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Investigation of Sustainability Challenges Faced by Food Fortification Programs Targeting Pregnant Women and Children in Developing Countries

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Abstract

Aim: This review aimed to investigate the sustainability challenges faced by food fortification programs targeting pregnant women and children in developing countries.

Methods: This study employed desktop review of literature. The data sources for this study included academic databases such as Google Scholar as well as reports and policy documents from relevant international organizations such as UNICEF, WHO, and FAO. The search strategy involved a combination of keywords and phrases related to food fortification programs, sustainability, pregnant women, and children.

Results: The study found that one of the biggest challenges facing food fortification programs is funding. Many developing countries lack the resources and infrastructure necessary to establish and maintain food fortification programs. Another challenge facing sustainability of food fortification programs in developing countries is supply chain challenges. Supply chain challenges include issues related to procurement of premixes, transportation and storage of fortified foods, distribution to remote areas, and monitoring and quality control of the fortification process. The study also showed that inadequate enforcement of fortification standards and insufficient monitoring are common challenges facing food fortification programs in developing countries. The study also identified consumer acceptance as challenge facing food fortification programs in developing countries.

Conclusion: The study provides valuable insights into the sustainability of food fortification programs and highlights the need for continued efforts to address the challenges faced by these programs to ensure their long-term success.

Recommendations: To overcome funding challenge, governments, donors, and other stakeholders must work together to ensure that adequate and sustainable funding is available for food fortification programs to continue. To overcome supply chain challenges, supply chain actors must ensure that fortified foods are available and accessible to vulnerable populations.

Keywords: *Food fortification programs, developing countries, sustainability, challenges.*

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INTRODUCTION

Food fortification programs are a form of food intervention strategy that involves the addition of essential micronutrients to food products (World Health Organization, 2006). Fortification involves the addition of specific micronutrients, such as iron, zinc, folic acid, vitamin B12, and vitamin A, to commonly consumed food products such as flour, rice, and cooking oil. Micronutrient deficiencies, also known as hidden hunger, are a major public health concern affecting vulnerable populations globally. According to the Stevens et al. (2022), approximately 2 billion people suffer from micronutrient deficiencies. Food fortification programs are increasingly been adopted in several countries around the world, particularly in developing countries, where micronutrient deficiencies are most prevalent. As an example, 88% of the global population uses iodized salt because diets in many countries cannot provide adequate iodine without iodine fortification of salt (Hatch-McChesney, & Lieberman, 2022).

According to Hatch-McChesney et al. (2022), 124 countries have legislation for mandatory salt iodization and 21 have legislation allowing voluntary iodization. Other examples of fortification program are milk fortification with vitamin D in Canada in 1972, wheat flour fortification with iron and folic acid in Costa Rica in 1999, wheat flour fortification with folic acid in Argentina in 2004, maize flour fortification with iron and folic acid in Mexico in 2006. Also, Morocco implemented a national program to fortify wheat flour with iron, folic acid, and other essential micronutrients in 2003. In 2011, Tanzania implemented a national program to fortify edible oil with vitamin A. In 2012, Kenya implemented a program to fortify milk with vitamin A and D. In 2013, Zambia implemented a program to fortify maize flour with iron, folic acid, and other essential micronutrients (Mannar & Hurrell, 2018).

Globally, particularly in developing countries, food fortification programs have focused on targeting vulnerable populations, such as pregnant women and children. Pregnant women and children are particularly vulnerable to the negative effects of poor nutritional diets (Benton, 2010). Poor nutrition result in stunted growth in children, which ultimately have long-term negative impacts on physical and cognitive development. Poor nutrition also results in cognitive impairments in children, which have long-term negative impacts on educational attainment and economic productivity (Benton, 2010). Additionally, poor nutrition increases the risk of chronic diseases, such as diabetes and cardiovascular disease, later in child's life. In pregnant women, poor nutrition during pregnancy can increase the risk of birth defects, such as neural tube defects, in infants. Also, poor nutrition contributes to anemia, particularly in pregnant women and children. Anemia have significant negative impacts on maternal and child health, including increased risk of maternal mortality and preterm birth, as well as impaired cognitive development in children. Furthermore, poor nutrition weakens the immune system, making pregnant women and children more susceptible to infections (Rahman, 2016).

Addressing poor nutrition in pregnant women and children is critical for improving their health and well-being, as well as for the long-term economic and social development of communities and societies. Effective food fortification programs have been used as one of the strategies for

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addressing poor nutrition. While many of these programs have been successful in improving the nutritional status of vulnerable populations, there are still challenges to be addressed, including ensuring the sustainability of programs, addressing the needs of hard-to-reach populations, and monitoring the impact of programs on health outcomes. This review aimed to investigate the sustainability challenges faced by food fortification programs targeting pregnant women and children in developing countries.

