Food safety-related perspectives and practices of consumers and vendors in Ethiopia: A Scoping Review

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Highlights

- 116 relevant studies were identified through a well-defined search.
- Most studies focused on one state/city, urban areas, vendors, and practices.
- Studies suggest 'knowledge' and 'attitude' to be better than actual 'practices'.
- Food safety practices of consumers often aligned with those of vendors.
- Training may help improve knowledge, but rigorous evaluation is needed.

Abstract

Despite being one of the first African countries to prioritize food safety, foodborne diseases are of acute concern in Ethiopia. This review aims to understand food safety-related perspectives and practices among consumers and food vendors in Ethiopia to identify motivations, beliefs, and values that shape and/or drive their practices. A well-defined search and review identified 116 relevant articles. These spanned eight of the ten regional states and two chartered cities, with most work focusing on urban areas and on a sample within one state or chartered city. Ninety-four studies focused on vendors or food handlers; fifteen articles examined both consumers and vendors, but only four assessed interactions between the groups. Meat, dairy products, and ready-to-eat (street) foods were the most studied food groups. Food service establishments were the most examined outlets. Forty-six studies examined generic food safety issues or concerns. Overall, 102 studies assessed food safety practices (n = 102); 53 studies examined knowledge, and 19 studies assessed attitudes. A gap in vendors' observed practices *versus* knowledge and attitudes was noted. Consumer deductions of food safety were based on vendor practices. Both groups used physical attributes based on senses to assess quality and safety of animal-source foods, had their own 'coping' strategies to address food safety-related concerns, and had similar views on consumer choice motives. Analysis of food and the food handling environment revealed a high level of contamination. An additional study, included after the original search, identified training to be effective in influencing knowledge,

attitudes, and practices – though results for attitudes and practices were not sustained in the long term. Future research should address consumers and consumer-vendor interactions and include the full triad of knowledge-attitudes-practices. It is also recommended to focus on nutrient-rich foods as well as on traditional markets and local eateries. Improving the quality of research will be critical to improve food safety in Ethiopia.

Graphical abstract

[insert here]

Keywords: consumer**,** food safety, perceptions, practices, scoping review, vendor, Ethiopia

Acknowledgment: This study was made possible through support provided by Feed The Future through the United States Agency for International Development (USAID), under the terms of the EatSafe Cooperative Agreement No. 7200AA19CA00010. The opinions expressed herein are those of the author(s) and do not necessarily reflect the views of USAID the U.S. Agency for International Development or the United States Government.

The authors wish to thank Genet Gebremedhin and Smret Hagos for participating in the consultation on the results of the review and Elisabetta Lambertini, Anthony Wendt, Bonnie McClafferty, Caroline Smith DeWaal, and Abby Reich for review of earlier versions of this manuscript or the report on which it is based.

Conflicts of Interest: None

1. INTRODUCTION

Every year 1 in 10 people fall ill and 33 million healthy life years are lost due to the consumption of unsafe foods (World Health Organization, 2015). Children under age 5 years are particularly vulnerable, accounting for almost 40% of all foodborne diseases and 30% of total deaths related to unsafe food annually (World Health Organization, 2015). Most of the public health burden due to foodborne diseases falls on low- and middle-income countries (LMICs), with Sub-Saharan Africa presenting the highest per capita burden among all ages (World Health Organization, 2015). The foods most often implicated are highly nutritious animal-source foods and fresh produce (Grace, 2015b; Hoffmann et al., 2017).

Foodborne disease is closely interlinked with malnutrition (Nordhagen et al., 2022). In addition, the World Bank estimates economic losses up to US$95 billion a year in LMICs associated with productivity loss alone, attributable to foodborne diseases (Jaffee, Henson, Unnevehr, Grace, & Cassou, 2018). Due to the interlinkages of food safety with Sustainable Development Goals (SDGs) 2 (Zero hunger), 3 (Good health and wellbeing), 5 (Gender equality), 8 (Decent work and economic growth), and 12 (Responsible consumption and production), reducing the burden of foodborne disease in Africa is critical for the attainment of these SDGs. Furthermore, the implications of foodborne diseases for equity and culture cannot be ignored. In many African countries, women predominate in food production, processing, retail, and preparation within the household. Hence, ensuring that programs and policies are inclusive and empowering of women is essential in assuring food safety. Studies also show that unsafe and low-quality food may be channeled towards the poorest, putting them most at risk (Grace, 2015a). Food safety is thus an equity issue, as well as a public health and economic one.

All these issues are of acute relevance in Ethiopia, Africa's second-largest country, which is undergoing rapid economic development and still facing high levels of stunting (36.8% of children under age 5 years) (UNICEF, 2020). As in many other LMICs, many low-income consumers in Ethiopia rely on traditional markets for their provision of nutrient-dense foods such as animal-source foods and fresh fruits and vegetables (Fanzo et al., 2017). Evidence from LMICs suggests that much of the food sold in such traditional markets is already contaminated (Grace, 2015b) and that actions taken by consumers in food preparation are often not sufficient to mitigate the risk of foodborne illnesses (GAIN, 2020). At the same time, an increasing number of Ethiopian consumers eat outside their home, in open-air markets or small restaurants, where food may be provided in less-than-hygienic conditions; for example, prior research has found extensive contamination of utensils (between 2.8-27.3%) in Ethiopian food service settings (Teferi, 2020).

Despite being among the first African countries to prioritize food safety, Ethiopia will not overcome the complex food safety challenges that come with informal and transitioning food systems until everyday consumers demand safer food and vendors deliver it (Chamhuri & Batt, 2013; Ortega & Tschirley, 2017). To date, however, many LMICs have failed to effectively engage consumers on food safety and to empower or incentivize the private sector to deliver safer food (Jaffee et al., 2018). Knowledge of producer practices and consumer demand for food safety in LMICs is also limited (Ortega & Tschirley, 2017).

This paper aims to strengthen the knowledge base on food safety-related perspectives and practices among consumers and vendors in Ethiopia by consolidating existing evidence through a scoping review. Specifically, it addresses six questions : *1)* What are the current knowledge, attitudes, beliefs, and practices relevant to food safety among consumers and food

vendors in Ethiopia? *2)* What studies have included both consumers and food vendors to better describe how food safety is conceptualized among these actors? *3)* What is the gap between knowledge/attitudes and practices related to food safety among consumers and food vendors in Ethiopia? *4)* How can findings from available studies inform interventions that can address food safety for both consumers and food vendors? *5)* What theories have been used to describe consumer attitudes, beliefs, and perceptions of food safety? *6)* What are the key enabling factors and challenges experienced by vendors in implementing food safety measures? The synthesis of knowledge from this review is intended to help inform evidence-based strategies to improve safety of nutritious foods in traditional markets in Ethiopia.

