

Understanding drivers of food choice in low- and middle-income countries: A systematic mapping study

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ABSTRACT

Understanding individual-based motives governing food choice is necessary to design appropriate interventions and support food systems consistent with consumer characteristics, preferences and values. We used a systematic mapping approach to identify and systematize available evidence on drivers of food choice in low- and middle-income countries. We identified a list of forty (40) individual-based motives which were sorted into seven (7) clusters with a focus on health and nutrition perceptions, psychological factors, sociocultural factors, sensory appeal, social interactions, socio-demographic variables, and ethical concerns. We mapped the clusters and dimensions of the food environment, as well as the geographical locations of the reviewed studies. Most studies focused on adults and women in particular, especially those investigating the role of cultural-based food taboos and diet restrictions. Studies related to the dimensions of the food environment focused on food affordability, convenience, food availability and promotional information. Sub-Saharan Africa was the most studied region for understanding drivers of food choice followed by East Asia and Pacific and South Asia. Heatmaps of the current evidence across rural-urban landscapes revealed that existing studies are skewed towards urban settings with a dearth of studies in rural and peri-urban contexts. Based on our review, we highlight areas for future research such as food safety and ethical concerns for environmental sustainability, food waste, and animal welfare. There is a need for systemic research frameworks that contextually appreciate rural-urban and consumer-producer linkages, to inform a leverage point for more targeted interventions in promotion of healthier diets.

1. Introduction

Many low and middle income countries (LMICs) are in the process of a nutrition transition and are experiencing shifts in their food systems as a result of demographic change, rapid urbanization, supermarket expansion and globalization of agricultural markets and trade (HLPE, 2020; Popkin, 2017, 2009). This transition is also associated with malnutrition in all its forms (undernutrition, micronutrient deficiencies, overweight and obesity) and diet-related non-communicable diseases that remain a major impediment to achieving global food security and sustainable development (FAO et al., 2020; HLPE, 2017). The concept of healthier diets has gained traction in the international policy discourse and has been incorporated into the Sustainable Development Goals framework (SDG 2), and the UN Decade of Action on Nutrition 2016–2025, which provide global and national impetus to address malnutrition and universal access to sustainable diets (UN, 2016).

Diets, nutrition and health outcomes are, in part, consequences of interrelated food choice factors which poses challenges for implementing interventions aimed at addressing malnutrition and dietary challenges in LMICs (FAO and WHO, 2019). Food choice is defined as a process by which people select, acquire, prepare and consume foods, which results from the competing, reinforcing and interacting influences of a variety of factors (Shepherd et al., 2006). The decision-making process governing food choices has been increasingly understood in the context of the dimensions of the food environment (Downs et al., 2020; Herforth and Ahmed, 2015; Turner et al., 2018; Wertheim-Heck and Raneri, 2019). The food environment which describes the spaces within which consumers interact and make decisions about what to acquire, prepare and consume, is defined by physical and economic access, quality of foods, convenience and exposure to marketing information (Downs et al., 2020; HLPE, 2017). Lesser attention has been given to individual-based motives of food choice which form important

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pressure points for shifting the supply-side components of the food system in response to consumer needs (Fanzo and Davis, 2021). These individual-based motives are shaped by consumer preferences, socio-economic conditions, the social environment, psychological factors, attitudes and cultural relevance (Blake et al., 2021; Perignon et al., 2017). Understanding the underlying individual-based motives in food choices could inform a leverage point for more targeted consumer behavioral interventions in the promotion of healthier diets (Herforth and Ahmed, 2015; Spiker et al., 2020).

Consumers are key actors in any food system, and their interaction with the food environment offers an entry point for understanding what, where, when, how and why food choices are made (Downs et al., 2020; Herforth and Ahmed, 2015; Wertheim-Heck and Raneri, 2019). People are often faced with diverse food options and situational contexts (Chen and Antonelli, 2020), and the importance of some factors may change in varying contexts and shift over the lifecycle (e.g. from childhood, adolescence to adulthood, pregnancy etc.). These contextual dynamics include spatial and seasonal availability of food (Cruz-Garcia and Struik, 2015; McMullin et al., 2019) or the development of mass/social media marketing and advertising (Simeone and Scarpato, 2020) that can influence peoples' food choices. Despite this general understanding of the complexity of food choice processes, the underlying heterogeneity and relevance of different factors in LMICs is not as well understood compared to these processes in high income countries. A more systemic understanding of potential determinants of food choice and the underlying differences across geographical locations, rural-urban landscapes and population groups must be taken into account by initiatives aimed at promoting healthier diets and modification of other parts of the food system including food production models and markets (FAO and WHO, 2019).

There have been a number of review studies and syntheses aiming to understand determinants of food choice and consumption behavior. Some reviews have focused on one part of the food system such as the food environment (Ahmed et al., 2021; Constantinides et al., 2021; Downs et al., 2020; Larson and Story, 2009; Liguori et al., 2022; Penney et al., 2015; Turner et al., 2018), individual-based motives (Cecchini and Warin, 2016; Enriquez and Archila-Godinez, 2021; Escaron et al., 2013; Feeney, 2011; Filser, 2006; Kotler et al., 2012; Marcano-Olivier et al., 2020; Monterrosa et al., 2020), countries in the global north (Krølner et al., 2011; Osei-Kwasi et al., 2016) or by providing a global-scale overview (Bucher et al., 2016; Chen and Antonelli, 2020; Grunert et al., 2012; Sobal and Bisogni, 2009). Despite the many studies considered in these reviews, there are still knowledge gaps due to the limited coverage of studies across geographical contexts, rural-urban landscapes and target population groups. Understanding this complexity and how it relates to the LMIC context requires an integrated framework and an overall contextual understanding of the interplay between different types of influences. This mapping review examines the current evidence from LMICs where a nutrition transition and rapid increase in diet-related non-communicable diseases are under way. This review maps studies across different regions, identifies gaps and provides a structure for understanding how individual-based motives and the food environment affect food choices.

This paper aims to systematize the disparate and highly fragmented research about food choice motives in LMICs. The specific objectives are to:

- categorize the potential drivers of food choice processes related to individual-based motives and dimensions of the external food environment;
- use heatmaps to illustrate and highlight the scope of the current evidence and distribution of studies across geographical regions, rural-urban landscapes and target population groups; and
- synthesize key findings, identify evidence gaps and propose future research priorities for food choice research in LMICs.

