Shaping food environments to support sustainable healthy diets in low and middle-income countries

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The global ambitions to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture demand a complex transition of the current food environments for enabling sustainable healthy diets. The food environments in Low and Middle-Income Countries (LMICs) have been experiencing rapid and dynamic transitions across the globe, necessitating a system-level thinking and systemic approach to understand opportunities for improvement. There is a need for valid, reliable measures of food and nutrition environments for reorienting thinking and data collection toward determinants of food demand, especially the food environment components, which are critical to understand the transforming food systems. Food environment transformations are urgently required to provide consumers with more affordable and nutritious diets capable of meeting social and environmental challenges. In the present perspective, we aim to provide insights on prioritizing research on understanding and designing evidence based inclusive food environments which is crucial for promoting long-term food system innovations that are economically, socially, and environmentally sustainable and, above all, contribute to sustainable healthy diets.

KEYWORDS

food environment, framework, sustainable healthy diet, low and middle-income countries (LMICs), food system

Introduction

During the past few decades, the food system dynamics in low and middle-income countries (LMICs) have been evolving rapidly. The Global Panel on Agriculture and Food Systems for Nutrition (GLOPAN), the United Nations (UN) High-Level Panel of Experts on Food Security and Nutrition (HLPE), and several recent studies and landmark reports (UNICEF., 2021; WFP, 2022) emphasize an immediate need to transform food systems which are currently broken. The current food systems are unable to provide sustainable and adequate nutrition equitably mainly due to disorganized agricultural intensification, over emphasis on industrialization and commercialization of food with inadequate priority to address food insecurity and malnutrition, equitable access to food, resource and environmental degradation, and changing consumer behavior. To overcome these challenges, a robust analytical framework applicable to food systems and their components is needed to design and implement appropriate interventions that will promote sustainable production, equitable food distribution, and address nutrition deficiency and hunger, especially in the developing countries.

There is need to undertake extensive studies to understand complex linkages within the food systems and their components. Such evidence base would be critical to design interventions to improve the broken food systems. According to the existing literature, the food system consists of four broad components: stakeholders of food systems, domains of food systems, drivers of food systems, and outcomes of food systems (High Level Panel of Experts on Food Security Nutrition., 2017; De Brauw et al., 2019). The food environment[1] is one of the core components under the domain of the food systems. Therefore, research to better understand the food environment is imperative to fix the broken food systems, especially in the context of the first action area-sustainable, resilient food systems for healthy diets, of the UN Decade of Action on Nutrition 2016–2025[2]. However, in practice, hardly any systematic information is available on the food environments, especially in LMICs. A lack of integration of such knowledge and perspective makes the relevant policies much weaker. Therefore, enabling a deeper understanding of the food environments is increasingly becoming essential to elucidate its complexities and improve diets and address malnutrition.

The aim of this perspective is to strengthen the narrative around importance of building evidence based inclusive food environments. Objectives of this perspective are 2 fold; first is to see briefly the areas on which researchers are working to understand and improve the food environment in LMICs and the second is to identify the priorities for food environment research for development in LMICs.

Following this brief introduction, we have discussed the brief overview of existing research on food environments and then we have discussed the need to prioritize the food environment research in the next section, followed by conclusions.

Brief overview of existing research areas on the food environment in LMICs

Some research has been conducted on the topic of food environments in LMICs over the past couple of decades, with a focus on understanding the intricate interplay between various factors and their impact on individual people and communities. This research has shed light on the complex challenges that the communities in LMICs face when it comes to accessing healthy and affordable food,

and also highlights factors that contribute to food insecurity and malnutrition.

To gain a deeper comprehension of research on food environments, we can categorize it into two primary areas[3]: (a) Research on facts and frameworks to understand food environment interactions; (b) Research on policy interventions to improve food environments.

Both areas of research are important for understanding and addressing the complex and multifaceted challenges of the food environments in LMICs. In the following section we briefly discuss the major work streams under these categories:

Facts and frameworks to understand the food environment interactions

To promote a unified approach to food environment research, policies, and interventions, various authors have developed conceptual frameworks (Kanter et al., 2015; Turner et al., 2018, 2020; Downs et al., 2020; Bogard et al., 2021; Constantinides et al., 2021; Osei-Kwasi et al., 2021; Toure et al., 2021). These frameworks offer a clear and concise visual representation that links theoretical concepts with empirical research, enabling us to better comprehend the connections and relationships between food environment concepts, food choice, and nutrition and health outcomes. A comprehensive and flexible food environment framework allows us to evaluate the impact of physical, economic, political, and sociocultural contexts on people's interactions with the food system. It enables us to better understand how individuals make decisions about obtaining, preparing, and consuming food (Herforth and Ahmed, 2015; Downs et al., 2020; Lingham et al., 2022). The food environment framework offers valuable insights into the underlying factors that drive food consumption patterns. This framework also sheds light on the various pathways that influence food acquisition and consumption (Chen and Antonelli, 2020; Turner, 2020). Along with this framework, developing, testing, and validating standardized instruments and metrics to profile food environments in LMICs is crucial for understanding the diverse, complex and dynamic food environment that exists in these contexts. These standardized instruments and metrics can provide a comprehensive picture of the food environment by measuring and analyzing key indicators of food availability, accessibility, affordability, and quality (Ahmed et al., 2021). This can lead to informed evidence-based policies and interventions aimed at improving food security and nutrition outcomes (Ohri-Vachaspati and Leviton, 2010; Johnston et al., 2014; Herforth and Ahmed, 2015; Nguyen B. et al., 2021). Monitoring environmental footprints across the food systems is a crucial component of understanding the governance of food environments as the production, processing, transportation, and consumption of food are major drivers of environmental degradation and climate

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1 Food environments are the physical, economic, political, and sociocultural contexts in which people engage with the food system to make their decisions about acquiring, preparing, and consuming food. Therefore, food environments are spaces in which people make decisions about food. Food environments determine the availability, accessibility, affordability, and desirability of different foods. They are the interface between individuals and the broader physical, economic, political, and sociocultural drivers of the food system (Swinburn et al., 2013; Turner et al., 2018).

2 https://www.who.int/docs/default-source/nutritionlibrary/departmental-news/mid-term-review—un-decade-of-action-on-nutrition/nutrition-decade-mtr-foresight-paper-en.pdf?sfvrsn=c3c14085_4

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3 Basic structure of this distribution has been adopted from the Laar et al. (2022). It may be noted that neither this list is an exhaustive list, nor the cited literature is exhaustive one. Objective was to broadly identify the current research areas which help us to discuss the future priority areas of research with more clarity.

change, and can have significant impacts on the availability, accessibility, and affordability of nutritious foods (Kennedy et al., 2021).

Understanding consumer behavior is critical to identify the factors that influence consumers' choices in the context of local food environments and digital food environments[4]. The drivers of consumer behavior in these environments include individual, social, and environmental factors such as culture, personal preferences, social norms, convenience, and accessibility (Granheim et al., 2022; Turner et al., 2022). These factors influence consumers' livelihood and nutrition by shaping their food choices and dietary patterns. The local food environment provides consumers with access to fresh and healthy foods, while digital food environments offer convenience and accessibility (Granheim et al., 2022; Turner et al., 2022). Further, the commercial determinants of nutrition and health are important factors that influence individuals' dietary choices, particularly in LMICs. These determinants include the food industry's marketing and advertising practices, the availability and affordability of unhealthy foods, and the influence of multinational corporations (Clapp, 2021; Granheim et al., 2022). In LMICs there is growing evidence of associations between unhealthy/ultra-processed foods (added sugars, salt, and unhealthy fats) and the dietary, nutrition, and health outcomes. The negative health impacts of unhealthy/ultra-processed foods are of particular concern in LMICs, where rates of non-communicable diseases are increasing rapidly, and often multiple forms of malnutrition coexists within the populations (Popkin and Ng, 2022), especially in the child and young population (Carducci et al., 2021). Fast food marketing is successfully reaching children in developing and emerging economies using similar techniques as in developed economies (Witkowski, 2007). Children are heavily exposed to food marketing, particularly on television, promoting unhealthy, highly processed foods with appealing branding. This poses a significant danger to public health (Harris et al., 2009). Besides this formal sector, the informal sector plays a crucial role in shaping local food environments in LMICs. This sector encompasses various unregulated and non-formal economic activities, such as street vending, home-based food processing, and small-scale farming (Nguyen T. et al., 2021).

Research on policy interventions to improve food environments

The policy research related to food environments has to be primarily centered around ensuring that people have access to food and beverages that are safe, healthy, and convenient. The research on food environment policies can be conveniently classified into two categories: the first focuses on policy interventions at the individual and community levels, while the second

investigates policy interventions at the macro (province or national) level.