2. **METHODS**

Scoping reviews are appropriate when synthesizing knowledge from diverse body of literature that has yet to be reviewed (Colquhoun et al., 2014; Daudt, van Mossel, & Scott, 2013). This scoping review is aligned with the Preferred Reporting Items for Systematic Reviews and Meta Analyses—Extension for Scoping Reviews (PRISMA- ScR) (Tricco et al., 2018) checklist and guidelines to ensure robust and replicable process. It followed the methodological framework proposed by Arksey and O'Malley (2005), further developed by Levac et al. (2010), and integrates aspects of a full systematic review to improve replicability and comprehensiveness. The review protocol is registered and published on Open Science Framework (OSF): DOI 10.17605/OSF.IO/7JEMA (available at https://osf.io/7jema/).

2.1. Search strategy

A structured search was undertaken in July 2021 in three electronic databases: Web of Science, AgEcon, and Google Scholar using a syntax of keywords and subject headings. These databases were selected to cover a broad range of disciplines, as food safety is a topic studied

in biological as well as social sciences. An initial search was run on Web of Science Core Collection database, covering over 21,100 peer-reviewed journals, conference proceedings, and books published globally. This was then followed by a simple keyword search in AgEcon and Google Scholar, using the same search adapted to optimize the results from these databases. Websites of the Food and Agriculture Organization of the United Nations (FAO), International Food Policy Research Institute (IFPRI), World Health Organization, The World Bank, International Livestock Research Institute (ILRI), World Trade Organization (WTO), and European Commission (EC) were also searched using the same key search terms. Additional studies were identified through citation searching of above-average or high-quality publications (see Section 2.5) from peer-reviewed literature and relevant grey literature sources. Searches were carried out by two independent researchers, in consultation with a third researcher. The full search details are provided in Supplementary Table 1.

2.2. Study eligibility and screening

The Population, Concept and Context (PCC) framework (Joanna Briggs Institute, 2015) (Table 1) was used to define the eligibility criteria. Additional definitions that guided the review included: food safety *knowledge* – this referred to 'what is known' and covered factual understanding of different food safety aspects such as personal hygiene, cross-contamination, causes and symptoms of foodborne diseases, and time/temperature control; *attitude* – this was defined as 'what is thought' and included reflected positions, opinions, beliefs, and ways of being, a position on aspects such as importance of handwashing, cross contamination, food handling, and storage; *practices* implied 'what is done' and included observable actions, often in response to stimulus, on aspects such as personal hygiene, handwashing, and food handling and storage practices (GAIN, 2020; Nordhagen, 2022).

[insert Table 1 here]

Only studies published in or after 2000, that included primary data, and were published in scientific journals and/or reports of select high-quality institutions as listed above were included. Search limits to 2000 and onwards was applied as studies conducted more than two decades ago are unlikely to remain applicable in the context of Ethiopia's rapid socioeconomic development. Furthermore, we relied on electronic databases for our search and retrieval, and many publications prior to 2000 were not available digitally. There were no restrictions placed on study type.

Literature search results were imported to EndNote X9 (Clarivate, Philadelphia, PA, USA), and duplicates were removed prior to eligibility assessment. Title and abstract screening were followed by the retrieval and screening of full-text articles. The screening for all identified studies was done by two independent researchers, and conflicts were adjudicated by the third reviewer. The screening protocol was piloted on five articles to ensure consistency. The reviewers met regularly to discuss the selection process and resolve conflicts, if any.

2.3. Data charting

For all eligible studies, information was extracted in a standardized review form by both reviewers with a focus on population(s), specific food(s), specific retail outlet(s), aspects assessed, and main results related to consumer and/or vendor populations. These forms were piloted by the reviewers on five articles and refined, in consultation with the third reviewer, to ensure all the relevant data were adequately captured.

2.4. Quality appraisal

Articles published in national or international journals were appraised for methodological quality independently by two reviewers using MMAT, 2018 version (Hong et al., 2018). The

MMAT allows for simultaneous quality appraisal of multiple study types including qualitative, quantitative, and mixed methods studies and hence is considered appropriate for this review. After responding to two screening questions, each included study was rated for the appropriate category of criteria as either 'yes' (1), 'no' (2), or 'can't tell' (3). MMAT scores representing the number of criteria met (rated 'yes'), were divided by five and translated into percentages; scores ranged from 20% (noted as *, low quality) to 100% (noted as *****, high quality). Both reviewers discussed the appraisal scores, and, in case of difference, the question was rated as 'no' (2) or 'can't tell' (3). As recommended by Hong *et al*. (2018), no overall quality score was calculated. A third reviewer was consulted in case of lack of consensus between the reviewers. Quality scores were not used to include or exclude studies but rather to describe the quality of available evidence as part of the mapping component of this review.

2.5. Consultation

In accordance with the recommendation of Levac et al. (2010), a virtual consultation workshop was organized with two Global Alliance for Improved Nutrition (GAIN) stakeholders in Ethiopia to share the preliminary findings of this scoping review. This exercise was undertaken to address the local context and identify any additional, unreported issues, practices, or perspectives pertaining to food safety.

3. RESULTS

A total of 4704 records were identified, of which 116 studies were included in the data synthesis (Figure 1)(Supplementary Table 2). An overview of the key characteristics of included studies is presented in Supplementary Tables 3-5. Articles were published from January 2007 to July 2021, with the number of publications increasing per year (Figure 2)

[Insert Figure 1]

[Insert Figure 2]

3.1. Food safety research landscape in Ethiopia

3.1.1. Geographic distribution of studies

All studies but one focused only on Ethiopia. The exception, Knight-Jones et al. (2021), compared results from Ethiopia to another African country, Burkina Faso. The included studies spanned eight of the ten Ethiopian regional states and the two chartered cities (Addis Ababa and Dire Dawa). There were no studies examining the populations in the Afar and Gambella regions (Figure 3).

[Insert Figure 3]

One hundred twelve studies examined a sample within just one Ethiopian regional state or chartered city, and four studies featured multiple territories. Most of the studies focused on urban areas (n = 54) or did not specify a focus (n = 55).