2. Methodology

2.1. Research approach

We adopt a systematic mapping approach to identify and systematize the available research on drivers of food choice in LMICs. Systematic mapping reviews are increasingly perceived as robust approaches to structure a research area, describe the scope of available evidence and identify evidence gaps within the literature (James et al., 2016; Petersen et al., 2015). Our mapping review is comprised of three methodological steps:

- identification of search terminologies and evaluation criteria (Sections 2.3 and 2.4);
- selection and screening of articles according to evaluation criteria (Section 2.5);
- data extraction, analysis and mapping the scope and distribution of current evidence (Section 2.6).

2.2. Conceptual framework

Several conceptual models have been inductively developed using qualitative research to understand food choice motives by which people consider, acquire, prepare and consume foods (e.g. (Connors et al., 2001; Furst et al., 1996; Sobal and Bisogni, 2009). Furst et al. (1996) proposed a model consisting of three major components including past experiences with food, sociocultural and physical environments to which a person is exposed. Other models feature the role of food properties, attitudes and socio-economic factors (Connors et al., 2001; Shepherd, 1999; Steenkamp, 1993; Steptoe et al., 1995). Food properties (e.g. sensory appeal) can trigger physiological effects (e.g. hunger, aversion) that directly contribute to the formation of attitudes and decision-making under the influence of socio-economic contexts (e.g. food price, income) and cultural relevance. The components of these models are not mutually exclusive as they overlap and interact to clarify how individual-based motives affect food choice. In recent years, literature syntheses have enriched earlier proposed conceptual models with different components through which individuals interact with the food environment to acquire, prepare and consume food (Ahmed et al., 2021; Blake et al., 2021; Constantinides et al., 2021; Downs et al., 2020; Turner et al., 2018). For instance, Downs et al. (2020) and Turner et al. (2018) elaborated the role of the food environment in the context of food availability, physical and economic accessibility (affordability), convenience, food quality/safety and promotional information.

2.3. Search strategy

An iterative scoping exercise and consultation within the author-group was carried out to develop a search strategy and identify a list of search terms appropriate to the research question (Table 1). Literature searches were carried out in the electronic databases Web of Science and

Table 1
Categories of search terms from initial scoping.

Main search terms	Expanded terms
driver*	OR factor* OR motiv* OR facilitat* OR determin* OR constrain* OR barr*
AND "Food choice"	OR "food prefer*" OR "diet choice*" OR "diet prefer*" OR "food consum*" OR "food select*" OR "food habit*" OR "food decision*" OR culinary
OR "Food environment"	OR "physical environment" OR market* OR vendor* OR convenien *OR availab* OR access* OR afford* OR "food safety" OR "food quality" OR retail OR season* OR cost* OR price* OR advert* OR promot* OR brand* OR label* OR obesogenic OR "food desert*" OR "food swamp*" OR supermarket*

Scopus. In addition, Google Scholar was used to identify publications not indexed in these portals. The reference lists of included literature were reviewed alongside data extraction to identify studies missed by electronic searches. Electronic database searches were carried out from September to December 2020, while the screening of reference lists continued up until the end of January 2021. Retrieved studies were added to Mendeley referencing software; catalogued by recording the key bibliographic information and exported to an excel database. To identify the literature, we conducted an exhaustive search of all relevant publications following PRISMA-based principles (Liberati et al., 2009; Moher et al., 2015) (see Fig. 1).

2.4. Eligibility criteria

To be eligible for inclusion, the study title, abstract and keywords included ≥ 1 of the search terms identified in Table 1 and featured ≥ 1 LMIC based on country classifications according to the World Bank's

country income classification of 2020 (World Bank, 2020). We focused on peer-reviewed articles published in English language until December 2020. Observational and experimental studies using quantitative, qualitative or mixed methods (combination of qualitative and quantitative data methods) were included. We excluded studies examining dietary intake without describing the motivations and reasons why decisions to acquire, prepare or consume the food were made. However, any studies that identified an association between a factor of food choice and dietary intake were retained. All studies that did not meet the above-described criteria were excluded from further review.

2.5. Screening

There were two stages of screening of the selected articles. The initial screening for study inclusion or exclusion consisted of simple coding decisions on titles and abstracts. At this stage, sub-categories were used to justify the decision to include or exclude a study, which were intended

