Sattva Knowledge Institute SKI perspective

BIOFORTIFICATION: PATHWAYS FOR SCALE IN ADDRESSING HIDDEN HUNGER

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Acknowledgements

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Executive Summary

Hunger and food security have always been a pressing challenge and an important part of the global agenda. The UN SDG goal to achieve zero hunger by 2030, in fact, includes food and nutrition access to seven billion people worldwide, keeping population and resources under control. While hunger has been addressed, the form of hunger that is often ignored or overshadowed is known as hidden hunger, otherwise known as micronutrient deficiency.

Hidden hunger affects two billion globally, with nearly half of them from India.

Though hidden hunger can affect the population of all strata, the core issues are around diet diversity and micronutrient absorption of food rather than challenges with intake. Hence, vulnerability increases for people with existing health conditions, children, pregnant and lactating mothers where affordability of a balanced diet itself is a daily struggle. COVID-19 has pushed economies around the world further back in their fight against hidden hunger. The deficiency of essential vitamins and minerals has long-term, irreversible health effects that sometimes act as a slow poison without being detected in the long term. This leads to a wide number of health problems, including impaired cognitive development, lower resistance to disease, and increased risks during childbirth for both mothers and children (FAO).

Biofortification as a potential solution to address hidden hunger.

To combat the same, traditional approaches like dietary diversification have been the focus of the government in the past. Now other innovative solutions have been in the spotlight which include food supplementation, fortification and biofortification, which are complementary to each other and have been of significance to combat hidden hunger. As the problem of hidden hunger is affected by food production and consumption, the solution which addresses the root cause and complements other solutions is biofortification. Not only does biofortification offer nutrition sufficiency through a production and consumer lens, but it is also an economic and cost-effective solution with other time-tested benefits. For example, one important benefit is that biofortification is climate resilient and has a high response to climate change.

With growing commercialisation, biofortification is now on the pathway towards scaling up to strengthen supply and demand and build an enabling ecosystem.

The initiatives and conversations in the nutrition ecosystem have been emerging around the scaling up of biofortification. While these can catalyse nutrition sufficiency among vulnerable populations, interventions are still required to define pathways to scale-up biofortification. Innovative measures, such as the incorporation of blockchain and traceability tools in the value chain, could support the scale-up effectively. The government needs to provide support in the form of programmes around biofortification such as Poshan Abhiyaan and women's health, centres to combat child hunger and malnutrition like Anganwadi and the integration of biofortified varieties in midday meals.

Hidden Hunger: A Silent Epidemic

The nature of the hunger and food insecurity burden facing the world has gradually become more complex. Hidden hunger, also known as micronutrient deficiency, afflicts more than two billion people globally, of which nearly half are in India (USAI 2005). In recent years, the major drivers of availability, accessibility, and utility (FAO 2000) of food have made countries around the world conscious of tracking indicators to end world hunger and malnutrition in all its forms by 2030 (UN SDG 2015).

Figure 1: Hunger Crisis in India

101 RANK
of India out of 116 countries in the Global Hunger Index 2021.

30%
gap in actual and recommended dietary energy intake of people living in rural India.

0.5%
of farmers in India are growing Biofortified crops as of 2019.

~27%
of women in India are malnourished due to micronutrient-deficient diet.

~32%
of adolescents in India between the age of 10-19 years are zinc deficient.

The core issues of hunger and food insecurity can be acknowledged in the form of food and nutrition unavailability (FAO 2008), where people suffer from a chronic lack of sufficient food and constantly experience a sensation of hunger as part of food unavailability. Nutritional deficiencies in agricultural crops lead to reduced intake or deficiency, resulting in nutritional unavailability.

