

EatSafe: Evidence and Action Towards Safe, Nutritious Food

Consumer and Vendor Perspectives and Practices Related to Food Safety in Ethiopia: A Review

September 2021

This EatSafe report presents evidence that will help engage and empower consumers and market actors to better obtain safe nutritious food. It will be used to design and test consumer-centered food safety interventions in traditional markets through the EatSafe program.

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ACRONYMS AND ABBREVIATIONS

Below is a list of all acronyms and abbreviations used in the report.

EatSafe	Evidence and Action Towards Safe, Nutritious Food
EC	European Commission
FAO	Food and Agriculture Organization of the United Nations
GAIN	Global Alliance for Improved Nutrition
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
LMIC	Low- and Middle-Income Country
MMAT	Mixed Method Appraisal Tool
PCC	Population, Concept, Context
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta Analyses
USAID	The United States Agency for International Development
WB	The World Bank
WHO	World Health Organization
WTO	World Trade Organization

EXECUTIVE SUMMARY

Foodborne diseases impose a tremendous health burden in low- and middle-income countries and are associated with correspondingly large economic costs and psychosocial distress, which can negatively impact health and well-being. While Ethiopia has prioritized food safety, these concerns remain of acute relevance to the country. Improving food safety requires actions across the value chain, including at the level of retail—which is the target of the USAID-funded EatSafe Ethiopia project. An understanding of the motivations, beliefs, values, culture, and practices that shape and/or drive behavior of consumers and vendors is crucial for designing sustainable and effective strategies to improve food safety. This review, therefore, was undertaken to support EatSafe Ethiopia by providing insights on prior research on food safety-related perspectives and practices among consumers and food vendors in Ethiopia.

A systematic search and review of three databases and grey literature sources was conducted in July 2021 and retrieved 4,704 records. In total, 116 articles met the review's eligibility criteria and were included in the synthesis. Collectively, articles spanned eight of the ten Ethiopian regional states and the two chartered cities, with most work focusing on urban areas and on a sample within one state or chartered city. No articles included Afar and Gambella regions, and only one cross-country comparison was reported. The majority of studies (n=94) focused on vendors or food handlers, with a comparatively limited number of consumer studies (n=7). Fifteen articles examined both consumers and vendors, but only four attempted to assess interactions between the groups. Meat, milk (and other dairy products), and ready-to-eat (street) foods were the most studied food groups (n=40). Food service establishments (such as cafeterias, restaurants, hotels, and juice bars) were the most examined outlets (n=41). Forty-six studies examined generic food safety issues or concerns.

Articles featured quantitative descriptive (n=109), qualitative (n=4), and mixed-method designs (n=3); all studies were cross-sectional in nature. Studies predominantly analyzed food safety practices (n=102), while only 53 studies examined knowledge and 19 studies assessed attitudes.

Vendor-focused studies assessed knowledge, attitudes, and practices for common themes: critical times for handwashing, personal appearance, environmental cleanliness, maintaining fingernails, training on food safety and handling, frequency of medical check-ups, and importance of segregating utensils/knives for different foods. Studies tended to find observed practices “poor,” while knowledge was found to be “adequate,” and attitudes were rated as “satisfactory.” There appeared to be distinctive gender roles associated with food handling, with males dominating food handling in abattoirs and butcher shops and females in all other outlets.

The themes for knowledge and practice assessments in consumer-focused studies were generally related to food safety awareness, handwashing habits, cross-

contamination of foods at home, storage conditions of food, food vendors' hygiene, and the importance of proper cooking or refrigeration. Only one study assessed consumers' willingness to pay for safe and quality food. Limited evidence on consumer-vendor interactions suggests that both groups used physical attributes based on senses (such as color, smell, and consistency) to assess quality and safety of animal-source foods, had their own 'coping' strategies to reduce levels of food safety-related concern, and had similar perceptions of consumer motives driving purchase.

Analysis of food and the food handling environment revealed a high level of contamination. Twenty-eight studies isolated a range of intestinal pathogens in feces of food handlers, and three studies identified food handlers' carrying pathogens on their hands and/or clothes. Thirty-four studies identified at least one hygiene/sanitation practice and/or demographic trait associated with these food safety issues. Studies suffered from numerous methodological weaknesses; of the 116 studies, only nine were assessed to be of high quality. One intervention study examined a training intervention and found it to be effective in influencing knowledge, attitudes, and practices, albeit only in the short to medium term.¹

The paucity of evidence from high-quality studies is a limitation, highlighting the critical need for improved study designs with standardized methods and metrics. Future research on food safety-related practices and perspectives must address consumers and consumer-vendor interactions, include the full triad of knowledge, attitudes, and practices outcomes, consider behavioral outcomes, and focus gender and culture throughout the research process. Improving the quality of research will be critical to the design of feasible, appropriate, and effective interventions to improve food safety in Ethiopia.

¹ This intervention study did not appear in the original systematic search and was included in the review in September 2021, after it was identified separately.

KEY CONCLUSIONS BASED ON FINDINGS OF THIS REVIEW

- Food safety is a field of active and growing research interest in Ethiopia;
- Research is heavily skewed towards vendors or food handlers; the limited focus on consumers or consumer-vendor interactions merits caution in interpretation of results;
- Food safety is largely conceptualized as practices, with limited focus on knowledge, attitudes, or the combination of all three;
- In-depth insights into deep-rooted beliefs, behaviors, and underlying factors that can translate knowledge or attitudes into practice are lacking;
- Nutrient-rich foods such as fruits, vegetables, eggs, and fish have received comparatively little attention, as have traditional markets and local eateries;
- There is a gap between vendors' observed practices and their knowledge and attitudes;
- Consumer deductions of food safety and microbial quality are largely based on vendor practices;
- There appears to be an alignment in the food safety-related practices and perspectives of consumers and vendors;
- A high level of contamination is seen in foods, the food environment and carried by food handlers; these foodborne hazards have been found to be associated with hygiene and sanitation practices and/or demographic traits of vendors;
- Training appears to be an effective intervention, but efforts are needed to ensure sustained impact; and
- Evidence from high-quality studies using standardized, validated tools is sparse, warranting an urgent need to improve study designs and tools.

