aquaculture or the biofortification of staple crops with micronutrients, the chain between nutrition-focused agricultural production and improved nutrition is a long and fragile one.

It is not that these interventions are unsuccessful in agricultural terms—they do increase the production of the food in question. But because they are often a relatively small part of a farm portfolio they don't increase household income sufficiently to improve diet and child growth. Are there other pathways through which nutrition-focused agriculture might work to improve nutrition? Well, the farm household consumption of these micronutrient rich foods does increase (and the homestead gardening interventions perform particularly well here) but we don't know enough about the other parts of the farm household diets to say if the overall diet has improved.

What about the nutrition status of children? This after all is the ultimate outcome of interest. The results here are weak—there is little impact detected, but it is not clear whether this is because the interventions do not work or because of the finding that the impact studies associated with them are simply not strong enough to detect impact—even if present.

So what are the takeaway messages for policymakers?

- ***Don't be half hearted about investing in nutrition-focused agriculture.***

There are many stages in the chain that have to be navigated if nutrition-focused interventions are to work. They have to increase production, increase the food consumption of young girls and infants and they must not divert time away from caring for women and infants. This is a tall order, but one that is not impossible. It requires a nutrition focus at all stages of the chain. Interventions such as intensive dairy farming and orange-fleshed sweet potatoes show it can be done. Furthermore, the demand for nutrient rich agricultural products is going to increase as incomes improve and urbanisation occurs. And while we don't know if nutrition-focused agricultural investments are more costly than other nutrition interventions, but their scale out rates are likely to be good.

- ***Learn from “nutrition-focused” agriculture about how to make all agricultural interventions more “nutrition sensitive”.***

Although nutrition-focused interventions represent a growing part of the agricultural development portfolio, they are still a relatively small part of it. We should resist the temptation to ghettoise nutrition in “nutrition-focused” interventions but rather use them as a laboratory for making much larger agricultural resource flows pack a greater nutrition punch.

- ***Treat biofortification as a promising technology for improving nutrition, but no more than that for now.***

However, wait for more positive impact study results to come in before taking the improved crops to scale. The crops need to show they can increase profitability, gain consumer acceptance and increase the intake of micronutrients in bioavailable forms.

- ***Insist on proper nutrition impact evaluations.***

We need to know which types of nutrition-focused agricultural interventions actually deliver improved nutrition. We also need to know the factors behind the successes. The way to do this is through rigorous impact evaluations. So governments and donors should not fund any agricultural intervention without an independently evaluated impact assessment plan. And they should make one of the first payments conditional upon the completion of a baseline in a control and treatment area.

Agriculture cannot improve nutrition on its own. Direct nutrition interventions such as breastfeeding promotion and the production of infant and young child foods are vital too. But agriculture commands large resource flows and so the potential for improving nutrition through agriculture is vast. Unfortunately this potential will not be automatically realised. The bad news is that converting nutrition focus to nutrition delivery will require higher levels of resolve, planning and measurement than commonly observed. The good news, however, is that we know what to do to convert focus to delivery and if successful, it is potentially very scalable.

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Systematic Review basics

Who is this briefing for?

People making decisions concerning children's nutritional status and maternal and newborn health

What this briefing includes

- Key findings and lessons learned
- Implications for policies and programmes
- Synthesis of impact evaluations

What it doesn't include

- Explicit recommendations
- Additional evidence not included in the systematic review
- Detailed descriptions of interventions or their implementation

This briefing is based on

Masset E, Haddad L, Cornelius A and Isaza-Castro J(2011), A systematic review of agricultural interventions that aim to improve nutritional status of children, London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London

What is a systematic review?

Systematic Reviews aim to provide an unbiased assessment of what works and why by identifying relevant studies and synthesising quantitative and qualitative evidence. Using explicit, rigorous and transparent methods they aim to include all published and unpublished research relevant to the research questions and to synthesise the findings in a way that is easily accessible to those making policy or practice decisions.

Additional resources

World Health Organization, Global Database on Child Growth and Malnutrition

http://resources.3ieimpact.org/useful_resources_on_systematic_reviews

www.dfid.gov.uk/r4d/SystematicReviewNew.asp

<http://www.unicef.org/sowc09/docs/SOWC09-FullReport-EN.pdf>

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Editorial team Louise Daniel and Christelle Chapoy

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