LITERATURE REVIEW

Hossain et al. (2017) conducted a comprehensive review of the sustainability of food fortification programs in developing countries. The study aimed to identify the challenges and factors that affect the long-term sustainability of food fortification programs, with a specific focus on developing countries. The authors identified several challenges that contribute to the lack of sustainability of food fortification programs, including inadequate funding, limited government support, lack of enforcement mechanisms, insufficient monitoring and evaluation, and inadequate stakeholder engagement. The authors also noted that despite the benefits of food fortification programs, some challenges are unique to specific types of fortification. For example, while wheat flour fortification has shown to be sustainable in many countries, salt iodization and oil fortification programs face significant challenges due to lack of consumer demand and production capacity constraints. The authors concluded that addressing these sustainability challenges requires a multi-sectoral approach involving key stakeholders, including government agencies, private sector partners, civil society organizations, and donors. The study provides valuable insights into the sustainability of food fortification programs and highlights the need for continued efforts to address the challenges faced by these programs to ensure their long-term success.

A study by Ali et al. (2016) aimed to evaluate the sustainability of food fortification with folic acid in Uganda through a public-private partnership program. The study was conducted using a mixed-methods approach, including document reviews, key informant interviews, and surveys of salt and wheat flour producers. The target population included salt and wheat flour producers and consumers in Uganda. The study found that the program was well-implemented and successful in reducing the prevalence of neural tube defects, but there were challenges to sustaining the program. One challenge was the lack of enforcement of fortification standards, which led to some producers not fortifying their products. Another challenge was the cost of fortification, which was passed on to consumers, making fortified products less affordable. The study concludes that the sustainability of food fortification programs in developing countries is dependent on several factors, including stakeholder engagement, effective regulatory frameworks, and cost-effective fortification methods. The study recommends the need for continued monitoring and evaluation of food fortification programs to ensure their sustainability and effectiveness in reducing micronutrient deficiencies.

Sablah et al. (2017) conducted a study in Ghana to examine market-level factors that influence industry compliance with food fortification regulations. The study aimed to identify the factors that promote or hinder the adoption of food fortification among food industry players. The authors

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Vol.2, Issue 1, pp 10 – 18, 2023

used a cross-sectional survey of 95 food industries in Ghana, and the data were analyzed using descriptive and logistic regression analyses. The study found that industry size, export orientation, and the use of imported raw materials were positively associated with industry compliance with food fortification regulations. In contrast, limited technical capacity, inadequate quality control measures, and the perceived high cost of fortification were barriers to compliance. The authors concluded that industry compliance with food fortification regulations in Ghana is influenced by both external and internal factors. The study suggests that efforts to improve industry compliance with food fortification regulations should focus on addressing the challenges faced by small and medium-sized enterprises and building the technical capacity of industry players to implement fortification. Overall, the study provides important insights into the factors that affect industry compliance with food fortification regulations and the need for targeted interventions to improve compliance in the food industry.

Another study by Klemm et al. (2016) aimed to investigate the factors associated with low use and non-use of micronutrient supplements among pregnant women in rural Bangladesh. The study used a cross-sectional survey design, and a total of 6,997 pregnant women were included in the study. The data was collected through face-to-face interviews using a structured questionnaire. The study found that only 36% of pregnant women reported using any micronutrient supplements, and only 11% reported using iron-folic acid (IFA) supplements. The study also identified several factors associated with low use and non-use of micronutrient supplements, including low education and income levels, lack of knowledge about the benefits of supplements, and poor access to health services. The authors recommend improving access to health services, increasing awareness about the benefits of micronutrient supplements, and addressing social and economic factors to improve the use of supplements among pregnant women in rural Bangladesh.

Luthra et al. (2021) conducted a study to identify and analyze the supply chain challenges that impact the sustainability of food fortification programs in developing countries. The study used a systematic literature review to identify 67 relevant studies, which were analyzed using a thematic content analysis approach. The authors identified several supply chain challenges that impact the sustainability of food fortification programs, including inadequate infrastructure, logistics, and storage facilities, limited availability of micronutrient premixes, weak regulatory frameworks, and limited funding. The authors also found that there is a lack of coordination and collaboration between stakeholders involved in food fortification programs, which further contributes to the sustainability challenges faced by these programs. Based on their analysis, the authors proposed a conceptual framework for sustainable food fortification that highlights the key supply chain challenges and potential strategies to address them. The study's findings suggest that addressing supply chain challenges is critical for ensuring the sustainability of food fortification programs in developing countries. The authors recommend that stakeholders involved in these programs should collaborate to address the supply chain challenges, improve regulatory frameworks, and increase funding for these programs to ensure their long-term sustainability. Overall, the study provides important insights into the supply chain challenges faced by food fortification programs in developing countries and highlights the need for coordinated efforts to address these challenges.