I. INTRODUCTION

Food is a source of nutrition, central to overall health and well-being of individuals and societies. If not handled, prepared, and stored appropriately, it can carry foodborne pathogens that transmit disease. Every year, one in 10 people fall ill and 33 million healthy life years are lost due to the consumption of unsafe foods (1). Children under five years of age are particularly vulnerable, accounting for almost 40% of all foodborne diseases and 30% of total deaths related to unsafe food annually (1). 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 (1). The foods most often implicated are animal-source foods and fresh produce (2, 3)—which are also highly nutritious.

Foodborne disease has numerous linkages with poor nutrition, including through its common manifestation as diarrhea, which is strongly associated with stunting (4, 5). In addition, foodborne illness is associated with a wide range of economic costs due to disease, treatment, food recalls, food safety governance, lost productivity, and risk-reducing practices. The World Bank estimates economic losses in LMICs of up to US\$95 billion a year associated with productivity loss alone (6). Due to the acknowledged 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 is necessary for attainment of the SDGs. Despite this, there is no clearly defined food safety indicator being monitored.

Foodborne diseases also have implications for equity and culture. In many LMICs, women predominate in food production, processing, retail, and preparation within the household. Hence, ensuring that programs and policies are inclusive of women is essential for assuring food safety. Other studies show that unsafe and low-quality food may be channeled towards the poorest, putting them most at risk (7). Food safety is thus an equity issue, as well as public health and economic one.

All these issues are of acute relevance to Ethiopia, Africa's second-largest country, which is undergoing rapid economic development yet still facing high levels of stunting (affecting 37% of children under age 5 years (8)). As with many other LMICs, many low(er)-income consumers in Ethiopia rely on traditional (or "informal") markets to access nutrient-dense foods such as animal-source foods and fresh fruits and vegetables (9). Evidence from other LMICs suggests that much of the food sold in such traditional markets is already contaminated (2) and that actions taken by consumers in food preparation are often not sufficient to mitigate the risk of foodborne illness (10). At the same time, an increasing number of Ethiopian consumers eat outside the home in open-air markets or small restaurants, where food may be provided in less-than-hygienic conditions (11).

Ethiopia is among the first African countries to prioritize food safety. The Ministry of Health is developing a functional food safety system that incentivizes companies to deliver safer food and regulates those that do not comply. However, Ethiopia will not overcome the complex food safety challenges that come with traditional and transitioning food systems until everyday consumers are empowered to become the first line of defense against unsafe food. The USAID-funded EatSafe (Evidence and Action Towards Safe, Nutritious Food) Ethiopia project aims to generate the evidence and knowledge needed to do this. It focuses on leveraging the potential for increased consumer demand for safe food to substantially improve the safety of nutritious foods in traditional market settings in Ethiopia. The five-year project is being undertaken by a consortium led by the Global Alliance for Improved Nutrition (GAIN) and containing the International Livestock Research Institute (ILRI), the Busara Center for Behavioral Economics, and Pierce Mill Education and Media.

Central to EatSafe's work is understanding (and potentially shaping) the motivations, attitudes, beliefs, and practices of consumers and food vendors in traditional markets. A focus on the point of sale is essential as vendors' actions can impact food safety and compromise control measures taken earlier in the value chain. Also, market-level choices are central to enabling consumers to demand safer food and vendors to deliver it (12, 13). 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 (6), and knowledge of producer behavior and consumer demand for food safety in LMICs is limited (13). While EatSafe will undertake novel primary research on consumer and vendor motivations and practices, it is essential to ensure that this work is informed by and builds on what has already been done—both in terms of methods used and results obtained.

The objective of this systematic scoping review, therefore, is to understand prior research on perspectives and practices related to food safety among consumers and food vendors in Ethiopia to inform future EatSafe strategies for improving safety of nutritious food in traditional markets in the country.

2. METHODS

Scoping reviews are recognized as a salient approach when synthesizing knowledge from a diverse body of literature that has yet to be reviewed. The approach involves systematically searching, selecting, and charting existing knowledge to identify key concepts, gaps in the research, and types and sources of evidence to inform practice, policymaking, and research (14, 15). This scoping review is aligned with the Preferred Reporting Items for Systematic Reviews and Meta Analyses—Extension for Scoping Reviews (PRISMA- ScR) (16) checklist and guidelines. We followed the methodological framework proposed by Arksey and O'Malley (17) and further developed by Levac et al (18). This framework included the following steps: identifying the research question(s); identifying relevant studies; selection of studies; data charting; collating, summarizing and reporting the findings; and consultation.

The protocol of this scoping review was registered and published on Open Science Framework.² The methods were designed to largely align to a prior literature review carried out for the EatSafe project in Nigeria.³

2.1 RESEARCH QUESTIONS

This review was motivated by the following research questions:⁴

- What are the current knowledge, attitudes, beliefs, and behaviors relevant to food safety among consumers and food vendors in Ethiopia?
- What studies have included both consumers and food vendors to better describe how food safety is conceptualized among these actors?
- What is the gap between knowledge/attitudes and practices related to food safety among consumers and food vendors in Ethiopia?
- How can findings from available studies inform interventions that can address food safety for both consumers and food vendors?

2.2 IDENTIFYING RELEVANT STUDIES

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. We also searched the websites of the Food and Agriculture Organization of the United Nations (FAO), International Food Policy Research Institute (IFPRI), World Health Organization, World Bank, International Livestock Research Institute (ILRI), World Trade Organization (WTO), and European Commission (EC) using the same key search terms. Additional studies were identified through citation searching of above-average or high-quality publications 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 in [Appendix 1](#).

2.3 CRITERIA FOR INCLUDING AND EXCLUDING STUDIES

The Population, Concept, and Context (PCC) framework (19) (**Table 1**) was used to define the eligibility criteria for the review. Additional definitions that guided the review included: food safety *knowledge* – this refers to “what is known” and covered factual understanding of different food safety aspects such as personal hygiene,

² Available online at DOI 10.17605/OSF.IO/7JEMA (available at <https://osf.io/7jema/>).

³ See EatSafe Project Year 1 deliverable, “Consumer and Vendor Perspectives on and Practices Related to Food Safety in Nigeria.”

⁴ It was initially planned to include, and the searching was carried out to cover, two additional 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?” However, due to insufficient or no information found in the included studies, these questions were not addressed through the review and are not covered in this report.

cross-contamination, causes and symptoms of foodborne diseases, and time/temperature control; *attitude* – this is 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* implies “what is done” and includes observable actions, often in response to stimuli, on aspects such as personal hygiene, handwashing, and food handling and storage practices.