3.1.2. Focus of food safety research in Ethiopia

Most of the reviewed research in Ethiopia focused on vendors or food handlers (n = 94) including managers and/or owners of food establishments and institutions, with meat, milk and other dairy products, and ready-to-eat foods being the most evaluated food items. The distribution of studies by food and population group of focus is presented in Table 2. There was very limited focus (n = 2) on specific sub-populations, such as the Borana pastoralists, in the available body of literature.

[Insert Table 2]

Seventy-six studies reported on the gender of the study participants. Of these, 72 studies included both men and women, three included only women, and one included only men. Only three studies reported key results disaggregated by gender or associations between key results and gender.

The most-examined food safety hazards or issues were generic foodborne illness, food pathogens, or food poisoning (n = 46); microbial contamination with bacteria and parasites (n=36); and oral-fecal parasites (n = 8). Two studies focused on adulteration, and one study each focused on aflatoxin contamination, zoonotic disease (brucellosis), and fungal pathogens. Twenty-one studies did not specify any particular food safety hazard or issue but examined aspects of food safety-related perspectives and practices of vendors (n=13), consumers (n=4), or both (n=4).

Food service establishments (such as cafeterias, restaurants, hotels, and juice bars) were the most examined outlets (n = 41), followed by abattoirs and butcher shops (n = 16), university cafeterias (n = 15), local markets (n = 13), and street vending sites (n = 11). Other outlets studied were hospital cafeterias, farms, milk collection centers, prisons, households, catering establishments, and corner shops. Half of the included studies examined multiple outlet types, while five studies did not mention any specific focus.

3.1.3. Conceptualization of food safety in the studies

Practices related to food safety featured prominently in the studies (n = 102) and included aspects such as personal and environmental hygiene (n = 68), sanitation (n = 12), and food handling (n = 17). Fifty-three studies examined food safety-related knowledge or awareness while 19 studies examined attitudes or beliefs. More than half the studies (n = 67) included a combination of practice with knowledge (n = 48) or attitude (n = 19), whereas only a few

studies (n = 20) examined the triad of knowledge, attitudes, and practices (KAP). While these studies examined multiple concepts, few reported on interlinks between them. Two studies explored consumer willingness-to-pay for quality and safety attributes, and four studies (consumer-focused: n = 2; consumers and vendors: n= 2) assessed how perceptions influence practices (Amenu et al., 2019; Ayza & Yilma, 2014; Tolosa et al., 2016; Trübswasser et al., 2020).

Seventy studies examined objective measures in addition to the subjective measure of perception or practice. Of these, 34 studies assessed microbial quality of foods, with a focus on animal-source foods (n=16), fruits and vegetables (n=10), and ready-to-eat foods (n=8). Three studies performed swab analysis for presence of food hazards in the food handling environment, such as on knives, chopping boards, or weighing scales. Twenty-nine studies investigated the carriage of foodborne hazards by food handlers via stool analysis, and three studies used swab analysis for hands and/or clothes. Only one study investigated the seroprevalence of brucellosis.

*3.1.4. Designs, methods, and measures implemented in the studi*es

Most of the studies (n = 109) used quantitative descriptive methods in isolation, either to describe or analyze indicators associated with food safety or to test for associations with outcomes of interest. All the articles featured cross-sectional study designs and used at least two measurement methods: questionnaire-based surveys, face-to-face structured interviews, direct observations or observation checklists, and objective measures.

Four studies used qualitative descriptive methods to investigate food safety and employed a combination of approaches, including semi-structured interviews, structured in-depth

interviews, focus group discussions, participatory rural appraisal, informal discussions, direct observation, or the photovoice method. Mixed-methods were employed by three studies, using methods and measures used by the quantitative-only and qualitative-only studies.

Overall, the studies measured a wide range of outcome indicators and metrics and had several methodological constraints: unclear research questions, unclear sampling strategy or representativeness of samples, instruments and/or methods not pre-tested or standardized/ validated, missing information on response rates and potential sources of bias, unclear analysis approach, and insufficiently substantiated link between analysis and interpretation. On the whole, the quality of the research was rated as low, with only nine studies assessed to be of high quality and eight as above-average quality (Supplementary Table 6).

3.2. Perspectives and practices, and gaps vis-à-vis knowledge and attitudes

3.2.1. Vendors

All 94 vendor-focused studies employed self-report instruments with closed-ended or multiple-choice questions to examine food safety-related perceptions and practices. Only 46 studies supplemented this self-reported data with observations. There was considerable overlap in the questions used to assess "attitude" with those intended to assess "knowledge" and/or "practices". KAP were assessed through both subjective and objective indicators. An overview of the most-used subjective indicators to assess food safety is presented in Table 3; the objective indicators are discussed in a subsequent section in this paper.

[Insert Table 3]

Nearly all studies reported on practices (n = 91), while 38 studies reported on knowledge and 11 studies reported on attitudes related to food safety. The results were reported either by summarizing responses for individual questions or by assigning a rating of "good"/ "poor" for practices (in some cases including an intermediate category of "fair"), "adequate"/ "inadequate" for knowledge, and "satisfactory"/ "unsatisfactory" for attitudes, and/or assigning an overall rating combining knowledge, attitude, and/or practices. Of the 85 studies that assigned a rating to vendor practices, 52 studies classified these as "poor" and 33 studies as "good". Twenty-one studies reported vendor knowledge to be "adequate", one made no judgement, and the remaining 17 studies found knowledge to be "inadequate". Food safety-related attitude was found "satisfactory" in seven studies and "unsatisfactory" in three studies; one study did not make any judgement.

While detailed analysis based on gender was lacking, there appeared to be distinctive gender roles associated with food handling. Males dominated food handling in abattoirs and butcher shops, while all other outlets had predominantly female food handlers/ vendors.

Six studies explored factors associated with food safety practices and found a positive association with better knowledge (n = 2), positive attitude (n = 1), food safety training (n = 2), regular medical check-ups (n = 3), sanitation inspection (n = 1), and education (n = 2). Consistent recommendations across the studies pointed to the need for food safety and hygiene training, enforcing regular medical check-ups for food handlers, increased regulatory inspection, and improvement in infrastructure.

3.2.2. Consumers

Only seven studies attempted to assess food safety perspectives and practices among consumers. The populations varied widely and included students (n = 2), mothers (n = 2), and households, with no further descriptors provided for the respondents (n = 3).