Policy research at community/individual level

The development of effective strategies for promoting healthy diets (World Health Organization, 2019) is critical for reducing the burden of diet-related chronic diseases. Multiple strategies are needed at different levels to promote healthy diets and reduce the prevalence of diet-related chronic diseases in the communities. One approach that has been suggested is the use of nudges, which can encourage consumers to make healthier food choices in various commercial and institutional settings (Ruben et al., 2020). At the community level, it is important to raise awareness about the benefits of consuming locally generated nutritious foods while also highlighting the potential harms of consuming processed and ultra-processed foods (Herforth and Ahmed, 2015). Communities can also ensure access to safe, healthy, and convenient foods and beverages, particularly for individuals who have limited food preparation time (Brouwer et al., 2021). Identifying community-level priorities for their local food environments and establishing public-private partnerships to serve these needs can also be effective in promoting healthy diets (Thow et al., 2018; Yu et al., 2018). Furthermore, local governments can play a significant role in discouraging the consumption of low-cost and unhealthy processed foods through policies and regulations, as demonstrated by Mozaffarian et al. (2018) and Aylward et al. (2022).

Policy research at macro level

Transforming food environments requires cross-sectoral policy actions and convergence pathways to address the challenges posed by the triple burden of malnutrition. One of the first steps toward this goal is mapping community food environments and identifying community-level context-specific nutrition and dietary policy and implementation strategy. These strategies can be developed and implemented at the community level through collaborations between various stakeholders such as policymakers, public health experts, and community members (Baker et al., 2020; Laar et al., 2020, 2022). Fiscal policy can play a critical role in promoting healthy diets by offering subsidies to producers or consumers of healthy food and imposing taxes on unhealthy food. For instance, subsidies on fruits, vegetables, and whole grains can help to lower their price and increase their accessibility, while taxes on sugary drinks, snacks, and other unhealthy foods can discourage their consumption. Such policy measures can improve accessibility to healthy and sustainable diets, thereby contributing to reducing the prevalence of malnutrition. However, it is important to assess the impact of such measures on the triple burden of malnutrition, including undernutrition, overweight and obesity, and micronutrient deficiencies. This requires a comprehensive evaluation of the direct and indirect effects of fiscal policy on food prices, consumption patterns, and health outcomes (Gómez et al., 2013; DeFries et al., 2018; Mockshell et al., 2021). To evaluate the effectiveness of interventions, there is need to conduct robust longitudinal and experimental studies at multiple scales that assess the multi-dimensional impact on diets,

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4   Digital food environments are the online settings through which flows of services and information that influence people's food and nutrition choices and behavior are directed. They encompass a range of elements, including social media, digital health promotion interventions, digital food marketing and online food retail (World Health Organization, 2021a).

nutrition status, and health outcomes. Such studies can provide critical evidence on the effectiveness of different interventions and would help policymakers to design evidence-based policies that can lead to better health outcomes (Keats et al., 2019; Turner et al., 2020). Furthermore, effective nutrition literacy policies can increase awareness and encourage healthier diets across commercial and institutional channels, as well as locally generated healthy nutritious food. Nutrition literacy policies can include nutrition education programs, labeling requirements, and nutrition information campaigns that target different population groups. These policies can help to improve food choices and eating habits by promoting healthy and sustainable diets (Aldaya et al., 2021; World Health Organization, 2021b). Finally, it is important to identify and promote innovations that stimulate demand for sustainable and healthy diets. These innovations can include new products, services, and business models that promote healthy and sustainable food consumption. For instance, food delivery services that provide healthy and sustainable meals can increase accessibility to healthy food and reduce the need for unhealthy food options (Dwivedi et al., 2017; De Brauw et al., 2019). By adopting these cross-sectoral policy actions and convergence pathways, it is possible to transform food environments and reduce the prevalence of malnutrition.

Need to prioritize the food environment research

LMICs' food environments are undergoing rapid changes, presenting a massive challenge to food environment research. The assessment, monitoring, and evaluation of food environments and the implementation relevant policies in LMICs is a complex task due to the lack of standardized metrics and methods, proper data and implementation strategy. Instruments specific to the LMICs' settings are still under development, as the unique and multifaceted nature of their food environments makes it challenging to establish common terms and definitions. Hence there is a need for prioritizing the food environment research specially in the following the areas:

Development of measurable holistic framework

The food environments in LMICs are influenced by a wide range of complex variables that include seasonal cycles, economic and climate shocks, gender and social biases, cultural circumstances, conflicts, infrastructural disparity, the multiplicity of supply chain actors, religion, policy, education, networks, and human capital and weak institutions. Along with these factors, the presence of various food sources, such as market-based vendors, informal food vendors, and non-market-based food sources, and the small scale of food businesses, add another layer of complexity to the research. Even though many frameworks have been developed for describing or understanding relationships between agriculture and nutrition, they have often

been oriented toward project design and implementation or focus on sub-sections of the food environment without adequate attention to big-picture linkages which are frequently needed for consideration by policymakers. Effective policies to transform food systems cannot be designed and implemented without a holistic understanding of the food environments. These factors make the food environment in LMICs distinctly different from high-income countries (HICs) and require a specialized approach to understand and assess them. The lack of standardized metrics and the presence of various non-measurable variables further exacerbate the complexity of researching the food environment in LMICs.

Hence there is a need for a comprehensive structural framework that allows an interdisciplinary approach to understanding the interactions among different domains and elements of food environments and the food system to promote effective interventions to improve nutrition and health outcomes in these settings.

Collection of comprehensive and reliable data

The availability and reliability of data are critical for understanding the food environment in LMICs. Unfortunately, there is a significant lack of coherent data on various dimensions of the food environment in these settings. The lack of reliable data on logistics, storage, and marketing is a significant issue in LMICs. Detailed datasets that contain geotagged information about food vendors are also limited, if not entirely non-existent. This lack of data makes it difficult to assess the location and density of food outlets in a given area and hinders efforts to identify food deserts or other areas that lack access to healthy food options.

Additionally, food and nutrition regulations and documentation may be less readily available in LMICs. The lack of regulatory oversight and documentation makes it difficult to monitor the quality of food sold in markets and restaurants, leading to a higher risk of foodborne illnesses and other health problems. The absence of reliable data also makes it challenging to assess the impact of various interventions aimed at improving the food environment in LMICs.

Furthermore, the absence of data on the food environment in LMICs can lead to a lack of political will to make changes in the food system. Inadequate data can also hinder efforts to secure funding for food-related research and interventions.

Therefore, it is essential to prioritize the collection of comprehensive and reliable data over time on various dimensions of the food environment in LMICs. This data should include information on the location and density of food outlets, the availability of healthy food options, food safety, quality, and food and nutrition regulations. Collecting this data will enable policymakers, researchers, and stakeholders to better understand the food environment in LMICs, and develop evidence-based interventions, and ultimately promote positive nutrition and health outcomes in these settings.

Policy implementation strategy

Suitable policy development can be one of the most important instruments to improve the food environment in the LMICs. However, policymakers and researchers often face significant challenges in designing and implementing appropriate policies in the field due to the highly diverse contexts of LMICs. This is particularly true when it comes to food-related policies, as the food environment is influenced by a multitude of factors, including social, cultural, religion, economic conditions, and political stability.

To successfully implement policies aimed at improving the food environment in LMICs, it is necessary to develop a comprehensive implementation strategy that takes into account the unique challenges faced by extension agents in the field. These challenges may include limited resources, cultural barriers, and logistical difficulties. Without proper research on the implementation strategy, policy development may fail to yield the desired outcomes.

Furthermore, it is essential to involve local communities and stakeholders in the policy development and implementation process. The involvement of these groups can help to ensure that policies are culturally appropriate and meet the needs of local populations. It can also help to build trust between policymakers and local communities, and facilitate the successful implementation of policies.

Research on effective policy implementation in LMICs requires a holistic approach that takes into account the complex and diverse nature of the food environment. This approach should involve robust research on implementation strategies, appropriate business models for engaging local communities and stakeholders, and a commitment to building strong partnerships among policymakers, researchers, and extension agents.

Conclusions

This perspective builds a narrative that there is an urgent need for systematic research to understand the complex interactions and connections among different elements of the food environment and the broader food system to achieve sustainable healthy diets in LMICs. The current understanding of the food environment in LMICs is still in its early stages. We argue that the future research need to promote a comprehensive structural framework that allows an understanding of interactions among different domains, generating coherent evidence monitored through key performance indicators and developing evidence based actionable policies for implementation to improve the food environments. It needs to integrate qualitative and quantitative findings to develop new hypotheses and refine ongoing studies. By doing so, policymakers can develop effective policies that can improve the food environment and promote sustainable positive nutrition and health outcomes. The conceptual nature of our proposition is its limitation and it can continue to evolve when implemented on the ground in the LMICs.

Author contributions

SK: conceptualization, review and editing, supervision, and funding acquisition. AD and KK: conceptualization and original draft. BR: review and editing. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

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