Table 1. PCC Model of the Scoping Review

Population (P)	<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</p>
	<p>“Consumers:” all those who purchased or otherwise acquired food for themselves or their families.</p>
Concept (C)	<p>“Perspectives and practices” related to food safety: any of knowledge, beliefs, or attitudes; actions or practices; factors motivating food choice, purchase habits, or pricing; or willingness to pay.</p>
Context (C)	Ethiopia

Studies were eligible for inclusion in the scoping review if they were published in 2000 or afterwards, were in English, had a consumer and/or vendor focus (as defined in **Table 1**), and included perspectives and practices related to food safety (as defined in **Table 1**). Only studies that included primary data, had a focus on Ethiopia (national or subnational) and/or a region containing Ethiopia (e.g., East Africa), and were published in peer-reviewed scientific national and international journals and/or reports of select high-quality institutions (listed above) were included. There were no restrictions placed on study type.

As this review was motivated by an interest in food safety at the retail stage (and specifically in traditional/open-air markets), we excluded studies that focused on consumers’ in-home behaviors or actors such as farmers who had no interaction with end-consumers (indirect sales). Papers with a sole focus on export markets and/or countries other than Ethiopia were also excluded.

2.4 STUDY SELECTION

Literature search results from the above-mentioned databases were imported to EndNote X9 and duplicates were removed prior to eligibility assessment. The screening of citations for inclusion entailed first a review of titles followed by a review of abstracts (or summaries) for relevance versus inclusion/exclusion criteria. For papers passing the abstract screening, a full-text review was conducted. For papers passing the full-text review, we proceeded with data charting (Section 2.5) and quality appraisal (Section 2.6). An amended PRISMA flow diagram (

Figure 1) reports the search and screening results, including reasons for exclusion of studies.

The screening for all identified studies was done by two independent researchers, and conflicts were adjudicated by an independent reviewer. The reviewers met regularly to discuss the selection process and resolve conflicts, if any.

2.5 DATA CHARTING

For all eligible studies, relevant information was extracted in a standardized review form by both reviewers. In brief, information extracted included: lead author, year, title, publication type, journal (if applicable), geographic focus area, population(s), specific food(s), specific retail outlet(s), methods, aspects assessed, main results related to consumer and/or vendor populations, and methodological quality based on Mixed Method Appraisal Tool (MMAT; see Section 2.6). These forms were piloted by the reviewers, and minor modifications were made after the first five studies were extracted to ensure all the relevant data was adequately captured.

2.6 QUALITY APPRAISAL

All included studies were appraised independently by two reviewers on methodological quality (and not the quality of their reporting) using MMAT, 2018 version (20). We used this tool as it is designed for simultaneous quality appraisal of multiple study types, including qualitative, quantitative, and mixed-methods studies. 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). Both reviewers discussed the appraisal scores and in case of difference, the question was rated as 'no' (2) or 'can't tell' (3). A third reviewer was consulted in case of disagreement with no consensus. MMAT scores representing the number of criteria met (rated 'yes'), divided by five and translated into percentages were subsequently calculated; scoring ranges from 20% (noted as *, low quality) to 100% (noted as *****, high quality). There was no follow-up with authors to obtain additional information if the eligible studies and reports did not provide sufficient information to fully appraise quality using the MMAT. Also, reports identified through institutions (as opposed to database searches of published scientific literature) were not appraised for quality. As recommended by Hong *et al.* (20), the overall quality score was not calculated, and instead a more detailed presentation of the ratings of each criterion is provided. 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 scoping review.

2.7 COLLATING, SUMMARIZING, AND REPORTING THE FINDINGS

The data in the data extraction forms formed the basis for the narrative synthesis on the body of research available on vendor and consumer perspectives on food safety in Ethiopia. We undertook a numerical analysis of the number of included studies, their geographical distribution, and the food categories and food safety aspects they

cover. Since the studies were heterogenous in terms of methods and metrics, we synthesized them thematically. Where feasible, we attempted to identify interlinks between the perspectives and practices of consumers and vendors.

2.8 CONSULTATION

In accordance with the recommendation of Levac *et al* (18), we organized a virtual consultation workshop with internal 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. Insights gained were used to translate the outcomes of the review into more actionable recommendations.

3. RESULTS

We identified 4,704 records, of which 116 studies⁵ (21-136) were included in the data synthesis. The study selection process, including reasons for exclusion, is given in

Figure 1. An overview of the key characteristics of included studies is presented in Appendices [2](#), [3](#), and [4](#).