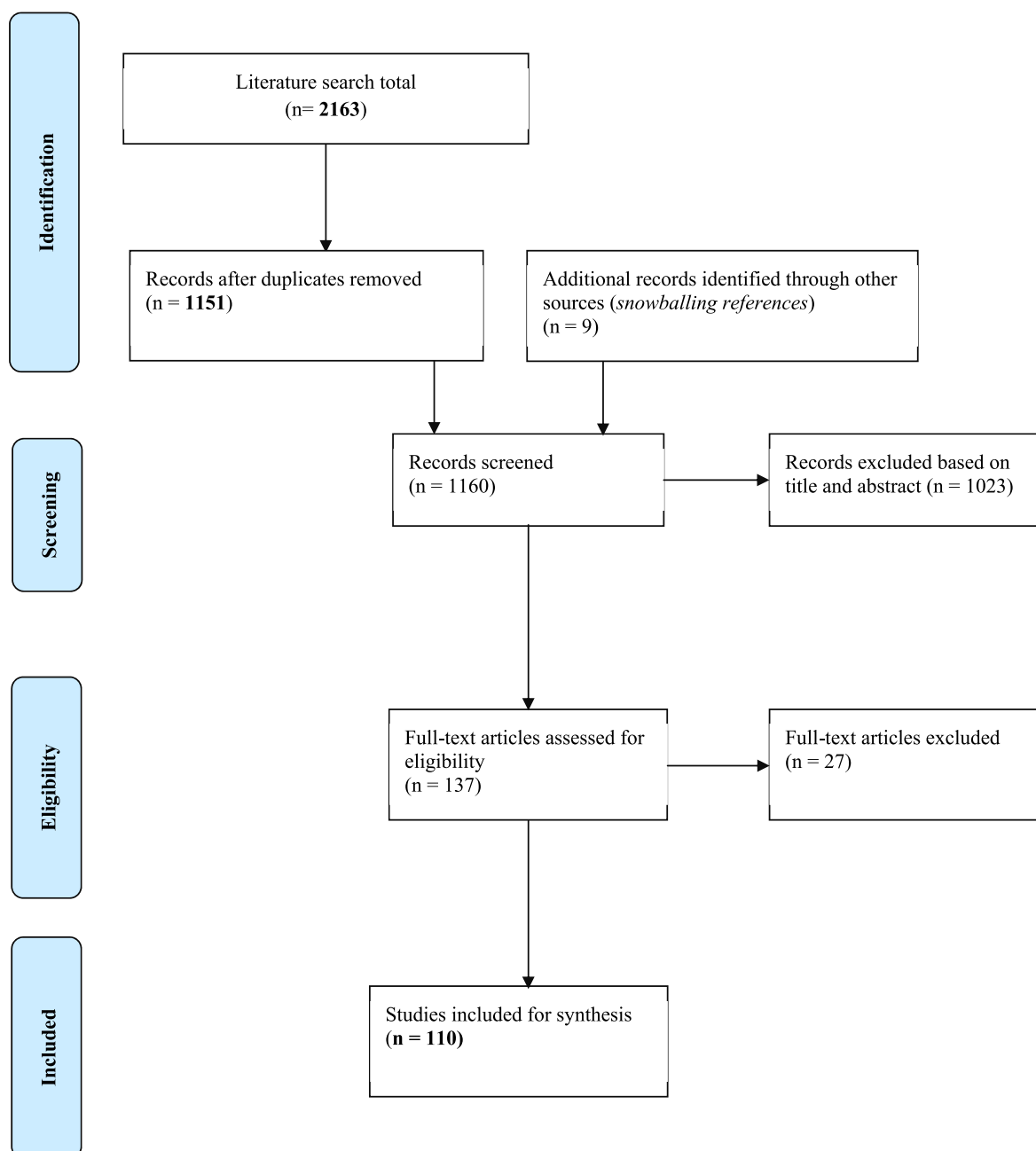


Fig. 1. PRISMA-driven flowchart for selection of studies included in the systematic mapping of drivers of food choice in LMICs.

to be a logical guide to the overall decision-making process. For example, “exclude – not featuring LMIC” or “exclude – not on topic.” At the full-text screening stage, all records in the literature pool were screened independently by authors AK and BS against eligibility criteria (Section 2.2). The screening stage involved guidance from authors AI and SMcM. Cases of disagreement were resolved by discussion until consensus was reached. If one study led to more than one publication presenting the same data, only one publication record was included for data extraction and synthesis. However, if publication records presented different data from a single study, all records were included.

2.6. Data extraction and synthesis

Following full-text screening, data were extracted using a standardised data extraction spreadsheet designed in MS. Excel. A draft data extraction form was piloted and modified following discussion among co-authors. Data charting was completed with a focus on title, author(s), year, study design, study aim, study setting (rural/urban/peri-urban¹), country, sample characteristics (age, sex, socioeconomic indicators), methods (sample size, sampling strategy, study design, method of measurement and analysis), research measures (individual-based motives or food environment) and a summary of core findings and author-recommended avenues for future research.

Data were grouped and analysed according to relevant elements of (i) individual-based motives and (ii) dimensions of the food environment. For (i), we adopted existing food choice frameworks to categorize and populate individual-based motives of food choice (Section 2.2). Two stages were used for this analysis. In the first stage, all individual-based motives that potentially influence food choices were extracted from the selected papers. The second stage involved generating and coding a list of factors from the extracted data, sorting and structuring the factors into clusters according to how they were interpreted to relate to each other (Trochim, 1989).

For (ii), the analysis builds on the food environment conceptual framework developed by Downs et al. (2020), whose dimensions serve as the link through which individuals interact with the food environment to acquire, prepare and consume food. The framework covers six dimensions including food availability (type and diversity of food from

the markets, cultivated or wild foods), affordability (food prices relative to household income or per capita income, or cost of a particular food item compared to other food types in the market), physical accessibility (distance or proximity to the nearest market), convenience (time cost for food acquisition, preparation and consumption), food quality (safety, hygiene, vendor trust) and promotional information (how a food item is presented, marketed, promoted, and front-of-pack labeling which is designed to influence the desirability of food).

3. Results

3.1. Characteristics of included studies

The search yielded a total of 2163 records. After removal of duplicates, 1151 titles and abstracts were screened against the eligibility criteria. Of these, 138 records qualified for full-text screening, and 37 records were excluded at the full-text stage. The remaining 101 records, plus an additional 9 articles from searches of reference lists, met the proposed criteria and were included for review. In total, we reviewed 110 articles published between 2002 and 2020, with the number of publications increasing per year (Supplementary Fig. S1).

The included studies in the systematic map span a range of regions and countries. The most studied regions addressing determinants of food choices are sub-Saharan Africa ($n = 38$), East Asia and Pacific ($n = 25$), South Asia ($n = 20$), Latin America and Caribbean ($n = 14$), Middle East and North Africa ($n = 9$) and Europe and Central Asia ($n = 4$) (Fig. 2). Supplementary Fig. S2 provides country-specific breakdown of the reviewed studies.

Seventy-two articles (65%) used quantitative methods and cross-sectional study designs to address exploratory research questions to describe factors affecting food choices. These articles featured different measurement tools including food choice questionnaires (Stephoe et al., 1995) ($n = 14$); semi-structured questionnaires ($n = 38$), and structured questionnaires ($n = 9$). Other methods included Visual Analogue Scale ($n = 4$), discrete choice experiments ($n = 2$), Eating Motivation Survey ($n = 2$), and Taste Attitude and Food Neophobia Scale ($n = 1$). Twenty-five articles (23%) used qualitative methods to describe drivers of food choice and dietary behaviours. The majority featured a single