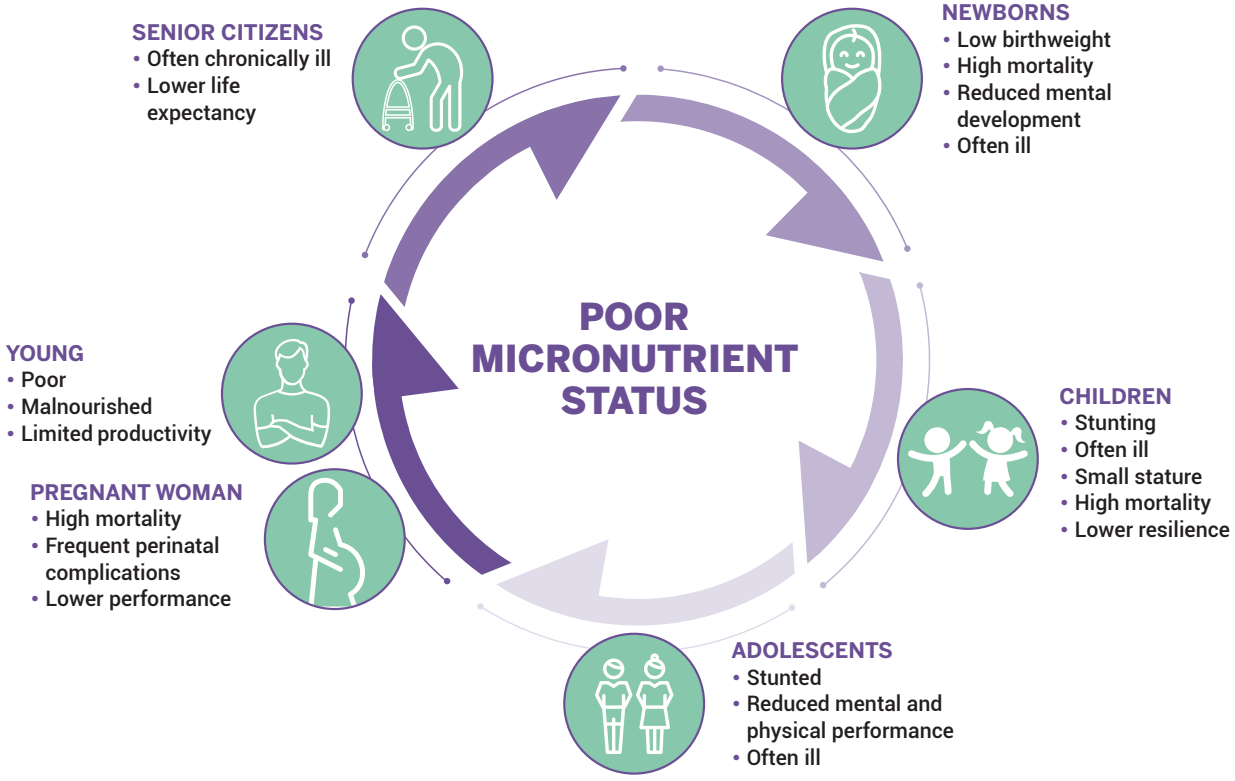
In India, even though policy initiatives have addressed the cause and effect of hunger and food security issues, an unperceived crisis exists because of poor diets, lack of nutrients in the soil, and lifestyle changes all leading to reduced intake of vital micronutrients, such as vitamin A, iron, zinc, folic acid, and iodine. This further leads to poor food absorption, known as hidden hunger, which is claimed to be a silent epidemic. WHO identifies micronutrients such as zinc, iodine and iron as key vitamins and minerals, the lack of which causes undernutrition. Moreover, if hidden hunger is not tackled, especially in terms of actions to

address major drivers of food insecurity and malnutrition, we cannot achieve SDG 2, that is, zero hunger by 2030 (FAO 2021).