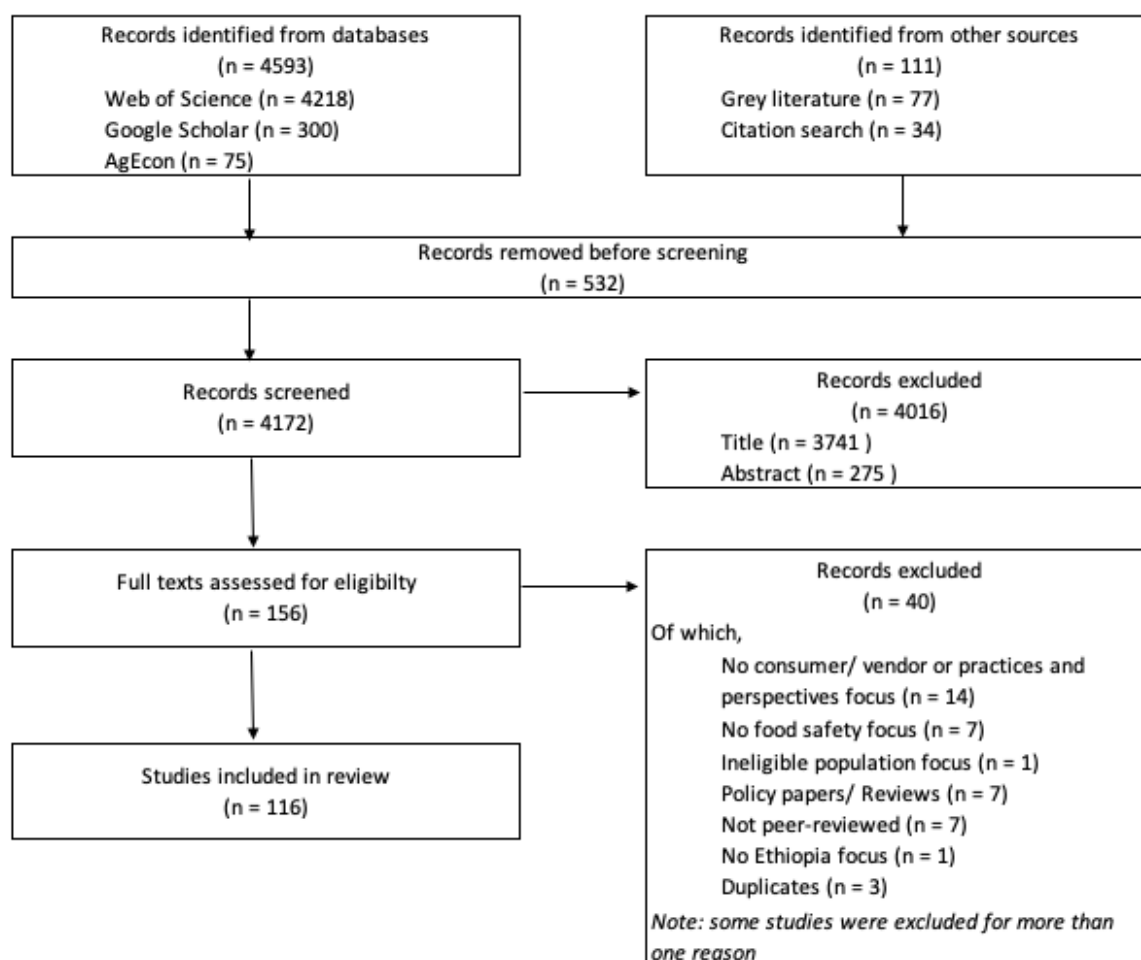


Figure 1. PRISMA-SCr Flowchart of Study Selection Process

Articles were published from January 2007 to July 2021, with the number of publications increasing by year, suggesting an increased focus of research on this topic (**Figure 2**). One hundred and twelve articles (97%) were published in scientific journals (though not necessarily peer-reviewed journals), while four were publications from high-quality institutions (two reports, one project brief, and one working paper).

⁵ One additional study was identified as relevant but did not appear in the original systematic search or citation search; it has been included in the review for completeness (Section 3.5).

Except one study, all studies focused only on Ethiopia. The exception, Knight-Jones et al (89), 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). The highest numbers of studies examined populations from Amhara and Oromia regions, followed by Addis Ababa and SNNPR, while the Afar and Gambella regions had no studies.

