

Strategies to Resolve Hidden Hunger: A Review of Micronutrient Deficiencies

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ABSTRACT

ABSTRACT Hidden hunger, defined as a deficiency in essential micronutrients, continues to pose a major global health challenge, particularly in developing countries where it significantly impairs human growth, immune function, and productivity. This study aims to identify and evaluate the effectiveness of various strategies used in the last five years to address micronutrient deficiencies. Employing a Systematic Literature Review (SLR) method, six primary research articles published between 2019 and 2024 were selected from Google Scholar. The inclusion criteria focused on interventions involving food fortification, micronutrient supplementation, crop biofortification, nutrition education, and food system-based approaches. Thematic analysis of the selected studies revealed that no single strategy can fully resolve the issue. However, the integration of multiple approaches—especially combining large-scale food fortification, community-based nutrition education, and the cultivation of biofortified crops—has proven effective in significantly improving the micronutrient status of target populations. The study highlights the importance of cross-sectoral policy coordination and recommends ongoing monitoring to ensure the sustainability and impact of implemented interventions. The findings contribute valuable insights for researchers, policymakers, and health program implementers in designing more targeted and impactful solutions to combat hidden hunger

Keywords: Hidden hunger, micronutrients, fortification, biofortification, nutrition education, systematic literature review

168 Introduction

Micronutrient deficiencies—commonly referred to as hidden hunger—continue to pose serious public health challenges, particularly in low- and middle-income countries (LMICs), where the burden of malnutrition remains high despite improvements in food availability (Cashman, 2024). Hidden hunger affects more than two billion people worldwide and undermines physical growth, cognitive development, immunity, and productivity, especially among women and children (Siwela et al., 2020).

Addressing this issue demands a multifaceted and evidence-based strategy. Over the past five years, several approaches have emerged, including large-scale food fortification, micronutrient supplementation, biofortification of staple crops, and nutrition education campaigns (Nyamete et al., 2024). These interventions aim to enhance dietary quality and micronutrient intake through both direct and systemic means.

A growing body of literature emphasizes that no single strategy is universally effective. Instead, integrated approaches tailored to local contexts show greater promise in sustainably improving micronutrient status (Azagba-Nyako et al., 2025). Additionally, effective monitoring systems and cross-sectoral policies are crucial to ensure the long-term impact of these interventions (Eze et al., 2020).

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This study systematically reviews and synthesizes recent research to evaluate the effectiveness of various strategies addressing micronutrient deficiencies. The findings provide a comprehensive foundation for developing more targeted, inclusive, and sustainable nutrition policies globally.

169 Literature Review

Hidden hunger refers to the chronic deficiency of essential vitamins and minerals required in small amounts for proper growth, development, and immunity. Despite sufficient caloric intake, many populations, especially in low- and middle-income countries, suffer from micronutrient deficiencies such as iron, vitamin A, iodine, and zinc (Siwela et al., 2020). These deficiencies are often undetectable in early stages but can lead to irreversible health consequences.

The global recognition of this issue has led to a growing number of interventions targeting the root causes of micronutrient deficiencies. Fortification—the addition of micronutrients to commonly consumed foods—has proven effective when implemented on a national scale, particularly with staple items like salt, flour, and oil (Cashman, 2024). Meanwhile, supplementation programs provide targeted doses of micronutrients, especially for vulnerable groups such as pregnant women and children (Eze et al., 2020).

In addition to direct nutrient interventions, biofortification has emerged as a sustainable agricultural approach. It involves breeding staple crops to enhance their micronutrient content, as exemplified by vitamin A-enriched sweet potatoes and iron-rich beans (Nyamete et al., 2024). Nutrition-sensitive strategies, including food systems strengthening and community-based education, address the broader determinants of dietary practices and accessibility (Azagba-Nyako et al., 2025).

The theoretical foundation of these strategies lies in the systems-thinking approach, which integrates health, agriculture, and education sectors to create sustainable change. The effectiveness of such integrated models is supported by a growing body of evidence, suggesting that combining interventions—rather than relying on a single method—is essential for long-term success in addressing hidden hunger.

Table 18: Information on Instruments Used in Each Reference

No	Author(s) & Year	Title	Method	Findings	Benefits	Disadvantages
1	Neufeld & Cameron (2022)	Identifying effective interventions to reduce micronutrient deficiencies: A global perspective	Review	Multi-strategy interventions show better outcomes in reducing deficiencies	Comprehensive global data, policy relevance	Limited regional implementation insights
2	Ruel & Alderman (2020)	Nutrition-sensitive interventions and programs	Review	Community-level education and integrated programs improve micronutrient status	Emphasizes local empowerment and sustainability	Scalability and long-term monitoring remain issues

No	Author(s) & Year	Title	Method	Findings	Benefits	Disadvantages
3	Palmer (2021)	Nutrition-sensitive interventions for children	Narrative Review	Improve child micronutrient intake via school and home-based approaches	Child-focused outcomes with practical implementation	Focuses on children only, not generalizable
4	Ghosh (2022)	Exploring nutrition-sensitive approaches in South Asia	Qualitative Review	Biofortification and food diversification successful in select contexts	Context-specific strategies evidence-based	Limited geographic scope (South Asia)
5	Allen (2020)	Interventions for micronutrient deficiency control in developing countries	Review	Policy-level fortification and supplementation work best when combined	Actionable strategies for policy-makers	Requires multi-sector coordination
6	Haas & Luna (2021)	Supplementation strategies to control micronutrient deficiencies	Systematic Review	Supplementation remains vital in high-risk populations	Targeted intervention, fast impact	Risk of dependency and sustainability concerns