> "The 'hidden hunger' due to micronutrient deficiency does not produce hunger as we know it. You might not feel it in the belly, but it strikes at the core of your health and vitality."
>
> — **Kul C. Gautam**, Former Deputy Executive Director, UNICEF

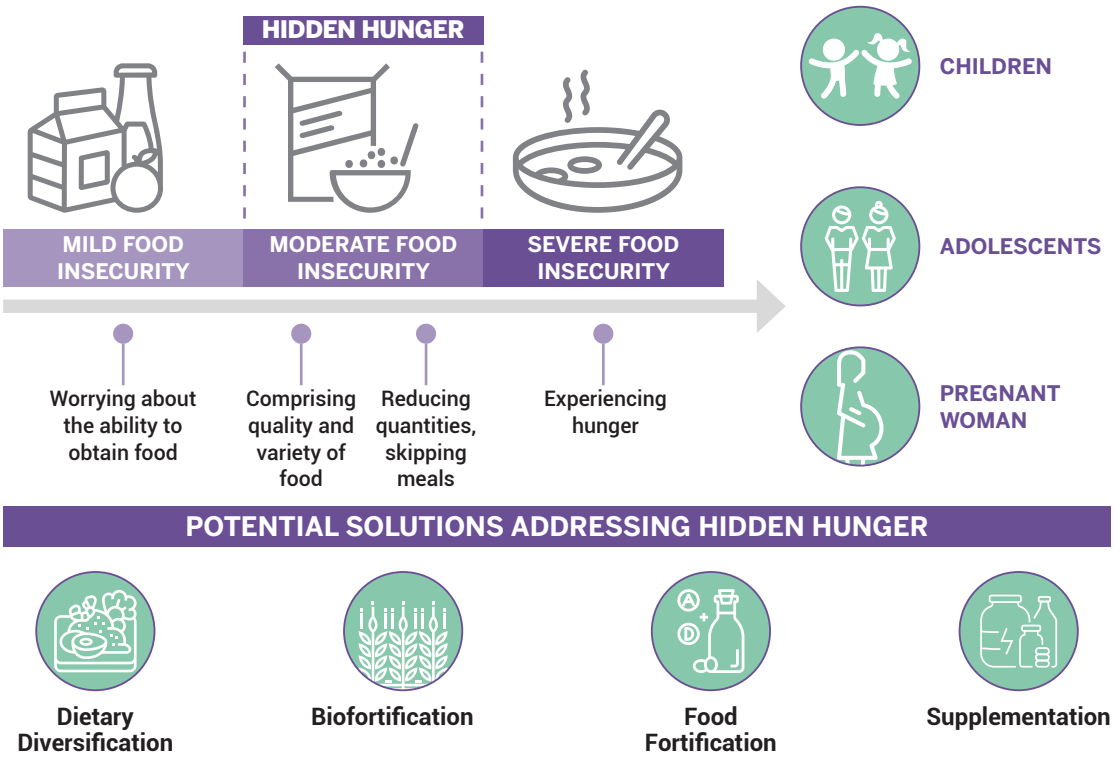
Food availability strategies across the world have revolved around increasing the production and productivity of staples. This has further complicated the food system, affecting the population of all strata across all geographies. The intensified production of high-yielding staple crops may have improved yields, but conversely has depleted the nutrition content of soil. In India, a large part of food crops grown are already prone to deficiencies of one or more micronutrients, resulting in a significant decline in bioavailability of essential micronutrients. The recent National Family Health Survey (NFHS) results indicate that at the national level 58.6% of children, 50% of pregnant women and 53% of non-pregnant women of reproductive age are anaemic (NFHS 2021). COVID-19 and subsequent lockdowns have worsened food insecurity, by disrupting the food distribution system across. It is evident therefore, that hidden hunger is a critical component of food insecurity that demands urgent action.

Figure 2: Impact of nutrient deficiency in the human life cycle



Traditional approaches to food plate diversity and supplementation, such as adding substances like micronutrients and supplements to a person's diet to ensure they get all the nutrients they need, have been the focus of many governments in the past. In addition to these, other innovative approaches like fortification (deliberately increasing the content of one or more micronutrients in food to improve its nutritional quality) and biofortification have gained momentum in recent years. However, to move towards zero hidden hunger, priorities need to be distributed across both food production as well as consumption.