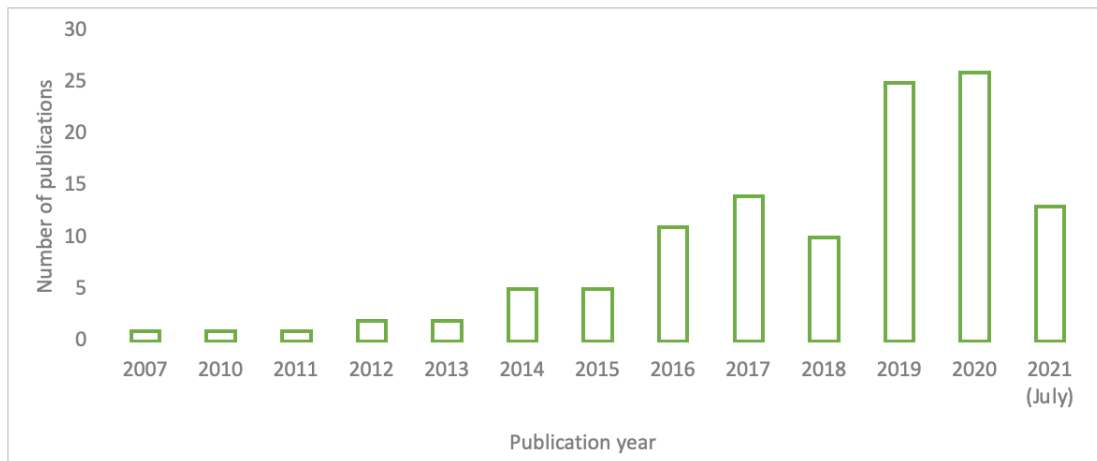


Figure 2. Publication Year of the Included Studies

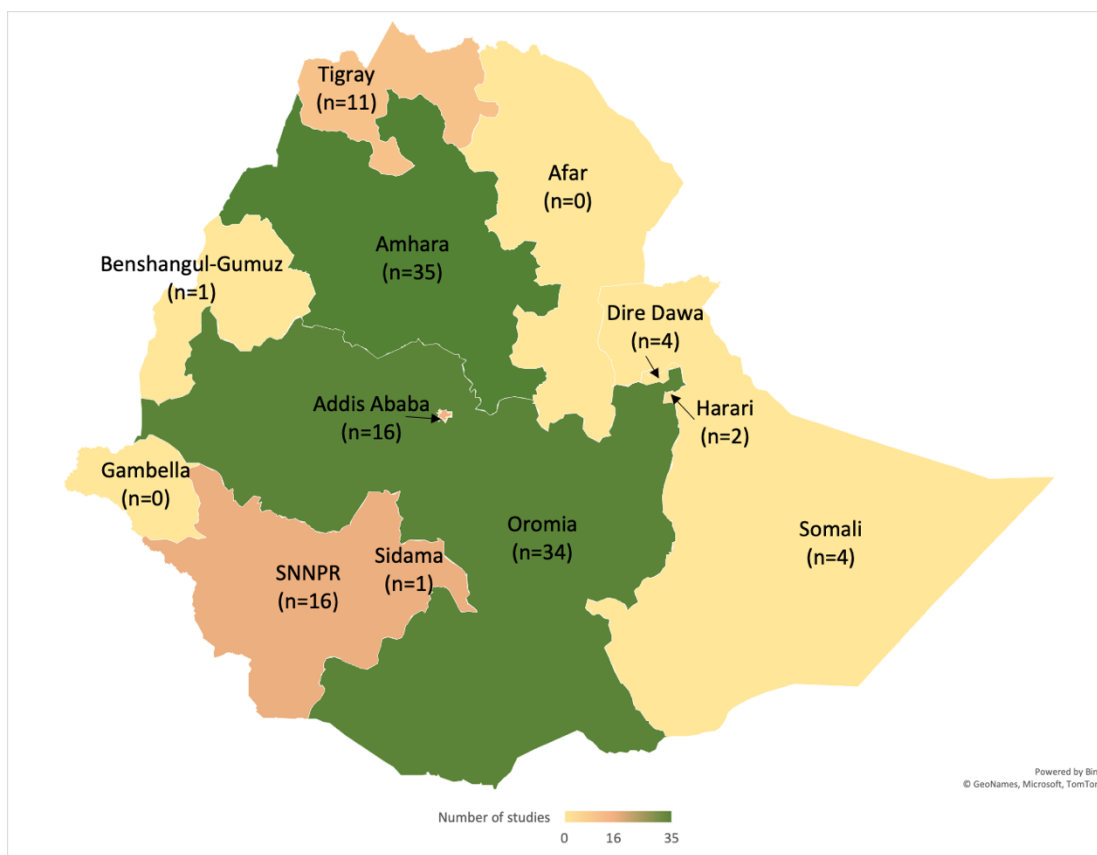


Figure 3. Distribution of Studies Across Ethiopia

One hundred and twelve studies (97%) examined a sample within just one Ethiopian regional state or chartered city, and four studies (3%) featured multiple regional

states and/or chartered cities. The majority of the studies focused on urban areas (47%) or did not specify a focus (47%), while 3% studies focused on rural areas and 3.4% studies focused on both urban and rural areas.

The majority of the studies (81%) focused on vendors or food handlers⁶ (including managers and/or owners of food establishments and institutions): 6% focused just on consumers (students, households, and mothers), and 13% focused on both consumers and vendors. Only two studies focused on specific sub-populations such as the Borana pastoralists (37, 59). There was no particular food focus in 59 studies, the majority of which were on vendors/ food handlers. Meat, milk (and other dairy products), and ready-to-eat (street) foods were the most common focus of the included studies. The distribution of studies by food and population group of focus is presented in **Table 2**.

Table 2. Foods and Populations Examined in the Included Studies

FOOD	N	NUMBER OF STUDIES PER POPULATION		
		VENDORS	CONSUMERS	BOTH
Ready-to-eat foods*	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, 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

*Refers to composite menu items from street vendors, restaurants and local eateries. Some examples include fuul, sambusa, ades, bonbolino, and injera.

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

⁶ This includes respondents from large and small food establishments, retail shops and supermarkets, open markets, educational institutions, abattoirs and butcher shops, street food stalls and juice bars, farms (only those with direct consumer interaction) and production/ processing units, and hospital and prison cafeterias.

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 commonly examined outlet (35%), followed by abattoirs and butcher shops (14%), university cafeterias (13%), local markets (11%) and street vending sites (10%). Other outlets studied were hospital cafeterias, farms, milk collection centers, prisons, households, catering establishments, and corner shops (13%). Half of the included studies examined multiple outlet types, while five studies did not mention any specific focus.

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 (67 of 116) included a combination of practice with knowledge (n=48) or attitude (n=19), whereas only a few studies examined the triad of knowledge, attitude, and practices (n=20). Although these studies examined multiple concepts, few reported on interlinks between them. Two studies explored consumer willingness-to-pay for quality and safety attributes (81, 105), and four studies (two consumer-focused; two involving both consumers and vendors) assessed how perceptions influence behaviors (37, 43, 128, 129).

The majority of the studies (94%) used quantitative descriptive methods⁷ in isolation, either to describe or analyze indicators associated with food safety or test for associations with outcomes of interest. All the articles featured cross-sectional study designs and used a range of measurement methods, including questionnaire-based surveys (82%), face-to-face structured interviews (20%), observations (direct or checklist; 41%), analysis of food for contaminants⁸ (26%), environmental swab analysis (3%), and biological sample (stool/swab) analysis (28%). All studies used at least two of these approaches.

Only four studies (3%) used qualitative descriptive methods⁷ to investigate food safety. Those studies included a combination of approaches from semi-structured interviews (37), structured in-depth interviews (50, 129), focus group discussions (37, 59, 129), participatory rural appraisal (59), informal discussions (37), direct observation (37), and the photovoice method (129). Mixed (qualitative and quantitative) methods⁷ were employed by three studies (3%), using methods and measures overlapping with those used by the quantitative-only and qualitative-only studies.

⁷ Included studies were categorized as quantitative, qualitative, or mixed methods using the criteria in the MMAT User Guide.

⁸ Studies including only laboratory analysis, without any other research methods designed to study consumer or vendor practices and perceptions, are not covered here.

Seventy-six studies reported on the gender of the study participants; the remaining 40 studies did not include gender in their demographic reporting. Of those studies reporting on gender, 72 studies included both men and women, three included only women (37, 50, 57), and one included only men (22). Only three studies reported key results disaggregated by gender or associations between key results and gender.

Nine studies were assessed to be of high quality, and eight were of above-average quality. The remaining studies were assessed to be of average or below quality (meeting less than 60% of MMAT criteria). The main limitations noted were unclear research question(s), 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. Critical appraisal of the included studies using MMAT is presented in [Appendix 5](#).

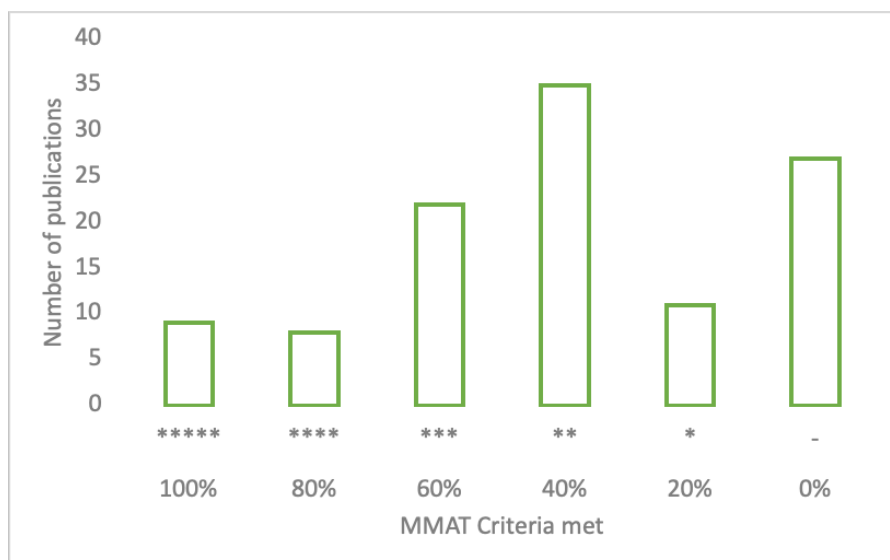


Figure 4. Quality Appraisal using Mixed Methods Appraisal Tool (MMAT)