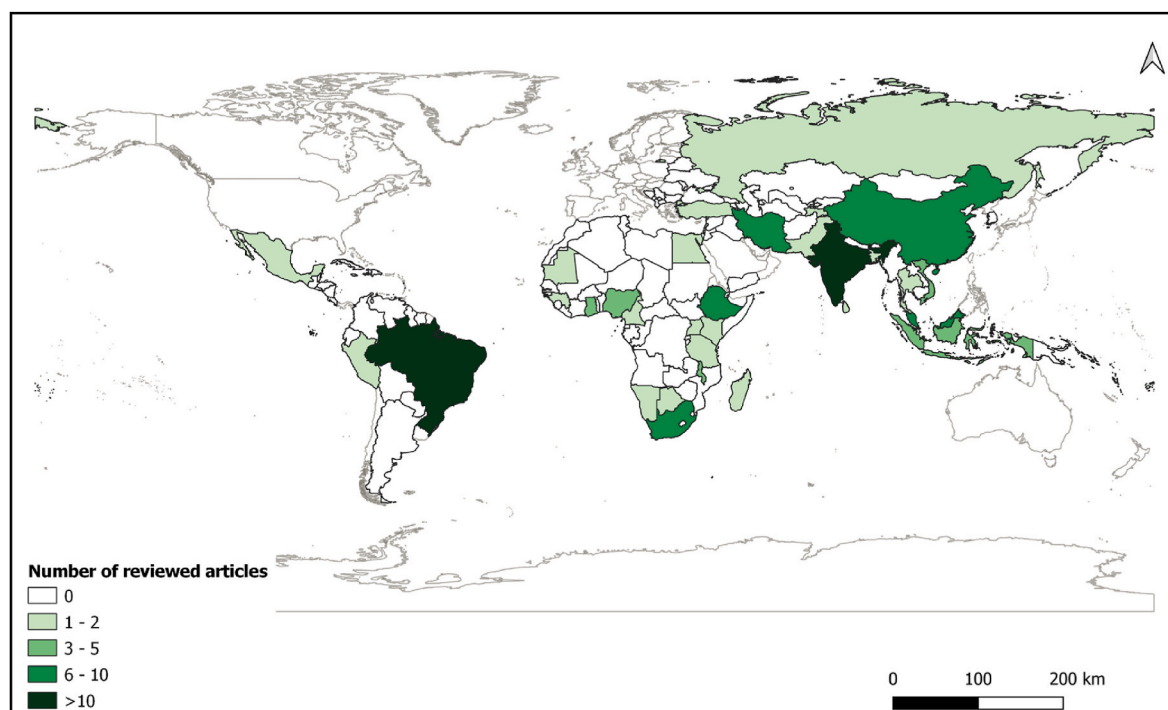


Fig. 2. A map showing geographical distribution of reviewed studies on drivers of food choice in LMICs.

qualitative method such as semi-structured interviews ($n = 16$), focus group discussions ($n = 7$), ethnographic survey ($n = 1$), and expert elicitation workshops ($n = 1$). Thirteen (12%) articles featured mixed methods using a combination of qualitative and quantitative data-gathering techniques. A summary of basic characteristics of the 110 included studies is presented in [Supplementary Table S1](#) (qualitative studies), [S2](#) (quantitative studies) and [S3](#) (mixed methods).

In terms of distribution of studies across rural-urban landscapes, 66 articles (60%) were carried out in urban settings while only 16 articles (15%) in rural areas. Eleven studies were carried out in both rural and urban settings, rural and peri-urban ($n = 1$), peri-urban ($n = 3$), while the rest were not specified ($n = 13$). Most of the studies were conducted among adults ($n = 39$), adolescents ($n = 13$), women-specific ($n = 12$), children ($n = 10$), pregnant and lactating mothers ($n = 10$), college students ($n = 9$), and elderly ($n = 4$), with studies exploring household motives ($n = 5$) and mother-child dyads ($n = 3$) also found.

3.2. Emerging clusters for conceptualizing individual-based motives of food choice

Out of the 110 reviewed studies, 99 studies (90%) covered individual-based motives of food choice. Following the data extraction procedure explained in Section 2.6, the mapping exercise generated a list of 40 individual factors which we grouped into seven clusters including psychological (11 factors), sociocultural (7 factors), sensory appeal (6 factors), health and nutrition perceptions (4 factors), ethical concerns (4 factors), social interactions (4 factors) and socio-demographic variables (4 factors). Overall, most studies which covered individual-based motives of food choice focus on aspects of health and nutrition perceptions (36%, $n = 40$), psychological factors (33%, $n = 36$), sociocultural factors (30%, $n = 33$), sensory appeal (29%, $n = 32$), social interactions ($n = 23$, 21%), socio-demographic variables (20%, $n = 22$) and ethical concerns (6%, $n = 7$) ([Table 2](#)). Some of the reviewed studies (53%, $n = 58$) cover more than one factor or cluster of individual-based motives of food choice (see [Supplementary Tables S1–S3](#)).

The ‘psychological’ cluster contained the highest number of individual-based motives identified to influence food choice in LMICs. These include factors related to eating behaviors such as food familiarity, hunger, appetite, feelings of satiety ([Ahmad et al., 2019](#); [Cabral et al., 2019](#); [Gama et al., 2018](#); [Raaijmakers et al., 2018](#); [Sulaiman and Pei Sin, 2011](#)), neophobic prevention orientation ([Alemu and Olsen, 2019](#)), mood ([Ahmad et al., 2019](#); [Gama et al., 2018](#); [Koksal, 2019](#); [Peltzer, 2002](#)), food acceptability ([Nichols, 2017](#); [Offei-Ansah, 2012](#); [Thakwalakwa et al., 2020](#)), attitude and food preference ([Gong et al., 2020](#); [Honkanen and Frewer, 2009](#); [Tey et al., 2018](#)). We categorized the factors shaping attitudes, habits, and practices in relation to food choice

processes within different cultural contexts into a ‘sociocultural’ cluster. These factors include ethnic-based food taboos and related beliefs that certain foods or food types are prohibited for women during pregnancy, lactation and menstruation including legumes, honey, milk, eggs, and some fruits and vegetables ([Asi et al., 2018](#); [Biza, 2015](#); [Tela et al., 2020](#); [Zerfu et al., 2016](#)). There are other reported taboos on specific clan-based food restrictions for pregnant women in Kenya ([Young and Pike, 2012](#)), Nigeria ([Ekwochi et al., 2016](#)), South Africa ([Okoro et al., 2017](#)), The Gambia ([Martínez Pérez and Pascual García, 2013](#)), Malawi ([Maliwichi-Nyirenda and Maliwichi, 2016](#)) and Indonesia ([Jayadi et al., 2020](#); [Tobing et al., 2019](#)). Other factors grouped under the sociocultural cluster include religious food prohibitions and restrictions such as fasting practices among Ethiopian Orthodox Christians that restrict milk and meat intake on specific days ([D’Haene et al., 2019](#); [Kibr et al., 2020](#)), and Muslim restrictions on consuming pork as well as changes of eating patterns during religious events such as Ramadan and Muharram ([Haghighian Roudsari et al., 2017, 2019](#)). Consumer ethnocentrism also emerged as a determinant of food choice where people make food decisions based on a derived positive country image ([Kilders et al., 2020](#)).