Figure 3: Potential solutions to hidden hunger



Biofortification as a core solution addresses both the levers of food production and consumption. It is also one of the more cost-effective solutions to be implemented at scale, complementing the other approaches in the nutrition ecosystem to address hidden hunger. Biofortification has gained prominence, both nationally and internationally, as a feasible solution for vulnerable communities, farming communities (which can be a high resource for subsistence farming) and the general population.

> "Micronutrient deficiency in the soil results in micronutrient malnutrition in people, since crops grown on such soils tend to be deficient in the nutrients needed to fight hidden hunger."
>
> — **M. S. Swaminathan**

Exploring Biofortification as an Emerging Solution

Biofortification is the process of increasing the density of vital micronutrients such as zinc, iron, and vitamin A in widely consumed staple crops, on the principle that regular consumption of these biofortified crops can provide 40-100% of the daily required micronutrients. Biofortification as a scientific approach started emerging in the early 2000s to provide nutrient-enriched food crops for vulnerable populations who were most susceptible to micronutrient deficiencies, including young children, adolescent girls and women of childbearing age. Organisations like HarvestPlus, a pioneer arm of the Consortium of International Agricultural Research Centres (CGIAR), have ensured that there are efforts to pilot and validate this approach. They have piloted it across geographies and driven future investments to implement this at scale through continuous research and providing evidence. So far, over 400 varieties have been officially released in 40 countries, with a special focus on food crops like rice, wheat, beans, cassava, corn, sweet potato and millets. These are staples for low and middle-income countries, particularly in rural and low-income urban households. The initiative impacts around 68 million individuals by not only improving nutrition for vulnerable communities but also by enabling an increase in farmers' income.

In India, the scale-up efforts for promoting iron pearl millet, zinc wheat, and zinc rice have extended to Maharashtra, Karnataka, Uttar Pradesh, Rajasthan, Punjab, Bihar, Odisha, Chhattisgarh, and Jharkhand, with further plans to extend this to other crops and geographies (HarvestPlus 2021). However, there is still a long way to go towards ensuring the implementation of biofortification as a solution for highly vulnerable communities, across all states and food categories, and encouraging more diversity on the food plate.

Initial evidence and rollout have shown positive signs from farmers towards adopting the biofortified varieties for cultivation, because of the high-scale benefits of high yield, climate resistance and short-duration crops. The government has also been supportive in building awareness and recognising the potential of commercialising biofortified varieties. Even the Prime Minister of India has endorsed biofortified crops by releasing 17 varieties of 8 crops to the nation on the 75th anniversary of the FAO and suggested integrating biofortified crops in several government programmes like Mid-Day Meal (MDM), Anganwadi, and Integrated Child Development Scheme (ICDS). This further validates the change seen in the prioritisation of solutions toward hidden hunger. Despite this publicity and policy-level interventions that have supported production acceleration, there is a lack of integration in the mainstream of biofortification in national crop breeding programmes. If incorporated, this could accelerate the scale-up of biofortification and strengthen its outcomes.

Stakeholders in the nutrition sector are beginning to explore the potential of biofortification and even though significant initiatives are underway to introduce and scale biofortification, several challenges prevail:

Maximising potential to meet supply and scaling adoption by farmers

Slow behavioural change at the farmers' level is a significant challenge. Due to deep-rooted traditional practices and low interest in crop diversification, it is critical to ensure the right knowledge transfer to farmers. There is a perception that some of the currently available biofortified crops are not high-yielding, as compared to the traditionally preferred varieties in a particular region, which also discourages their adoption by farmers.

Need for consistent demand across vulnerable target groups and consumers

There is a need for significant work to be done to increase consumerism for biofortified varieties, as scientific terminologies associated with biofortification make it complex for a consumer to resonate with their buying behaviors. This creates a barrier for consumers to proactively choose biofortified food.