Note: Quality appraisal reported only for published articles (n=112)

Quality: *****) 100% criteria met, ****) 80% criteria met, ***) 60% criteria met, **) 40% criteria met, *) 20% criteria met; dash (-) indicate no criteria are met

Overall, the studies on perspectives and practices used a wide range of different outcome indicators and metrics, making it difficult to quantitatively summarize results across all studies and infeasible to attempt a meta-analysis. As such, we describe main trends in results as well as particularly interesting insights or aberrant results.

3.1 VENDOR PERSPECTIVES AND PRACTICES

All 94 vendor-focused studies were quantitative, descriptive, cross-sectional surveys that examined food safety-related perceptions and practices using closed-ended questions (e.g., multiple-choice questions). Knowledge, attitudes, and practices were assessed along the lines of a set of common themes, including critical times for handwashing, personal appearance, environmental cleanliness, maintaining

fingernails, trainings on food safety and handling, frequency of medical check-ups, and importance of segregating utensils/knives for different foods. A set of example questions, drawn verbatim from four studies, is included in **Box 1**. There was considerable overlap in the questions used to assess “attitude” with those intended to assess “knowledge” and/or “practices”; this was also evident in the evaluation approach, for example, several attitudinal variables were coded as right or wrong (instead of, e.g., an agreement ‘Likert’ scale), as though they were assessing knowledge.

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 (score-based) 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. Of the 85 studies that assigned a clear 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 (e.g., hotels, cafés, restaurants, bar, cafeterias, juice shops, street stalls, local markets) had predominantly female food handlers/ vendors.

Food safety in vendor-focused studies was assessed using both subjective (i.e., based on responses to questionnaires) and objective (i.e., based on lab analysis or similar measures of actual contamination of food or other substances/objects) indicators. An overview of the most used subjective indicators is presented in **Table 3**; the objective indicators are discussed in Section 3.4.

Box 1. Examples of Typical Questions Used in Vendor-Focused Studies

Drawn from Adane (27), Azenaw (45), Mardu (100), and Tegegne (121). Response options are given in parentheses, in italic text.

KNOWLEDGE

- Are you aware of fecal-oral transmission? (*Yes/No*)
- Can you mention foodborne illness? (*Yes/No*)
- Do you know the importance of gowning? (*Yes/No*)
- Uncooked meat should be stored in the lower part of the refrigerator (*Yes/No*)
- Contact between uncooked and cooked food causes cross-contamination (*Yes/No*)
- Wearing gloves will reduce the contamination of food (*Yes/No*)
- Contamination of cooked foods cannot be detected using sense organs (*Yes/No*)
- Use of the same knife for cutting vegetables and meat exposed to foodborne diseases (*Yes/No*)
- Contaminated foodstuffs always change their characteristics (*Yes/No*)
- Food contamination risk zone (40-140°F) (*Yes/No*)
- Frequent food contact surface cleaning can reduce contamination (*Yes/No*)

ATTITUDE

- Meat handlers with wounds, bruises or injuries on their hands must not touch or handle meat (*Right answer/Wrong answer/Not sure*)
- Using watches, earrings and rings will increase the risk of meat contamination
- Improper meat storage is dangerous to health (*Right answer/Wrong answer/Not sure*)
- Hand washing before handling meat reduces the risk of contamination (*Right answer/Wrong answer/Not sure*)
- Regular training could improve meat safety and hygiene practices (*Right answer/Wrong answer/Not sure*)
- Safe meat handling to avoid contamination and diseases is part of meat handler job responsibilities (*Right answer/Wrong answer/Not sure*)

PRACTICES

- Do you wash your hands before handling and cooking food with soap and water? (*Never, Rarely, Sometimes, Most of the time, Always*)
- After counting money, do you wash your hands? *Never, Rarely, Sometimes, Most of the time, Always*)
- Do you always wear a gown while handling food? (*Yes/No/Don't know*)
- Do you always wear hair restraint while handling food? (*Yes/No/Don't know*)
- Do you always wear finger ornaments while handling food? (*Yes/No/Don't know*)
- Do you use gloves to prepare or handle food? (*Yes/No/Don't know*)
- Do you properly cover prepared food until consumption? (*Yes/No/Don't know*)
- Have you ever prepared food while you have diarrhea? (*Yes/No/Don't know*)
- Do you always wash utensils just before use? (*Yes/No/Don't know*)
- Do you always wash your hands with soap and water after toilet? (*Yes/No/Don't know*)

Table 3. Common Indicators Used to Assess Food Safety

PERSONAL HYGIENE	FOOD HANDLING	ENVIRONMENT
Handwashing (<i>with soap and at critical times: after toilet, touching money or other dirty material, before handling food, after handling raw foods</i>)	Separate knives, equipment for raw and cooked foods, meat, and other produce	Appearance of the establishment/ vending site (<i>condition and material of floors, walls; dirt spots</i>)
Fingernails (<i>trimmed, polished</i>)	Using clean utensils and equipment	Availability and distance of toilets from kitchen
Clean clothes, appearance	Cleaning utensils and equipment with clean water, soap	Availability of handwashing facilities in or near toilets
Use of personal protective equipment (<i>hairnets, gloves, aprons</i>)	Storage conditions, refrigeration (<i>temperature, containers, protected from elements such as dust, sun</i>)	Garbage disposal and waste collection (<i>system, area/ proximity to food</i>)
	Clean product display (<i>above ground, using mats, protected from elements such as flies, dust, sun</i>)	Clean vending sites (<i>no stagnating water or waste, protected from elements such as flies, dust, sun</i>)
	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 (<i>frequency, health certificate</i>), inspection by regulatory authorities, trainings (<i>formal, informal</i>), valid licenses		

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). For gender, few and inconsistent associations were noted. Alemayehu et al (30) reported positive associations of both knowledge and practice with education, food safety training, and favorable attitudes.