The ‘nutritional and health perceptions’ cluster includes food choices based on physiological conditions ([Farris et al., 2020](#); [Koksal, 2019](#); [Offei-Ansah, 2012](#); [Stowe et al., 2020](#)) including medical dietary restrictions ([Quevedo-Silva et al., 2018](#)), dentition conditions especially among the elderly ([Akpata et al., 2011](#)), weight consciousness in pursuit of an ideal body size ([Gong et al., 2020](#); [Marina et al., 2020](#); [Mohajeri et al., 2019](#); [Sato et al., 2020](#)), nutritional value and healing properties of food items ([Boatema et al., 2018](#); [Gunsam and Murden, 2007](#); [Heim and Pyhälä, 2020](#); [Nguyen et al., 2020](#); [Soyer et al., 2008](#)) and natural properties of food ([Ahmad et al., 2019](#); [Honkanen and Frewer, 2009](#); [Moraes et al., 2020](#)). The ‘ethical concerns’ cluster included perceived impacts of selected foods on animal welfare ([Radder and Le Roux, 2005](#); [Souza et al., 2020](#)) and environmental impacts ([Nguyen et al., 2020](#)) which influence purchase behavior for food grown with limited amounts of pesticides and fertilizers ([Tong et al., 2020](#)). Behavioral responses derived from chemical and physical properties of food were categorized under a ‘sensory appeal’ cluster. The sensory attributes do not on their own determine whether a person will eat a food but rather the person’s liking for these attributes in that food ([Kibr et al., 2020](#); [Sato et al., 2020](#)). These factors include food-related attributes such as flavor and aroma ([Anand, 2011](#); [Stowe et al., 2020](#); [Tey et al., 2018](#)), texture or appearance ([Bhatt et al., 2019](#); [Quevedo-Silva et al., 2018](#)), visual aesthetics ([Abdollahi et al., 2011](#); [Sirasa et al., 2020](#); [Thiruselvakumar et al., 2014](#); [Wertheim-Heck and Raneri, 2019](#)) and genetic sensitivity to bitter compounds ([Sharma and Kaur, 2014](#)).

We also grouped a list of four factors in the ‘social interactions’ cluster to describe social contexts in which consumers live and eat and how they influence their food choices. These factors include peer

Table 2

A map of 40 factors and 7 clusters that emerged from sorting out and classifying the reviewed individual-based motives.

Cluster	Psychological factors	Sociocultural factors	Sensory appeal	Health and nutrition perceptions	Ethical concerns	Social interactions	Socio-demographic variables
Factors	<ul style="list-style-type: none"> – mood – attitude – food preferences – food neophobia – food familiarity – acceptability – motivation (hunger/satiety, appetite, palatability, craving, aversion) – lifestyle choices – personality – pleasure – ambivalence 	<ul style="list-style-type: none"> – food tradition/customs – food taboos – religion – beliefs – cultural values – ethnocentrism – habit/routine 	<ul style="list-style-type: none"> – taste – color/aesthetic – smell/aroma – texture – appearance – genetics 	<ul style="list-style-type: none"> – Nutritional composition – nutritional value – impact on body weight – perceived health benefits 	<ul style="list-style-type: none"> – animal welfare – environmental impacts – food wastage – fair trade 	<ul style="list-style-type: none"> – peer influence – parental influence – child influence – migration 	<ul style="list-style-type: none"> – income – education – age – gender dynamics
No. of factors	11	7	6	4	4	4	4

influence (Brown et al., 2015; Teerakapibal and Melanthiou, 2019; Waqa and Mavoa, 2006), parental control (Bailey et al., 2018; Longo-Silva et al., 2016; Sedibe et al., 2014) and instances of caregivers aligning their food choices with the tastes and preferences of their children (Haghighian Roudsari et al., 2019; Wertheim-Heck and Raneri, 2019). The most influential social events include parties and gatherings, feasts and special occasions, holidays and traveling (Kapelari et al., 2020; Nguyen et al., 2020). The review further identified studies that showed that food choice motives are not to be considered in isolation from consumer demographic and socioeconomic profiles; several studies demonstrated that gender (Ahmad, 2020; Bechoff et al., 2020), age (Abdul Rahman et al., 2013; Gama et al., 2018), education level (Farajzadeh-Moghanjoughi et al., 2019; Kilders et al., 2020; Qiu and Hou, 2020) and income (Kilders et al., 2020; Okoro et al., 2017; Rachmi et al., 2018) influence food decision making.

3.3. Dimensions of the food environment

In addition to the individual-based motives of food choice, we reviewed the components of the food environment which describes the interface and space within which consumers make decisions about which foods to acquire, prepare and consume (Downs et al., 2020). Out of the 110 studies, only 11 studies (10%) explicitly discuss the influence of dimensions of the food environment on food choice, while 59 studies (54%) cover interactions between the dimensions of the food environment and individual based motives. Overall, most of the reviewed studies related to the elements of the food environment focused on food affordability (n = 26), convenience (n = 26); promotional information (n = 25); food availability (n = 16); food accessibility (n = 12); and food safety (n = 9). However, it is worth noting that some of these articles are duplicative since some of the reviewed studies (27%, n = 30) cover more than one dimension of the food environment (see Supplementary Tables S1–S3).

In rural settings, agricultural production is a key determinant of food consumption decisions which is affected by seasonal fluctuations (Heim and Pyhälä, 2020; Thakwalakwa et al., 2020) and agro-ecological conditions (Farris et al., 2020; Zerfu et al., 2016). For urban dwellers and communities depending on food markets, cost and affordability influence the degree to which food choices are constrained by market food prices relative to household income (Boatema et al., 2018; Stokes-Walters et al., 2021; Sulaiman and Pei Sin, 2011), or cost of alternative food items (Ahmad, 2020; Cabral et al., 2019; Honkanen and Frewer, 2009; Kibr et al., 2020). In terms of food convenience, time expenditure for food procurement, preparation and cooking affect decisions and purchase intentions for desired foods (Bailey et al., 2018; Haghighian Roudsari et al., 2017) in favor of quick cooking foods (Masilamani and Sundaram, 2012) and pre-made foods (Hayford et al., 2013). Food labelling and nutritional information may influence food demand and individual preferences (Darkwa, 2014; Hayford et al., 2013; Marina et al., 2020; Yardimci and Koç, 2019; Zhang et al., 2019). Advertisements, food logos and brand awareness have also been found to enhance the sensation of hunger, and stimulate appetite hormones for ultra-processed foods and non-core food products (Dos Santos and De Rose, 2018; Feteira-Santos et al., 2020; Ng et al., 2015a,b). For children, food labels with attractive promotional characters (Dos Santos and De Rose, 2018), storylines, music, jingles or colorful visuals used during food advertisements, electronic games and special effects (animation) (Ng et al., 2015a,b), access to internet services (Haghighian Roudsari et al., 2017) and nutritional education (Schreinemachers et al., 2020) affect their food choices and purchase requests. At the physical level, food choices are made by considering local availability of foods produced by farmers, sold in local markets or collected from the wild environment (Okoro et al., 2017). Several studies (n = 9) describe issues of food safety as critical determinants of food choices especially for fruits, vegetables and animal source foods (Heim and Pyhälä, 2020; Radder and Le Roux, 2005). This includes aspects of food hygiene