Three of the five quantitative studies assessed knowledge and self-reported practice related to general food safety awareness, handwashing habits, cross-contamination of foods at home, storage conditions of food, food vendors' hygiene as a source of illness, and the importance of proper cooking or refrigeration, using similar questions to those used for vendors. Two studies assessed the level of knowledge and practice as "good" for some or all the aspects assessed. Only one study assessed attitude, along with knowledge and practices, and used statements quite similar to the questions/statements for examining knowledge and practice; it found attitudes to be "neutral" or "negative" and knowledge and practices to be poor. Where associations with other indicators or demographic characteristics were examined (n=2), studies generally found positive associations between self-reported practice and knowledge, education, or gender (further details not specified in the articles). The remaining two studies assessed consumer perceptions of the safety or quality of animal-source foods, milk, and meat, milk, and butter; lack of quality control, inspection, and regulated standards were cited as reasons for adulteration or unsafe foods.

Several factors were found to influence how consumers assessed if a food was safe (n = 3): whether it came from a "trusted vendor", environmental hygiene at the point of sale (e.g., apparent cleanliness of site and equipment, display of the product), whether the product appeared untampered/unadulterated, and whether the product was local (considered as safe). One study assessed the relative importance of different attributes associated with safe and

quality food (meat, milk, and butter), and consumers' willingness to pay for such attributes. While there were differences in consumer views on price as an indicator of quality and safety for meat, milk, and butter, the researchers concluded that most consumers were willing to pay up to 15% more for safe and quality food.

All studies concluded with recommendations for educating or creating awareness on improving food safety among the public, or for stricter regulations and implementation of food safety standards.

3.2.3. Vendor and consumer interactions

Fifteen studies examined food safety perspectives and practices among both consumers and vendors, using quantitative descriptive methods (n=10), qualitative designs (n = 2), and mixed-methods approach (n = 3). Most studies used similar themes as those in the studies focused solely on vendors or and consumers and reported comparable concerns for food safety. Overall, awareness about foodborne diseases and zoonotic diseases and concerns about chemical contamination or adulteration were relatively low.

Only four studies however, attempted to assess interactions or similarities and differences in perspectives and practices of the two populations or in the beliefs/ motivations driving them. Dewe et al. (2014) revealed that producers and vendors used sensorial physical attributes (such as color, smell, and consistency) to assess quality and safety of meat and milk and considered people who bought their products to have similar quality and safety perceptions. Amenu et al. (2019) identified the influence of deep-rooted cultural beliefs in milk boiling (e.g., *"boiled milk is dead milk"*) and choice of milk for consumption as well as practices motivated by health education for children. These studies also identified that both vendors and consumers had developed their own 'coping' or 'risk mitigation' strategies that allowed them to reduce the

level of concern they had about food safety, such as smoking of milk-related containers/utensils, trimming the affected part of meat, or consuming a local alcoholic beverage after eating raw meat. Melesse et al. (2019) identified that vendors' understandings of consumer motives for food choices were well-matched with consumers' motives and revolved around food quality, health and safety, and price of the product.

3.3. Foodborne hazards and associations with perceptions and practices

The review of microbial quality of animal-source foods (n = 16), fruits and vegetables (n = 10), and ready-to-eat foods (n = 8) identified high levels of bacterial contamination, with *Escherichia coli*, *Salmonella,* and *Staphylococcus aureus* most frequently isolated. Three studies also identified a high level of parasitic contamination in fruits and vegetables sold in local markets.

Twenty-eight studies, with a particular focus on vendors, isolated a range of intestinal pathogens from food handlers, with *Salmonella typhi, Salmonella spp, Shigella, Escherichia coli, Entaemoeba histolytica/dispar,* and *Ascaris lumbricoides* being the most frequently isolated. Three studies reported food handlers carrying *Shigella, Salmonella,* or *Escherichia coli* in their hands and/or clothes, while three studies reported contamination of the food handling equipment such as knives, chopping boards, or scales. Two studies examined food handlers' hands and clothes as well as food handling equipment and confirmed the high level of contamination.

Thirty-four studies sought to assess an association between microbial contamination, intestinal parasites or enteropathogens, and practices and identified one or more significant associations. Four of these studies also examined knowledge/awareness or attitude towards food safety

and/or foodborne illnesses but did not examine the associations of these outcomes with objective measures. A synthesis of results related to these associations is provided in Table 4.

[Insert Table 4]

3.4. Effectiveness of food safety training for improving practices and perspectives

Only one study assessed the effect of food safety-related interventions. Amenu et al. (2020) assessed the effect of community-tailored training designed to improve the hygienic handling and safe consumption of milk on the KAP of women who produce and sell dairy products. The authors found that a face-to-face training that delivered locally tailored content improved the knowledge of pastoral women, an effect that was also present after six months, suggesting that knowledge can be sustained at least in the medium term. In contrast, while attitude seemed to improve post-training, this change was not sustained over time, and training was unable to address attitudes that had deep cultural roots – such as the local belief that milk should be boiled before feeding to children to prevent milk curd forming in their stomachs. Training also seemed to positively affect adoption of most practices but only in short term.

4. DISCUSSION

The 116 articles included in this scoping review constitute an active and growing body of research on consumer and vendor perspectives and practices related to food safety in Ethiopia. Evidence from mostly low-quality studies shows that, in Ethiopia, food handlers' or vendors' and consumers' personal hygiene, environmental sanitation, handwashing practices, "good kitchen practices", and education and training are associated with objective measures of food safety (i.e., measured levels of contamination) and/or are perceived as indicators of safe and high-quality food by consumers. While correlative, evidence also suggests that practices of

food handlers across the post-farm value chain are related to increased contamination of foods, which can put consumers at increased risk of foodborne diseases. This concern around foods potentially containing contaminants or pathogens that could harm human health was also reflected in the few consumer-focused studies included in the review. Due to insufficient or no information found in the included studies, two initially planned research questions, "*What theories have been used to describe consumer attitudes, beliefs, and perceptions of food safety?*" and "*What are the key enabling factors as well as challenges experienced by vendors in implementing food safety measures?*", were not addressed in this review.