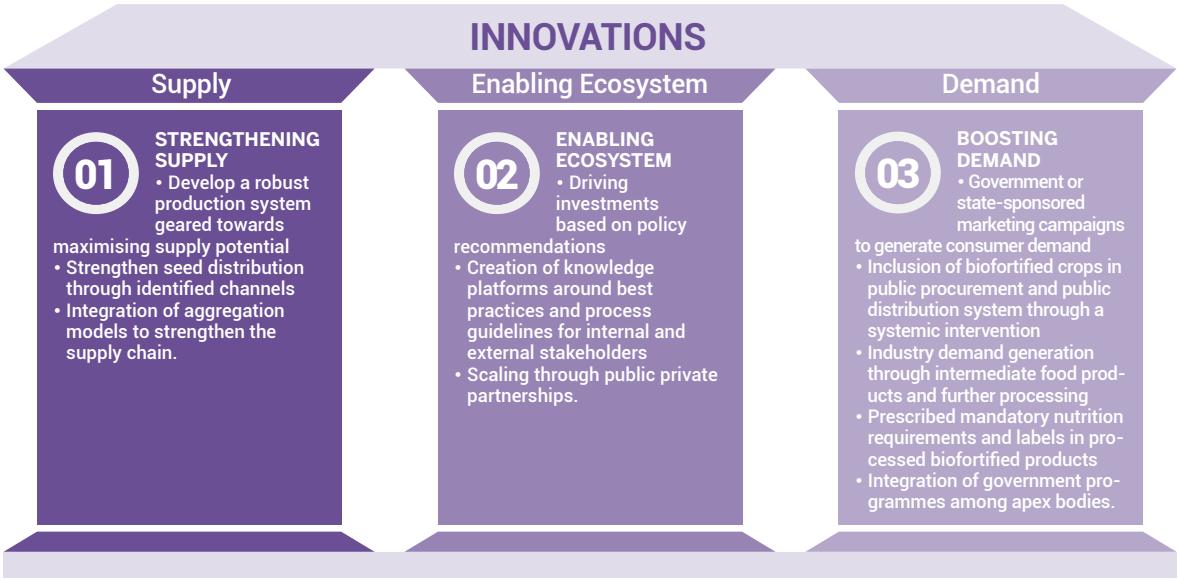
Integration of demand and supply indicators to drive investments

The current state and central level agricultural production database does not capture information on biofortified crops. As a result, the integration of production and consumption clusters becomes difficult. Limited data points are available around hidden hunger on specific vital micronutrient needs and the prevalence of specific deficiencies among the vulnerable population.

Biofortification: Pathways for Scale

It is critical to address the underlying limitations to achieve scale for biofortification. This calls for effective implementation and scale-up strategy, that strengthens systems on the aspects of supply and demand, and the enabling ecosystem.

Figure 4: Potential pathways to scale biofortification



Strengthening Supply

Develop a robust production system geared towards maximising supply potential

The initial focus should be on increasing seed production for varieties such as nutrient-rich zinc wheat, zinc rice, and iron-rich and calcium-rich millets to make a robust production system that covers the majority of the agricultural landscape in India. As wheat and rice are staple crops grown in India, focusing on these two crops can result in higher adoption of biofortified varieties. Iron-rich and calcium-rich millets can be promoted among the farmers in line with the specially designated International Year of Millets, 2023 (IYoM). A minimum micronutrient standard should also be established in the crop breeding programme at the national level, which will ensure high micronutrient density in released crops along with higher yield.

Strengthen seed distribution through identified channels

Distribution can be strengthened through a system which involves identified channels that enable access and affordability for farming communities through public-private partnerships. Enablement of seed subsidisation and incentives for seed suppliers can increase the adoption of biofortified varieties. Additionally, collaboration with state seed corporations can result in strengthening the supply chain across all levels.

Integration of aggregation models to strengthen the supply chain

The aggregation and integration channels like farmer interest groups, FPOs, agri-entrepreneurs, and agri-tech players can be a catalyst in scaling up through collectivisation. In addition, FPO leaders, agri-entrepreneurs, and progressive farmers at a local level can be influencers and flag bearers for the production and internal consumption of biofortified varieties.