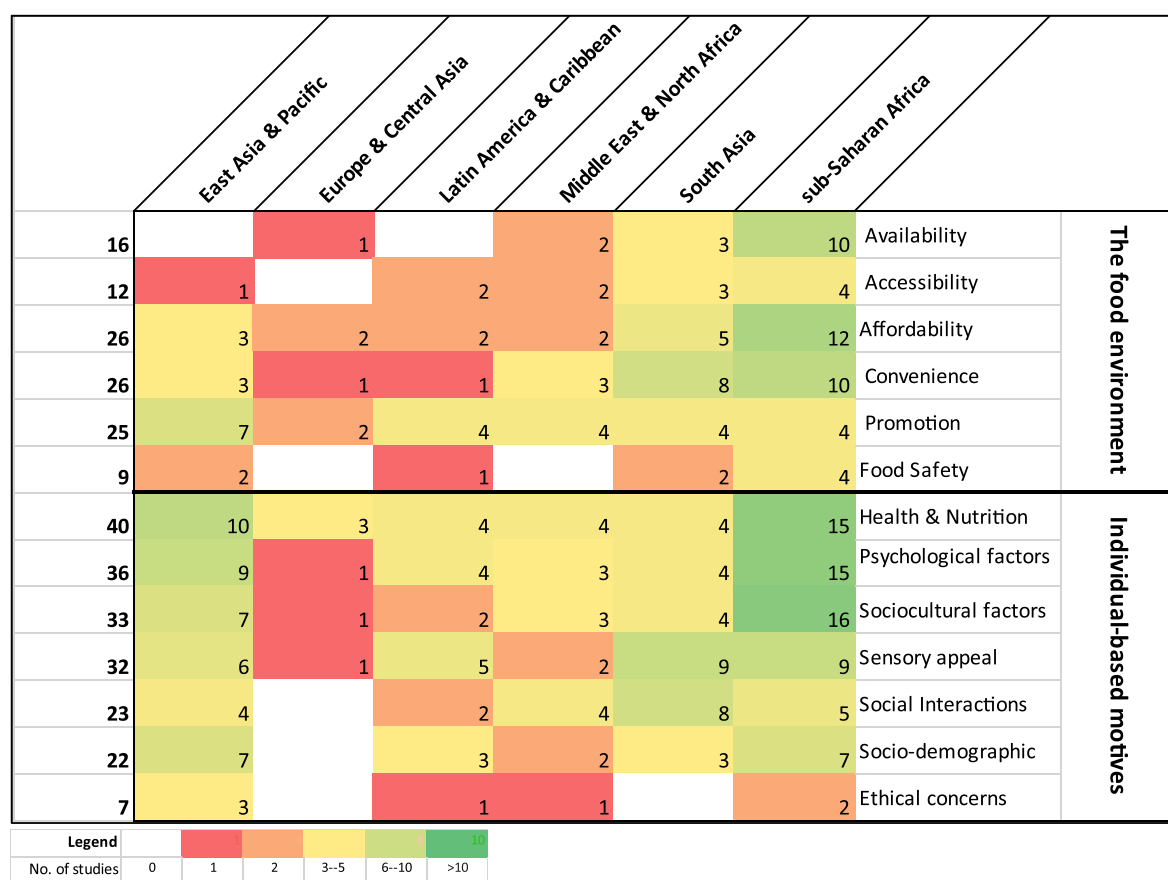


Fig. 3. Distribution of reviewed evidence on drivers of food choice across geographical regions in LMICs.

(Agyekum et al., 2018), vendor trust for safe food handling practices (Boatema et al., 2018; Kilders et al., 2020; Sedibe et al., 2014; Stokes-Walters et al., 2021), food storage environment (Bailey et al., 2018; Quevedo-Silva et al., 2018) and food freshness (Parmar and Rathod, 2019).

3.4. Understanding research gaps

Below we present several heatmaps to provide a visual overview of the observed patterns in the reviewed evidence (Figs. 3–5). The deep green color spectrum indicates more evidence (number of articles), while the red color spectrum indicates less published evidence. These maps show the number of studies and thus also the gaps in research on the different components of the individual-based motives and the food environment in food choice processes.

3.4.1. Understanding geographical distribution of studies

Fig. 3 is a heatmap illustrating the geographic and topic distribution of the reviewed studies. We see that there has been more research in sub-Saharan Africa (35%, $n = 38$), with studies on affordability ($n = 12$) and the individual-based motives, mostly on the role of socio-cultural attributes ($n = 16$), psychological factors ($n = 15$) and health and nutrition perceptions ($n = 15$). A relatively similar pattern is observed in East Asia and Pacific region (23%, $n = 25$), with more studies on health and nutrition perceptions ($n = 10$) and psychological factors ($n = 9$), while in South Asia (18%, $n = 20$), there were more studies on the role of sensory appeal ($n = 9$) and social interactions ($n = 8$). LMICs in Europe and Central Asia had the least number of reviewed studies (4%, $n = 4$) followed by Middle East and North Africa (8%, $n = 9$). The heatmap

highlights limited evidence on the role of food safety (8%, $n = 9$) and ethical concerns (6%, $n = 7$).

3.4.2. Understanding landscape level evidence and gaps

The heatmap in Fig. 4 reveals a high concentration of reviewed studies carried out in urban settings (66%, $n = 60$). These studies focused more on the individual-based motives of food choice with the greatest number of studies on health and nutrition perceptions ($n = 26$), sensory attributes ($n = 23$) and psychological factors ($n = 19$). The map further suggests that the studied factors categorized under the food environment domain are mostly focused on understanding the role of affordability ($n = 15$), promotional information ($n = 16$) and convenience ($n = 19$).

We observe a limited number of studies on drivers of food choice in rural areas (15%, $n = 16$) and peri-urban areas (the landscape interface adjacent to an urban area) (3%, $n = 3$), while eleven studies (10%) conducted a rural-urban comparative analysis of determinants of food choices. Research in rural areas focused on sociocultural factors ($n = 12$), particularly on the role of food taboos, beliefs and traditions restricting consumption of certain foods for children and pregnant women (Biza, 2015; Tela et al., 2020; Zerfu et al., 2016). We did not identify any studies seeking to understand the role of food promotion and advertisement, social interactions or ethical concerns in rural areas. Twelve studies (11%) were classified in the “not-specified” category since the respective authors did not specify the study sites as either rural, peri-urban or urban.