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Journal of Food Science and Human Nutrition
ISSN 2958 - 4191 (Online)
Vol.2, Issue 1, pp 10 – 18, 2023

A study by Said-Mohamed et al. (2020) aimed at evaluating the sustainability of a food fortification program in Morocco. Using a qualitative approach, the study uses a stakeholder analysis to identify the challenges and opportunities in sustaining the program. Data were collected through in-depth interviews with stakeholders involved in the program, including government officials, industry representatives, and non-governmental organizations. The study found that the fortification program was viewed positively by stakeholders and had improved the nutritional status of the population. However, there were several challenges to the sustainability of the program, including the lack of a legal framework for food fortification, inadequate monitoring and enforcement mechanisms, and insufficient funding for program implementation. The study suggests that addressing these challenges will require collaboration among stakeholders and the development of a comprehensive strategy that incorporates regulatory, monitoring, and financing mechanisms to support the long-term sustainability of the program.

Shankar et al. (2017) examined the sustainability of integrated nutrition and early child development interventions implemented in Cambodia by the NOURISH and GRoW projects. The authors used a qualitative approach, including interviews and focus group discussions with stakeholders, to identify challenges and enablers of sustainability. The findings showed that the success of sustainability efforts depended on the integration of nutrition and early child development interventions, as well as the involvement of various stakeholders, including government agencies, community-based organizations, and private sector partners. The authors suggest that engaging with communities and strengthening local capacity is crucial for sustaining nutrition interventions in the long-term. They also emphasize the importance of integrating nutrition and early child development interventions into existing health systems and policies.

Another study by Tariq, Siddiqui, Khalid, and Saadia (2017) aimed to identify the factors affecting the sustainability of food fortification programs in Pakistan, using a stakeholder analysis approach. Data were collected through in-depth interviews with 30 key informants from different sectors involved in the food fortification programs. The study found that the main factors affecting the sustainability of food fortification programs in Pakistan include limited government commitment, lack of enforcement of food safety regulations, weak inter-sectoral coordination, limited consumer awareness, and low demand for fortified foods. The study suggested the need for increased political will, improved enforcement of food safety regulations, and increased consumer awareness to enhance the sustainability of food fortification programs in Pakistan.

Also, Zandvakili et al. (2019) examined the sustainability of Iran's national iodine deficiency disorders (IDD) control program by using a qualitative study. The program was implemented in 1989 and included a salt iodization program, monitoring and evaluation, and education and communication activities. The study involved 45 participants, including policymakers, managers, experts, and stakeholders in the field of nutrition, health, and salt production. Data were collected through semi-structured interviews, and the results were analyzed using the content analysis method. The findings showed that the program had made significant progress in addressing iodine deficiency in Iran, and most stakeholders believed that the program was sustainable. However, the program faced some challenges, such as the lack of a specific budget allocation for monitoring and

Journal of Food Science and Human Nutrition
ISSN 2958 - 4191 (Online)
Vol.2, Issue 1, pp 10 – 18, 2023

evaluation, inadequate training for personnel, and the failure to engage the private sector in salt iodization. The study recommends addressing these challenges to ensure the sustainability of the program.

METHODOLOGY

This study employed desktop review of literature. The data sources for this study included academic databases such as Google Scholar as well as reports and policy documents from relevant international organizations such as UNICEF, WHO, and FAO. The search strategy involved a combination of keywords and phrases related to food fortification programs, sustainability, pregnant women, and children. The search was limited to articles published in English between the years 2010 and 2022. Studies were selected based on pre-defined inclusion and exclusion criteria. Included studies focused on sustainability challenges faced by food fortification programs targeting pregnant women and children in developing countries. Excluded studies included those that do not address sustainability challenges. Data was extracted from included studies using a standardized form that included information on study design, population, interventions, outcomes, and sustainability challenges identified.

SUMMARY OF FINDINGS

The review of literature has shown that one of the biggest challenges facing food fortification programs is funding (Hossain et al., 2017; Luthra et al., 2021; Said-Mohamed et al., 2020). Many developing countries lack the resources and infrastructure necessary to establish and maintain food fortification programs. These programs often require a significant investment of resources to ensure the continuous fortification of foods with essential micronutrients. The cost of fortification includes expenses for infrastructure, equipment, training, quality control, and monitoring, among other things. In addition, securing ongoing funding for these programs can be difficult, especially as other competing health priorities may arise. Without adequate funding, the sustainability of these programs is compromised, which result in reduced access to fortified foods and negative health outcomes for populations that rely on them.