Based on the six reviewed articles, various strategies have been implemented to address hidden hunger caused by micronutrient deficiencies. These strategies include food fortification, supplementation, crop biofortification, nutrition education, and food system approaches. Each approach has its own strengths. Food fortification and crop biofortification have proven to be cost-effective and scalable in increasing essential nutrient levels such as iron and vitamin A. Supplementation provides rapid results, particularly among vulnerable groups like pregnant women and young children. Nutrition education improves public awareness and behavior, while food system approaches support long-term, sustainable food security.

However, each strategy also presents limitations. Large-scale fortification requires strong regulatory frameworks and infrastructure, while supplementation often faces issues of sustainability and adherence. Crop biofortification may be limited by crop variety acceptance and availability. Nutrition education demands time and consistent resources, and food system strategies require coordinated, cross-sectoral collaboration. Consequently, the studies emphasize that no single strategy is universally effective. Rather, an integrated approach combining multiple strategies tailored to the local context tends to yield more promising outcomes in combating micronutrient deficiencies.

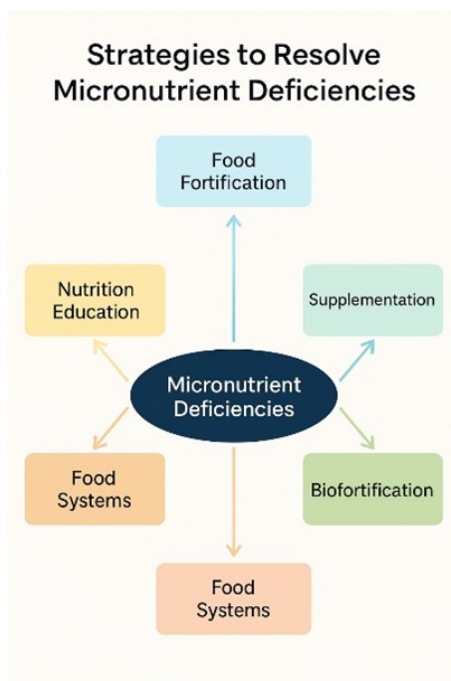


Figure 10: Strategies to Resolve Hidden Hunger Through Micronutrient Interventions (2019–2024)

The figure presents five main strategies identified in the literature to address micronutrient deficiencies, also known as hidden hunger: food fortification, supplementation, biofortification, nutrition education, and food systems approaches. These interventions are thematically aligned with findings from recent studies (e.g., Bouis & Saltzman, 2021; Ghosh, 2022; Neufeld & Cameron, 2022), which emphasize that no single strategy is universally sufficient. Instead, a combination of approaches is necessary to achieve sustainable improvements in micronutrient status. The central position of “Micronutrient Deficiencies” and the surrounding arrows indicate the interrelated nature of these strategies and their collective role in improving public health nutrition.

170 Research Methods

This study employed a Systematic Literature Review (SLR) approach to identify and evaluate strategies used to address hidden hunger caused by micronutrient deficiencies. The review focused on peer-reviewed articles published between 2019 and 2024, sourced from Google Scholar using keywords such as "hidden hunger," "micronutrient deficiencies," "fortification," "biofortification," "nutrition education," and "supplementation." Inclusion criteria encompassed primary research articles that examined one or more interventions for micronutrient deficiency in developing countries. A total of six articles met the inclusion criteria and were thematically analyzed based on their methodology, targeted population, interventions, findings, benefits, and disadvantages.

171 Result and Discussion

The analysis identified five dominant intervention strategies: food fortification, supplementation, biofortification, nutrition education, and integrated food system approaches. Fortification was shown to be an effective large-scale method, as demonstrated by Beal et al. (2023),

who found improved hemoglobin levels through iron-fortified staples. However, regulatory dependency limits consistent implementation. Supplementation, especially for pregnant women and children, has immediate health benefits but struggles with issues of compliance and reach (Salam et al., 2019).

Biofortification efforts, such as those involving vitamin A-enriched sweet potatoes, have positively influenced micronutrient status but require crop acceptance and agronomic feasibility (Bouis & Saltzman, 2021). Nutrition education fosters long-term behavior change and dietary diversification, though its impacts are slower and require sustained efforts (Ghosh, 2022). Systemic approaches addressing the entire food value chain have the potential to create lasting impacts but depend on cross-sectoral collaboration and policy alignment (Neufeld & Cameron, 2022).

Overall, the synthesis reveals that no single strategy suffices. Multidimensional interventions that combine approaches tailored to local contexts are more effective in addressing hidden hunger holistically (Zimmermann & Hurrell, 2020).

172 Conclusion

The findings affirm that addressing hidden hunger requires integrated and context-specific strategies. While fortification, supplementation, and biofortification offer significant benefits, their effectiveness increases when combined with nutrition education and systemic food interventions. Policymakers, health practitioners, and researchers should prioritize collaborative frameworks that combine technical and educational approaches, supported by robust monitoring systems. These efforts are essential to sustainably improve micronutrient status and reduce the global burden of hidden hunger.

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