The existing body of work points to a clear recognition of poor microbial quality of foods in Ethiopia, with most studies focusing on animal-source foods (predominantly milk and meat). The high level of contamination seen in the included analytical studies confirms these as the source of parasitic and bacterial pathogens responsible for foodborne diseases (Grace, 2015b). Recognizing the integral role for milk and meat in the Ethiopian food system, this focus is warranted. The other highly nutritious and equally high-risk food group, fresh fruits and vegetables, which have been studied elsewhere (Wallace, Mittal, Lambertini, & Nordhagen, 2022)through several high-quality studies such as in Vietnam (Wertheim-Heck & Raneri, 2019; Wertheim-Heck, Spaargaren, & Vellema, 2014), have also received less attention in Ethiopia. When examining consumers' and vendors' perceptions of food safety related to fresh produce, a future research focus on local, traditional markets is also highly justified. Most of the eggs, meat, milk, and fresh produce sold to low-income consumers in urban Africa is sourced from traditional markets (Resnick, 2017). Despite the vital role played by these markets in providing nutrition security to these consumers, they were found to be largely under-represented in the reviewed studies. A focus on ready-to-eat foods is also suggested, as these are increasingly popular in Ethiopia, and the evidence (albeit limited) from this review that ready-to-eat foods are as contaminated as raw foods is a matter of concern. Typically, cooking

(heat treatment) is effective at reducing contamination, suggesting ready-to-eat foods are affected by post-cooking re-contamination (Grace et al., 2018). As part of this work, future research should include street food establishments and restaurants, since these common outlets for ready-to-eat foods have been labelled as high risk for occurrences of foodborne illness in Sub-Saharan Africa (Morse, Masuku, Rippon, & Kubwalo, 2018) as well as in high-income countries such as the United States (Insfran-Rivarola et al., 2020). Street foods have also been widely studied in other LMICs; for example, in Tobago (Franklyn & Badrie, 2015), South Africa (Asiegbu, Lebelo, & Tabit, 2016), Brazil (Isoni Auad et al., 2019), and China (Ma, Chen, Yan, Wu, & Zhang, 2019).

While the review also suggests that food safety research in Ethiopia has largely been oriented towards vendor food handling and hygiene practices, very limited efforts have been made towards understanding their beliefs, perceptions, and motivations or the barriers that may influence food safety-related practices. This is in line with research from other countries, as are the poor practices observed in majority of the studies (GAIN, 2020; Nordhagen, 2022). Food safety knowledge or attitudes were found to be adequate or satisfactory, suggesting a gap in translation of knowledge and attitudes into practice, possibly from bias due to social desirability (tendency to underreport socially undesirable attitudes and practices, and to over report more desirable attributes)(Jespersen, MacLaurin, & Vlerick, 2017). KAP studies elsewhere have found similar gaps; for example, a review in Nigeria found that most studies found "good" knowledge – but also that most studies found "poor" practices (Nordhagen, 2022). A global review of vendor research found that most had no significant difference between knowledge and practice – primarily because both knowledge and practices were found to be poor – but that where a difference existed, it favored knowledge (Wallace et al., 2022). More observation-based studies of practices may provide more accurate information on food safety practices. In addition, it would be useful to have more in-depth evaluation combining

the triad of knowledge, attitudes, and practices, along with motivations and incentives that can influence improved food safety-related practices. Interestingly, the reviewed studies also suggest a congruence in consumers' and vendors' understanding of food choice motives, the use of physical attributes for assessing quality and safety of animal-source foods, and applying practices that eliminated or reduced the risk or level of concern they had about food safety (Amenu et al., 2019; Dewe, 2014; Melesse et al., 2019). There is a clear need for more intervention studies, potentially with different approaches to influence a sustained change in attitudes and practices, as such studies are essential to underpin food safety programming in Ethiopia.

The studies discussed here have several methodological gaps and weaknesses that make it difficult to make a thorough assessment of food safety perceptions and practices. The majority of the studies reviewed utilized a cross-sectional survey design, often using a variety of questionnaires, which did not appear to be pre-tested, validated, or tested for reliability prior to use. This lack of standardized food safety assessment tools can hinder a robust comparison as well as potential consolidation of available data to form a regional or national view of food safety. Another drawback of the (structured) survey designs employed by majority of the studies here is that it is constrained in its ability to provide deep insights into the beliefs, barriers, and motivations/ incentives that can influence the translation of knowledge to practice. We recommend complementing questionnaire-based information with qualitative methods such as focus group discussions or in-depth interviews as done in Nigeria and Vietnam (Nordhagen et al., 2022; Wertheim-Heck & Raneri, 2019), together with novel participatory approaches like Photovoice, as done by Trübswasser et al. (2020), or the use of video cameras (Chapman, Eversley, Fillion, MacLaurin, & Powell, 2010).

The studies included in this review also lacked theoretical underpinning and simply reported knowledge, attitudes, and/or practices of the populations under study. Theoretical models on (health) behavior or behavioral change, such as the Protection Motivation Theory (Chen, 2016; Choi, Nelson, & Almanza, 2019) or Theory of Planned Behavior (Lin & Roberts, 2020; Mullan, Wong, & Kothe, 2013), may provide a better understanding of food safety perceptions and practices. Similar gaps have been found in other reviews of food safety research (Bass et al., 2021), though there are examples of studies that do use theoretical bases, such as several applying the Theory of Planned Behavior (Mullan, Allom, Sainsbury, & Monds, 2015; Ruby, Abidin, Lihan, Jambari, & Radu, 2019; Thaivalappil, Papadopoulos, & Young, 2019). Future research should consider undertaking theory-based studies not only to identify food safety-related perceptions and practices (either current or intended) but also to better understand the role of the individual (e.g., socio-demographic, psychological factors such as beliefs and attitude), social (e.g., subjective norms), and contextual factors (e.g., food focus, safety issue) within the food system environment. In addition, we also suggest well-designed intervention studies targeting practices or proxy indicators of practices (e.g., behavioral intention, stated or revealed preference), as these are likely to provide a more direct measure of effectiveness compared to knowledge and attitudes.

Improvements in infrastructure and the enabling environment are also warranted to improve food safety in Ethiopia. Lack of adequate training, lack of water and sanitation facilities, lack of equipment/ resources, lack of incentives, and insufficient supervision and compliance checks were repeatedly reported by the studies reviewed here. These fundamental barriers call for substantial structural and policy improvements.

Evidence from this review emphasizes the criticality of food safety and hygiene at all steps of the farm-to-fork food supply chain in Ethiopia. In an ideal scenario, this would entail safe food

handling practices across the continuum of vendors to consumers (as well as among other supply chain actors) along with examining how consumers and vendors interact in their perspectives and practices related to food safety. Finally, the research reviewed here showed little focus on the intersection between gender and food safety. Given the role of women as gatekeepers for food consumption, preparation, processing, and retail, undertaking more in-depth gender analysis will be important in developing interventions to improve food safety.