Boosting Demand

Government or state-sponsored marketing campaigns to generate consumer demand

There is a need to promote direct demand among consumers. Defining the vocabulary for the general ecosystem is very important to achieve this. The term 'biofortification' is too scientific and technical, simplifying it for the average buyer is necessary for it to resonate with their buying behaviours. A strong yet simple marketing narrative which defines the potential health benefits could be a game changer to mainstream biofortified food in the market for consumers.

Inclusion of biofortified crops in public procurement and public distribution systems through a systemic intervention

The National Nutrition Strategy unveiled in 2017 by the NITI Aayog envisages the alleviation of malnutrition in the country through food-based solutions. Inclusion of biofortified crops in government-sponsored programmes such as the National Food Security Mission, Poshan Abhiyaan, ICDS, MDM scheme and others will benefit the most vulnerable populations and will trigger demand for these nutritious grains to improve nutritional outcomes. Biofortified grains and foods could be initially integrated into public procurement and distribution

programmes, which will provide more nutritious foods to specific impoverished populations, and simultaneously save substantial government resources.

Industry demand generation through intermediate food products and further processing
Private sector actors, including start-up enterprises, should be incentivised to drive consumer demand in the form of intermediate food products and finished goods. Innovative financing should be encouraged for promoting entrepreneurs across the biofortified value chains.

Prescribed mandatory nutrition requirements and labels in processed biofortified products
Stipulations could be introduced for a mandatory level of usage for biofortified crops in consumer goods, as a part of nutrition requirements and labels, in association with regulatory bodies and consumer goods companies. This could facilitate greater availability of nutrient-dense foods in consumer products, and achieve awareness about the use of biofortified varieties.

Integration of government programmes among apex bodies
Integration among the agriculture, health, women, and child development ministries will help generate awareness and demand for biofortified varieties through an anchoring mission, placing resources optimally and maximising the results.

Developing an Enabling Ecosystem

Driving investments based on policy recommendations
There is a need to renew existing policies, where policymakers can introduce biofortification as an approach, determine yearly budget allocations, and define investments through private funders and philanthropists. This will bolster the availability of biofortified varieties for vulnerable populations.

Creation of knowledge platforms around best practices and process guidelines for internal and external stakeholders
Knowledge development and dissemination systems can be leveraged to share best practices and frameworks as guiding tools for the ecosystem players and relevant stakeholders. A guiding tool for each stakeholder and compilation of best practices for internal (implementing organisations, farmers, consumers) and external stakeholders (government, funders, and resource institutions) can be helpful to drive efficient supply systems and demand generation.

Scaling through public-private partnerships
The scaling up of biofortification is possible through public-private partnerships, where the government can act as an intermediary support body. One such example of this is the National Egg Coordination Committee, which steered the egg promotion campaign in India.

Such collaboration could benefit all ecosystem players. The government could reap national health, economic, and political benefits, food companies could get a competitive advantage in an expanding consumer marketplace; the scientific, development and donor communities could make an impact by achieving global goals on malnutrition, and by demanding biofortified crops and foods, consumers could empower themselves to achieve their full social and economic potential.

Innovation is a key driver that can act as a catalyst across the value chain for scale-up. Potential innovations for biofortification could focus on traceability of the value chain which brings transparency to the system. Efforts to include **traceability** in the early stage of commercialisation are easier to implement and can be defined as a model for sustainability.

While digitisation to measure impact at each stage is an efficient way to enable a robust ecosystem, it is also significant in the process of scaling up as data capturing, impact results and relevant indicators to measure success are crucial to guiding the trajectory of an initiative. Startup India and ATAL Innovation Mission can play an important role in identifying, testing, and scaling up blockchain and traceability tools in the biofortified value chain.

Conclusion

Even though there are innovative solutions to solving hidden hunger, among them, biofortification offers a sustainable pathway to scale-up and has the potential to address hidden hunger adversely impacting vulnerable communities. Focused investments around biofortification, implementation with an evidence-based approach and utilisation of the right system enablers will drive change towards the achievement of outcomes around social, economic and environmental indicators.

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