		Rural	Rural + Peri-urban	Rural + Urban	Peri-urban	Urban	Not specified		
16	5		2			7	2	Availability	The food environment
12	3		2	1		5	1	Accessibility	
26	2		4	2		15	3	Affordability	
26	4		1			19	2	Convenience	
25			5			16	4	Promotion	
9	1		2			6		Food Safety	
40	2	1	1	2		26	8	Health & Nutrition	Individual-based motives
36	6		5	2		19	4	Psychological factors	
33	12		4			14	3	Sociocultural factors	
32	2		4	1		23	2	Sensory appeal	
23			4			17	2	Social Interactions	
22	3		1			17	1	Socio-demographic	
7			1			4	2	Ethical concerns	
Legend									
No. of studies	0	1	2	3–5	6–10	>10			

Fig. 4. Distribution of reviewed evidence on drivers of food choice across the rural-urban landscape (i.e. rural, peri-urban,¹ urban) in LMICs.

¹ Peri-urban areas are zones of transition from rural to urban land uses. They are located between the outer limits of urban zones/centres/sites(?) but retain rural characteristics such as substantial reliance on agricultural production (UNESCO, 2014).

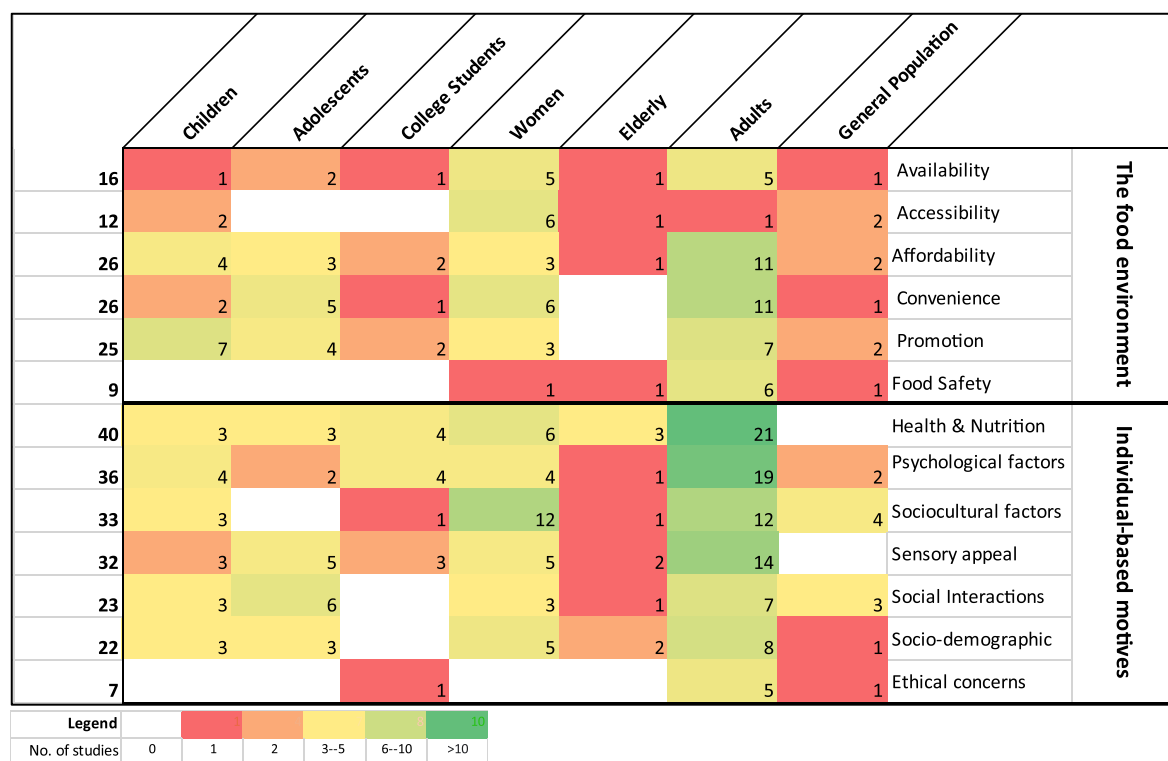


Fig. 5. Distribution of reviewed evidence on drivers of food choice across target population groups in LMICs.

3.4.3. Understanding evidence and gaps with respect to target population groups

Stages of life (i.e. childhood to adulthood) inform food choice and dietary behaviour due to past experiences with different foods, social interactions and contexts (Shepherd et al., 2006). The review found many studies focused on adults (35%, $n = 38$), particularly on health and nutrition perceptions ($n = 21$), psychological factors ($n = 19$), sensory appeal ($n = 14$) and sociocultural factors ($n = 12$) (Fig. 5). Similarly, there were many studies with adults as the studied population in the food environment domain that focused on understanding the role of food affordability ($n = 11$) and convenience ($n = 11$).

The review further identified studies focused on women-specific aspects of food choices (20%, $n = 22$), especially those investigating the role of cultural-based food taboos and diet restrictions for children and pregnant and lactating women ($n = 12$). The studies carried out with adolescents as the main focus (14%, $n = 15$), investigated the role of social influence ($n = 6$), sensory appeal ($n = 5$) and food convenience ($n = 5$). Considering that childhood is an influential stage in the formation of food preferences (Wardle and Cooke, 2008), it is not surprising that food promotion emerges as the most studied factor ($n = 7$) with a focus on the role of advertising, branding and other strategies to nudge children's food preferences and purchase requests (Dos Santos and De Rose, 2018; Esmaeilpour et al., 2018; Ng et al., 2015a,b).

4. Discussion

4.1. Synthesis of the systematic evidence mapping and avenues for future research

This is the first systematic mapping that has synthesized a myriad of highly fragmented factors affecting food choices in LMICs (to the best of the authors' knowledge). We use a systematic approach, attempting to integrate findings from different strands of literature on numerous individual-based motives and dimensions of the food environment shaping food choices. By geographical distribution, thirty five percent of

the reviewed studies ($n = 38$) came from sub-Saharan Africa followed by East Asia and Pacific ($n = 27$) and South Asia ($n = 22$). The heatmaps provided in Section 3.4 revealed that most studies were skewed towards urban settings (60%, $n = 66$) with a dearth of studies in rural (15%, $n = 16$) and peri-urban contexts (3%, $n = 3$).