5. STRENGTHS AND LIMITATIONS

This is the first scoping review focusing exclusively on the food safety-related perspectives and practices of consumers and vendors in Ethiopia. The strengths of this review include the use of the PRISMA-ScR guidelines to ensure a robust and replicable process; the use of three electronic databases supplemented with grey literature from high-quality institutions to capture the breadth and depth of (peer-reviewed) publications; the inclusion and comparison of quantitative, qualitative, and mixed-methods articles; design-specific quality appraisal of the included articles; and consultation with local experts to contextualize and translate findings into actionable recommendations.

We acknowledge a number of limitations. First, in order to maintain the feasibility of this review we focused on the generic term “food safety”. Although we developed our syntax of terms based on existing reviews, we recognize that there may be a wealth of relevant research that apply alternate nomenclature such as “food quality” or “food spoilage”. Second, we used a rather broad construct of “practices and perceptions” to frame the review and included a broad range of different study types and populations. The ability to synthesize disparate literature is a key strength of scoping reviews. However, the inclusion of such a broad range of articles also limits the scope for fine-grained analysis that other review types provide. Third, we set English

language as a limit for our search. While English is a widely spoken foreign language in Ethiopia and the language used for scientific documents, it is likely that we may have excluded studies reported in local languages. Fourth, our focus on published empirical articles and grey literature from high-quality institutions excluded any potentially relevant theses or reports from local organizations. Fifth, we relied exclusively on studies that were available electronically, which could have excluded articles for which full-text versions were not available online or some earlier work not available in digital versions. Finally, as many of the studies the review uncovered were not of high quality, caution is advised in interpreting the KAP conclusions.

6. CONCLUSION

This scoping review highlights a rapidly growing body of food safety literature in Ethiopia. The included articles predominantly feature vendors and outcomes related to food handling practices, personal hygiene, environmental sanitation, and education and training as critical factors. Evidence on consumer perceptions and practices as well as the linkages between vendors and consumers is limited at present, and an in-depth understanding of the deep-rooted beliefs, motivations, and incentives that drive food safety and hygiene for both groups are almost non-existent. Overall, studies suggest a lack of translation of knowledge and attitudes to practice. Furthermore, the paucity of evidence from high-quality studies suggests an urgent need to improve study designs, methods, and metrics to better capture food safety practices and perspectives. Improving the quality of research and filling the much-needed knowledge gap will be critical to influence a positive change in food safety practices and perspectives across the value chain in Ethiopia. Below are recommendations for future studies based on the current food safety research landscape in Ethiopia:

a. Fill the lack of consumer studies and, if feasible, extend the scope to evaluate both consumers and vendors in one study design

b. Measure consumer-vendor interactions to understand the similarities and differences in attitudes and practices on (the same) food safety issues and/or risk mitigation
c. Focus on diverse ethnic groups and their traditions as determinants of beliefs and/or practices
d. Pay attention to the intersection between gender and food safety, from sampling to reporting
e. Focus on fresh fruits and vegetables, as well as ready-to-eat foods
f. Focus on local markets
g. Target street food establishments and restaurants as potential hotspots of foodborne illness outbreaks
h. Develop and disseminate pre-tested and validated standardized tools to facilitate harmonized data collection on food safety across diverse settings and/or populations
i. Interpret self-reported data with caution
j. Consider complementing quantitative methods with qualitative ones, including novel approaches (e.g., Photovoice, video cameras)
k. Go beyond the application of the "KAP" model to include outcomes on behavioral change, founded on established theories.

Specifically for researchers undertaking additional KAP studies, we suggest the following:

a. identify a clear research question and use appropriate sampling strategies to address the research questions
b. use pre-tested and validated questionnaires where possible, avoid leading questions, and make original questionnaires or key questions available publicly, for example as supplementary material to publications
c. study knowledge, attitudes, and practices in an integrated way, and report gaps among them

d. include observations of practices, where resources permit, to supplement self-reported data, and when studying attitudes, include qualitative research methods following best practices for qualitative research (Taylor, Bogdan, & DeVault, 2015).

e. report outcomes using guidelines established by the EQUATOR (Enhancing the QUAlity and Transparency Of health Research) Network for different study types (EQUATOR network, 2022).

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Table 1. PCC model of the scoping review

Population (P)	"**Vendors**": any seller or handler of food with a direct link to the consumer; this would include sellers or handlers of both fresh and prepared foods in markets, restaurants, or institutional settings but not actors further up the value chain, such as farmers, who have no interaction with end consumers. "**Consumers**": all those who purchased or otherwise acquired food for themselves or their families.
Concept (C)	"**Perspectives and practices**" related to food safety in retail (and specifically in traditional markets): any of knowledge, beliefs, or attitudes; actions or practices; factors motivating food choice, purchase habits, or pricing; or willingness to pay.
Context (C)	**Ethiopia** (national or subnational) **and/or a region containing Ethiopia** (e.g., East Africa)

Table 2. Foods and populations examined in the included studies

Food	**N**	**Number of studies per population**		
		Vendors	**Consumers**	**Both**
Ready-to-eat foods[1]	11	11		
Meat	13	12		1
Raw meat (beef, goat)	2	2		
Milk, other dairy products	11	2	1	8
Meat and milk (cow, sheep, goat)	3	1	1	1
Fruits, fruit juices	6	6		
Fruits and vegetables	4	4		
Vegetables	1	1		
Vegetables and legume-based foods	1	1		
Vegetables and chicken	1			1
Eggs	2		1	1
Beer	1	1		
Fish	1	1		
Not Specified/No food focus	59	52	4	3
Number	116	94	7	15

[1] Refers to composite menu items from street vendors, restaurants and local eateries. Some examples include fuol, sambusa, ades, bonbolino, and injera.

Table 3. Common indicators used to assess food safety

Personal hygiene	Food handling	Environment
• Handwashing (*with soap and at critical times: after toilet, touching money or other dirty material, before handling food, after handling raw foods*) • Fingernails (*trimmed, polished*) • Clean clothes, appearance • Use of personal protective equipment (*hairnets, gloves, aprons*)	• Separate knives, equipment for raw and cooked foods, meat and other produce • Using clean utensils, equipment • Cleaning utensils, equipment with clean water, soap • Storage conditions, refrigeration (*temperatures, containers, protected from elements such as dust, sun*) • Clean product display (*above ground, using mats, protected from elements such as fleas, dust, sun*)	• Appearance of the establishment/ vending site (*condition and material of floors, walls; dirt spots*) • Availability and distance of toilets from kitchen • Availability of handwashing facilities in or near toilets • Garbage disposal and waste collection (*system, area/ proximity to food*) • Clean vending sites (*no stagnating water or waste, protected from elements such as fleas, dust, sun*)

	• Washing products before display • Stopping activities when unwell, with cuts or skin conditions • Not handling food while wearing jewelry • Covering mouth when sneezing, coughing	
Compliance: Medical checkups (*frequency, health certificate*), Inspection by regulatory authorities, Trainings (*formal, informal*), Valid licenses		

Note: Based on significant associations derived from studies on vendors (n=33), and vendors and consumers (n=1).