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 CONSUMER PERSPECTIVES AND PRACTICES

Only seven studies attempted to assess food safety perspectives and practices among consumers. The populations studied varied widely and included students (two studies) (44, 129), mothers (two studies) (50, 57), and households, with no further descriptors provided for the respondents (three studies) (40, 43, 81). With the exception of Berhane et al (50) and Trubswasser et al (129), which used qualitative approaches, the other studies followed a quantitative descriptive cross-sectional survey design.

Out of the five quantitative studies, three 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; these studies used similar questions to those used for vendors. Two studies assessed the level of knowledge and practice as "good" for some or all of the aspects. Only one study (Azanaw et al (44)) assessed attitude (along with knowledge and practices). That study used statements quite similar to the questions and statements used for examining knowledge and practice and 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 practice and knowledge, education, or gender (further details were not specified in the articles). The remaining two studies assessed consumer perceptions of the safety or quality of animal-source food (milk (43) and meat, milk, and butter (81)); lack of quality control, inspection, and regulated standards were cited as the reasons consumers cited for adulterated or unsafe foods.

From the consumer perspective, several factors were found to influence how they assessed if 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 to be safe). One study (81) 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 using participatory rapid appraisal methods. While there were differences in consumer views on price as an indicator of quality and safety for meat, milk, and butter, the study concluded that most consumers were willing to pay up to 15% higher prices for safe and quality food.

An example of a consumer-focused study using an atypical approach to understand perspectives and practices is highlighted in **Box 2**.

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

Box 2. *An Interesting, Atypical Study of Consumer Perspectives and Practices*

Trubswasser et al (129) employed the qualitative participatory method Photovoice to assess the views of adolescents on their food environment, in order to provide a better understanding of the factors shaping their food choices. The use of photographs, interviews, and focus group discussions provided not only deep insights into the influencing factors but also helped create awareness and dialogue on important issues among the studied population. Adolescents were primarily influenced by poor hygiene and sanitation of food outlets, their community and home environments (lack of water at home prevented them from washing fruits and vegetables before eating), and food prices. They were most drawn to foods that were affordable, available, and perceived as clean – even if that meant consuming less fresh produce and more packaged products.

3.3 INTERACTIONS BETWEEN CONSUMER AND VENDOR PERSPECTIVES AND PRACTICES

Fifteen studies examined food safety perspectives and practices among both consumers and vendors, of which ten employed quantitative descriptive cross-sectional designs, two used qualitative designs, and three featured a mixed-methods approach. Of the 15 studies, eight studies assessed knowledge, attitude, and hygiene practices across the milk value chain, on aspects such as milk handling, storage, transportation, quality perceptions, and consumption practices; one study focused on meat and milk from small ruminant animals (59); and one study each examined meat (41), vegetables and chicken (89), and eggs (87). The remaining three studies did not specify any food focus. Most studies assessed perspectives and practices along similar themes as reported in Sections 3.1 and 3.2, and reported comparable concerns related to food safety. Overall, awareness of foodborne diseases and zoonotic diseases and concerns about chemical contamination and adulteration were relatively limited.

Despite all 15 studies including both vendors and consumers as populations of interest, only four studies (36, 37, 59, 102) tried to assess interactions or similarities and differences in consumers' and vendors' perspectives and practices or in the beliefs and motivations driving them. These four studies are highlighted in **Box 3**.

Box 3. Four Studies Examining Differences Between Consumers and Vendors

Combining participatory research approaches with questionnaires and observations, Dewe et al (59) revealed that producers and vendors used physical attributes based on senses (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 (37) identified the influence of deep-rooted cultural beliefs in milk boiling ("*boiled milk is dead milk*") and choice of milk for consumption ("*They consider camels as dirty and because of that they do not consume [camel milk]*") as well as practices motivated by health education, in particular for children ("*When we visited the health centre, we were told to boil milk we give to children. When children are given raw milk and when they vomit, 'qullichoo' (curdled milk inside stomach) is formed and this can block the baby's esophagus*"). 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. Details on the perceptions, practices, and risk-mitigation strategies reported in Dewe et al (59) and Amenu et al (37) are presented in [Appendix 6](#).

Melesse et al (102) identified that the vendors' understanding 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.

Amentie et al (36) identified numerous sub-optimal practices that highlight how milk can be contaminated across the value chain, before *or after* it reaches the consumer.

3.4 ASSOCIATIONS OF FOODBORNE HAZARDS WITH PERCEPTIONS AND PRACTICES

Seventy studies examined objective measures (i.e., measures of actual contamination of food or other substances/objects) in addition to the subjective measure of perception or practice. Of these, 34 studies examined microbial quality of foods, with a focus on animal-source foods (n=16), fruits and vegetables⁹ (n=10), and ready-to-eat foods (n=8). Two studies examined adulteration in food samples, and one study focused on aflatoxin contamination. 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

⁹ Studies on fruit juices and vegetables in combination with legumes or chicken are included here.

did so using swab analysis of hands and/or clothes. Only one study investigated the seroprevalence of brucellosis.

The research examining microbial quality of animal source foods (22, 40, 42, 45, 51, 53, 62, 69, 72, 82, 87, 96, 114, 116, 122, 128), fruits and vegetables (33, 34, 48, 52, 66, 73, 84, 113, 118, 125), and ready-to-eat foods (28, 29, 35, 38, 58, 82, 108, 126) identified high levels of contamination, with *E. 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 (33, 34, 48).

Twenty-eight studies isolated a range of intestinal pathogens from food handlers, with *Salmonella typhi*, *Salmonellae spp*, *Shigella*, *E. coli*, *Entamoeba histolytica/dispar*, and *Ascaris lumbricoides* were most frequent (25, 26, 31, 32, 39, 47, 49, 60, 61, 64, 65, 74, 75, 83, 86, 90, 93, 97-99, 106, 107, 111, 115, 116, 120, 133, 134). Three studies reported food handlers carrying *Shigella*, *Salmonella*, or *E. coli* on their hands and/or clothes (22, 67, 68), while three studies reported contamination of food-handling equipment such as knives, chopping boards, or weighing balances (41, 51, 54). Two studies examined food handlers' hands (23, 42) and clothes (23) as well as food handling equipment and confirmed the high level of contamination.