Food choice is not only shaped by the elements of the food environment but also by individual-based motives. Therefore, in addition to the recent surge of interest in food environment research, we recommend more studies on individual-based motives, with consideration for contextual formulation and appreciation of diverse sociocultural values, both between and within countries (Blake et al., 2021; Constantinides et al., 2021; McMullin et al., 2021; Revoredo-Giha et al., 2018). In Section 3.2, we outlined a list of forty (40) individual-based motives of food choices in LMICs and categorized them into seven (7) clusters based on previous frameworks (Table 2). Health and nutrition perceptions (36%, $n = 40$), psychological factors (33%, $n = 36$) and sociocultural factors including food taboos, beliefs and religion (30%, $n = 33$) emerged as the most studied factors affecting food choices. Food safety and hygiene (8%, $n = 9$) and ethical concerns for environmental sustainability, food wastage, animal welfare etc. (6%, $n = 7$) were identified as the least-studied aspects influencing food choice behaviour.

It is worth noting that the majority of the reviewed studies focus on all foods as a single category. However, recent research is increasingly investigating the drivers of food choice at a food group level which might be relevant for understanding specific choices of interest such as fruit and vegetables (Bell et al., 2021; Yang et al., 2021), wild foods (Pawera et al., 2020), and neglected and underutilized food species (McMullin et al., 2021; Revoredo-Giha et al., 2022). Similarly, a wide variety of methods are currently used to measure preferences, motives, and food choice (Ahmed et al., 2021). The 40 factors and seven (7) clusters are not exhaustive and may differ with context and study. This is both a strength and a weakness but can make it difficult to draw conclusions and comparisons across studies.

Food safety is a conspicuously under-studied element of the food environment with only nine articles (8%) found on this topic. A more

strategic understanding of food safety perspectives is critical for influencing behaviors of consumers and choices during food acquisition, distribution and preparation (Constantinides et al., 2021; Downs et al., 2020; Liguori et al., 2022; Matita et al., 2021; Pires et al., 2020; Wertheim-Heck et al., 2019). In high-income countries, the Food Choice Values (FCV) questionnaire has adapted the Food Choice Questionnaire developed by (Steptoe et al., 1995) to include food safety - which is often ranked as the most important food choice factor (Bazzani et al., 2018; Lusk and Briggeman, 2009). This method has recently been used in some LMICs including Indonesia (Yang et al., 2021) and Viet Nam (Bell et al., 2021). However, this area of ongoing concern and importance may require the design of new or adapted tools of measurement, since food quality and safety could be difficult to measure in LMIC settings due to limited intervention and investment, poor government regulation and compliance (Grace, 2015; Warren et al., 2021; Wertheim-Heck and Raneri, 2020) and a large proportion of unregulated informal food vendors (Holdsworth et al., 2020; Simon, 2007).

There has been considerable evidence presented in previous reviews and reports characterizing the nutrition transition as implicated in the triple burden of malnutrition (undernutrition, micronutrient deficiencies, overweight and obesity) and diet-related non-communicable diseases in LMICs (Development Initiatives, 2020; FAO et al., 2020; Global Panel, 2017; HLPE, 2020, 2017). Concurrent dramatic shifts from traditional plant-based diets towards consumption of processed and ultra-processed foods, rooted in the process of westernization and urbanization, have also been reviewed and documented (Cunningham et al., 2021; FAO et al., 2020; Ronto et al., 2018; van Berkum et al., 2018). While this mapping review has highlighted the potential drivers of food choice factors, there is a need for more research to identify mechanisms through which the dimensions of the food environment and individual-based food choice motives (and their interactions) could be capitalized on to address the rapid dietary changes in LMICs (Blake et al., 2021; Constantinides et al., 2021; Turner et al., 2018). Such research efforts could provide a basis for developing policy interventions and practical solutions for the promotion of healthier diets.

Finally, there is a critical need to adopt systemic and spatially explicit research frameworks that appreciate cultural and socioeconomic contexts of consumers as a necessary pillar to understand the diversity of foods people consume including fruits, vegetables, neglected and underutilized varieties (what), their dietary choice behaviour and cultural relevance (why), food preparation methods (how), across rural-urban landscapes (where). This type of systemic research is necessary for understanding sustainability of local and national nutrition policies (Escobar-Alegria et al., 2022).

4.2. Study limitations

While the protocol used to generate this mapping review was designed to capture the breadth of relevant topics critical for understanding the current state of knowledge, it may not be exhaustive. First, while we attempted to capture the diversity of terminology across multiple relevant disciplines, we recognize that some suitable terms may have been missed resulting in bias in our evidence mapping. Second, the search was limited to articles written in English language only. We recognize that relevant literature likely exists in other languages and this is an area for further research. Since we have documented our search strategy and evaluation criteria in the methodology (Section 2), this search can easily be replicated and expanded upon. Third, this systematic mapping illustrates the quantity and geographical distribution of evidence, but it does not analyze the underlying quality of individual articles as we did not conduct a critical appraisal. It is worth noting that higher occurrences of evidence on a topic do not necessarily imply high quality evidence, only that it is a well-studied topic.

5. Conclusion

This evidence mapping review provides a comprehensive overview of the current state of knowledge on the determinants of food choice in LMICs and the distribution of current evidence by geography, rural-urban landscapes and population groups. Food choice is not simply a process shaped by the elements of the food environment, but also influenced by individual-based motives. We identified forty (40) individual-based motives that potentially influence food choice in LMICs and grouped them into seven (7) clusters based on previous frameworks. These clusters include psychological factors, sociocultural factors, sensory appeal, nutrition and health perceptions, ethical concerns, social interactions, and socio-demographic variables. We further reviewed and mapped evidence on the dimensions of the food environment including food availability, affordability, accessibility, convenience, food safety and promotional information. All these factors together enable a holistic understanding of the processes that link an individual to their food environment through their choices.

Understanding factors influencing consumer preferences and decision making can inform how policy, nutritional interventions and markets could be adjusted to influence consumer choice of healthier foods. This review thus presents a resource that can support on-going efforts to advance knowledge of dietary behaviors and contextual efforts necessary to promote healthier diets. The heatmaps (Section 3.4) serve as a visual tool for researchers to identify geographical and topical areas where there is emerging evidence to build on and to identify understudied areas requiring more strategic empirical research.

More evidence is needed to guide future effective policy making, especially through empirical investigation and field experiments to understand food choice behavior and dietary shifts across different landscapes. Furthermore, a range of different strategies and interventions are necessary to create supportive food environments, influence consumer awareness and spur behavioral change that can lead to healthier food choices.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gfs.2022.100615>.

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