Table 4. Hygiene and sanitation practices or demographic traits associated with food safety concerns

Microbial contamination of foods (n = 6)	**Intestinal parasites in food handlers** (n = 21)	**Enteropathogens on food handlers' person and/or food handling environment** (n = 6)
Handwashing habits (n = 4)	Handwashing habits (n =18)	Source of produce/ water (n=4)
Medical check-up frequency (n = 1)	Medical check-up frequency (n = 12)	Education level (n=2)
Personal hygiene (n=1)	Food hygiene and safety trainings (n = 7)	Fingernail length (n=2)
Cleanliness of knifes/ utensils/ environment (n=1)	Education level (n = 3)	Means/ place of display (n=2)
	Health status of the food handler (n = 1)	Washing of produce (n=2)
Fingernail length (n=2)	Knifes/ utensils for raw meat and other foods (n = 2)	Attitude (n=1)
Education level (n=1)		Personal and environmental cleanliness (n=2)
	Fingernail length (n=12)	Use of plastic containers (n=1)
	Handling food with bare hands (n = 1)	Medical check-up frequency (n=1)
	Personal cleanliness (n = 1)	
	Uncooked foods/ unpasteurized milk (n = 5)	
	Source of water for cleaning produce (n = 1)	

	Area of residence (n=1) Income (n=1) Gender (n=2) Customer feedback (n = 1) Washing utensils (n=1) Washing produce before consumption (n =1) Food storage (n = 1)	

Note: Based on significant associations derived from studies on vendors (n=33), and vendors and consumers (n=1).

Figure captions

Figure 1. PRISMA-SCr flowchart of study selection process

Figure 2. Publication year of the included studies

Figure 3. Distribution of studies across Ethiopia's regional states and chartered cities

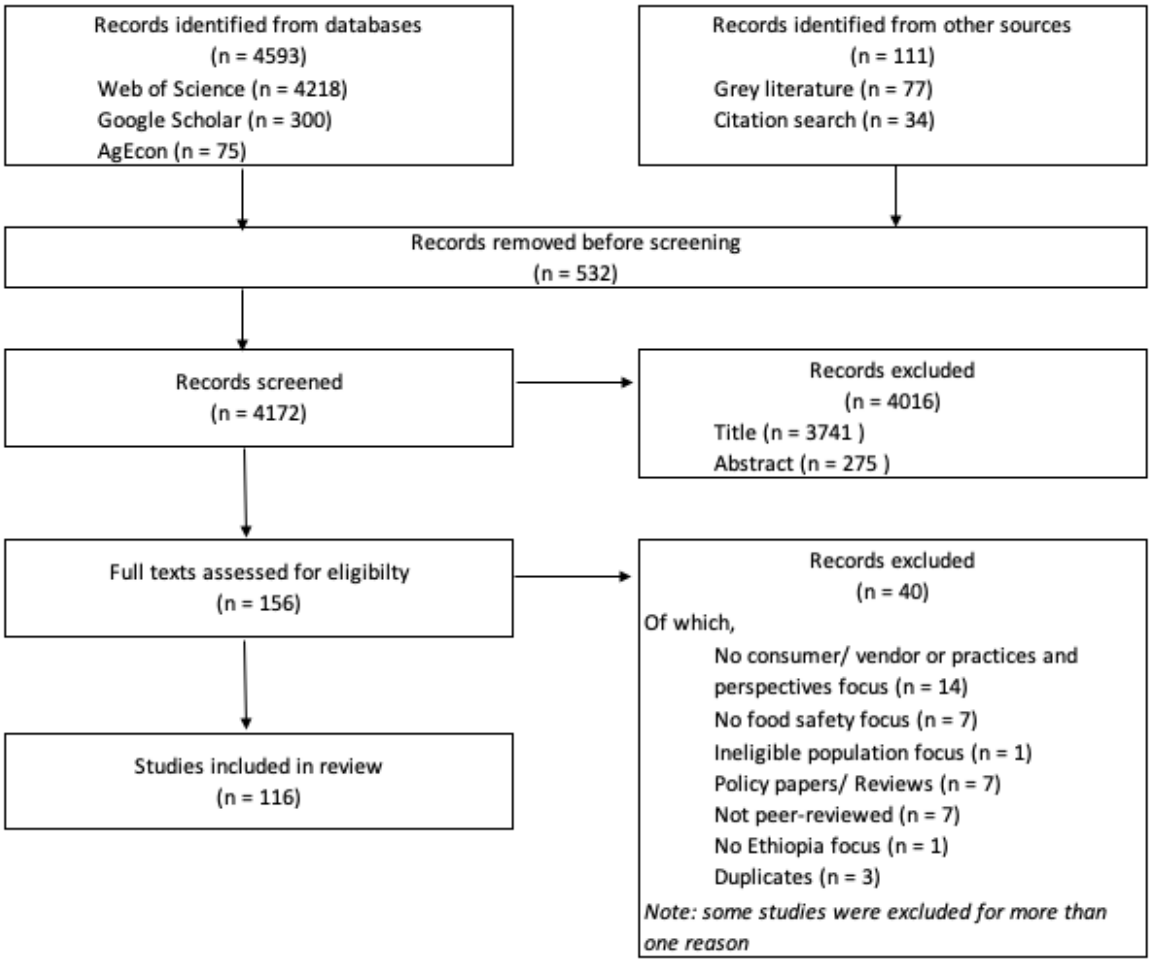

Records identified from databases
(n = 4593)
Web of Science (n = 4218)
Google Scholar (n = 300)
AgEcon (n = 75)
Records identified from other sources
(n = 111)
Grey literature (n = 77)
Citation search (n = 34)
Records removed before screening
(n = 532)
Records screened
(n = 4172)
Records excluded
(n = 4016)
Title (n = 3741)
Abstract (n = 275)
Full texts assessed for eligibilty
(n = 156)
Records excluded
(n = 40)
Of which,
No consumer/ vendor or practices and perspectives focus (n = 14)
No food safety focus (n = 7)
Ineligible population focus (n = 1)
Policy papers/ Reviews (n = 7)
Not peer-reviewed (n = 7)
No Ethiopia focus (n = 1)
Duplicates (n = 3)
Note: some studies were excluded for more than one reason
Studies included in review
(n = 116)

Fig 1.