Another challenge facing sustainability of food fortification programs in developing countries is supply chain challenges (Luthra et al., 2021). Supply chain challenges include issues related to procurement of premixes, transportation and storage of fortified foods, distribution to remote areas, and monitoring and quality control of the fortification process. The authors also found that the costs associated with supply chain challenges were increased the cost of fortification, which was passed on to consumers, making fortified products less affordable. Without a well-functioning supply chain, it is difficult to ensure that fortified foods reach the intended populations and maintain their nutrient content throughout the distribution process.

The review of literature also showed that inadequate enforcement of fortification standards and insufficient monitoring are common challenges facing food fortification programs in developing countries (Ali et al., 2016; Hossain et al., 2017; Said-Mohamed et al., 2020; Zandvakili et al., 2019). These factors can lead to inconsistent quality and quantity of fortification in foods, which

Journal of Food Science and Human Nutrition
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Vol.2, Issue 1, pp 10 – 18, 2023

can in turn lead to inadequate intake of essential micronutrients by the population. Without proper standards and monitoring, there is a risk of both over-fortification, which can lead to toxicity, and under-fortification, which render the program ineffective. Without proper monitoring and enforcement, it is also difficult to identify and address any issues or gaps in the program, which hinder its long-term sustainability.

The literature review also identified consumer acceptance as challenge facing food fortification programs in developing countries (Klemm et al., 2016; Zandvakili et al., 2019; Tariq et al., 2017). Consumers may not be aware of the benefits of fortified foods, may not trust the safety and quality of fortified foods, or may prefer traditional foods over fortified foods. Additionally, some fortified foods may have a different taste or texture that is not preferred by consumers hence low demand for fortified foods. Also, fortified foods are not always be culturally acceptable or are be too expensive for certain populations. This leads to low demand and poor uptake of the fortified products, making the program unsustainable. For example, while wheat flour fortification has shown to be sustainable in many countries, salt iodization and oil fortification programs face significant challenges due to lack of consumer demand.

CONCLUSION

The study aimed to identify sustainability challenges faced by food fortification programs targeting pregnant women and children with a specific focus on developing countries. The reviewed studies provide valuable insights into the sustainability of food fortification programs and highlights the need for continued efforts to address the challenges faced by these programs to ensure their long-term success. Whereas majority of studies showed that fortification program was viewed positively by stakeholders and had improved the nutritional status of the population, there were several challenges to the sustainability of the programs.

The authors identified several challenges that contribute to the lack of sustainability of food fortification programs, including inadequate funding, limited government support, lack of enforcement mechanisms, insufficient monitoring and evaluation, and inadequate stakeholder engagement. The authors also noted that despite the benefits of food fortification programs, some challenges are unique to specific types of fortification. For example, while wheat flour fortification has shown to be sustainable in many countries, salt iodization and oil fortification programs face significant challenges due to lack of consumer demand and production capacity constraints. The authors concluded that addressing these sustainability challenges requires a multi-sectoral approach involving key stakeholders, including government agencies, private sector partners, civil society organizations, and donors.

RECOMMENDATIONS

1. To overcome funding challenge, governments, donors, and other stakeholders must work together to ensure that adequate and sustainable funding is available for food fortification programs to continue. Therefore, it is essential to identify and secure sustainable funding mechanisms to ensure the continued success of food fortification programs.

Journal of Food Science and Human Nutrition
ISSN 2958 - 4191 (Online)
Vol.2, Issue 1, pp 10 – 18, 2023

2. To overcome supply chain challenges, supply chain actors must ensure that fortified foods are available and accessible to vulnerable populations. This requires a well-functioning supply chain, from the production and fortification of the food to the distribution and sale of the fortified products.
3. To overcome inadequate enforcement of fortification standards and insufficient monitoring
4. Governments should strengthen the regulatory framework for food fortification and set up monitoring mechanisms to ensure compliance with fortification standards. Also, governments in developing countries should build the capacity of regulatory agencies, food manufacturers, and other stakeholders involved in food fortification to ensure they have the necessary skills and knowledge to implement and monitor fortification programs.
5. To overcome consumer acceptance challenge, campaigns encouraging behavior change and educating populations on the benefits of fortified foods should be promoted.

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Conflicts of Interest

The authors declare no conflict of interest

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