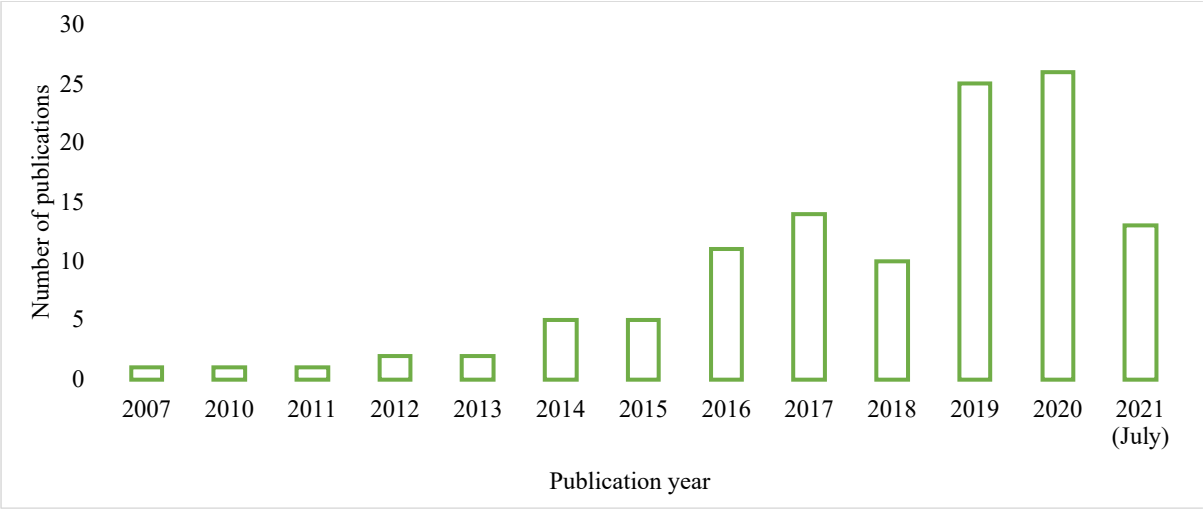
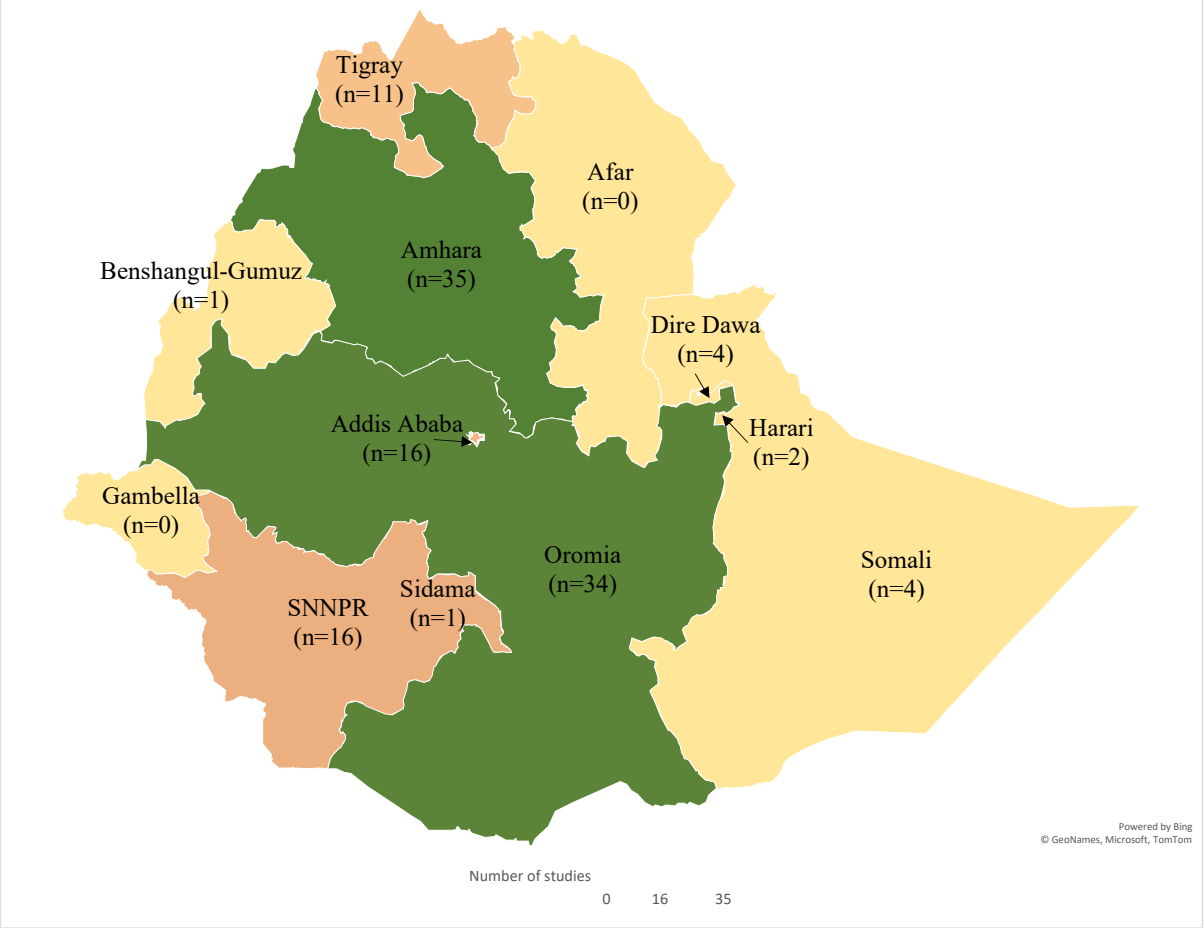

30
25
20
15
10
5
0
Number of publications
2007
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021 (July)
Publication year

Fig 2.


Tigray
(n=11)
Afar
(n=0)
Amhara
(n=35)
Benshangul-Gumuz
(n=1)
Dire Dawa
(n=4)
Addis Ababa
(n=16)
Harari
(n=2)
Gambella
(n=0)
Oromia
(n=34)
Somali
(n=4)
Sidama
(n=1)
SNNPR
(n=16)
Powered by Bing
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Number of studies
0
16
35

Fig 3.