Thirty-four studies sought to assess an association between the objective measure(s) and practices and identified one or more significant association. 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 the objective measures (51, 74, 83, 90). A synthesis of results related to these associations is provided in **Table 4**.

Unsurprisingly, nearly all of the studies in question are vendor-focused; the exception is Disassa *et al* (62), which included both vendors and consumers. On the whole, the quality of evidence from studies examining associations was average or below, with only two studies rated as good (74, 86) and three as above average (33, 90, 97, 120).

Table 4. Practices Significantly Associated with Food Safety Issues or Concerns

HYGIENE AND SANITATION PRACTICES OR DEMOGRAPHIC TRAITS
INTESTINAL PARASITES IN FOOD HANDLER'S STOOL (N=21)
Handwashing habits (n=18)
Medical check-up frequency (n=12)
Food hygiene and safety trainings (n=7)
Education level (n=3)
Health status of the food handler (n=1)
Mixed used of knives/ utensils for raw meat as well as other foods (n=2)
Fingernail length (n=12)
Handling food with bare hands (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)
Washing utensils (n=1)
Washing produce before consumption (n=1)
Food storage (n=1)
<i>References: (25, 31, 32, 39, 49, 60, 64, 65, 74, 75, 83, 86, 90, 97-99, 107, 111, 115, 120, 133, 134)</i>
MICROBIAL CONTAMINATION OF FOODS (N=6)
Handwashing habits (n=4)
Medical check-up frequency (n=1)
Personal hygiene (n=1)
Cleanliness of knives/ utensils/ environment (n=1)
Fingernail length (n=2)
Education level (n=1)
<i>References: (33, 34, 48, 51, 53, 62)</i>
ENTEROPATHOGENS IN FOOD HANDLER (N=6)
Source of produce/ water (n=4)
Education level (n=2)
Fingernail length (n=2)
Means/ place of display (n=2)
Washing of produce (n=2)
Attitude (n=1)
Personal and environmental cleanliness (n=2)
Use of plastic containers (n=1)
Medical check-up frequency (n=1)
<i>References: (61, 72, 93, 106, 115, 117)</i>

Based on significant associations derived from studies on vendors (n=33) and vendors and consumers (n=1), with significance determined by the analysis done as part of that study by the study's authors.

3.5 EFFECTIVENESS OF FOOD SAFETY TRAINING ON PRACTICES AND PERSPECTIVES

One study, Amenu et al (137),¹⁰ assessed the effect of community-tailored training designed to improve the hygienic handling and safe consumption of milk on the knowledge, attitudes, and practices 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 attitudes seemed to improve post-training, this change was not sustained over time, and training was unable to address attitudes with deep culture roots. As with attitudes, training also seemed to positively affect adoption of most practices but only in the short term.

4. DISCUSSION

The 116 articles included in this systematic 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 food handlers' (whether as vendors or consumers) personal hygiene, environmental sanitation, handwashing practices, "good kitchen practices,"¹¹ and education/ training are associated with objective measures of food safety (e.g., levels of contamination) and/or are perceived as indicators of safe and quality food by consumers. Evidence also suggests that behaviors 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. Concern around foods with contaminants or pathogens that could harm human health was also reflected in the sparse consumer-focused studies identified by the review.

The existing body of work¹² points to a clear recognition among the scientific community of poor quality of many foods in Ethiopia in terms of their microbial content, with the majority of the studies focusing on animal-source foods (predominantly milk and meat). The high level of contamination seen for these foods in the included analytical studies confirms they are the source of parasitic and bacterial pathogens responsible for foodborne diseases (2). Recognizing an integral role for (highly nutrient-dense) milk and meat in the Ethiopian food system, this focus is warranted. However, another highly nutritious and equally high-risk food group,

¹⁰ This study was identified through a free search on Borana pastoralists (undertaken to aid in interpretation of the results) and did not appear in any of the original systematic searches of the databases or in-hand searching of citations. In view of the dearth of intervention studies in Ethiopia, this article was included in this review.

¹¹ Encompasses practices such as use of clean utensils, appropriate storage, and refrigeration, segregating utensils/ knives for raw and cooked foods, and avoiding cross-contamination.

¹² Refers to included studies as well as those excluded due to focusing only on objective/biological measures (as opposed to perceptions and practices).

fresh fruits and vegetables, has received considerably less research attention. Given the focus of EatSafe Ethiopia on highly nutritious fresh foods, this is a gap that can be addressed through the project's planned primary research.

When examining consumers' and vendors' perceptions of food safety related to fresh produce, EatSafe's 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 (138). Despite the vital role played by these markets in providing nutrition security to these consumers, they were found to be largely underrepresented in the reviewed studies.

Resources and time permitting, a focus on ready-to-eat foods would also be warranted: these popular foods are frequently sold alongside fresh foods in traditional markets and the evidence (albeit limited) that ready-to-eat foods are as contaminated as raw foods gives cause for concern, as these hazards are less likely to be mitigated before consumption. Typically, cooking (heat treatment) is effective at reducing contamination, and the fact that cooked ready-to-eat foods are still contaminated, as found in the reviewed studies, suggests possible re-contamination (139). Street food establishments and restaurants, two common outlets for ready-to-eat foods, have been labelled as high risk for exposure to hazards associated with foodborne illness in sub-Saharan Africa (140) as well as high-income countries such as the United States (141), so it will also be important to include them in future research.

The review also suggests that food safety research in Ethiopia has largely been conceptualized as being about food handling and hygiene practices, with vendors as the population of primary interest. Very limited efforts have been made in understanding the beliefs, perceptions, motivations, or barriers that may influence food safety-related practices. This is in line with EatSafe research from other countries, as are the poor practices observed in the majority of the studies (142, 143). The few studies that examined food safety knowledge or attitudes mostly found the level to be adequate or satisfactory, suggesting a gap in translation of knowledge and attitudes to practice. A plausible explanation could be the introduction of bias due to "Hawthorne effect" (i.e., the tendency of individuals to alter their behavior in response to their awareness of being observed) or social desirability (i.e., the tendency to underreport socially undesirable attitudes and behaviors and to over-report more desirable attributes), as most studies relied on self-report questionnaires for knowledge, attitudes, and/or practice (141, 144). An in-depth evaluation combining study of knowledge, attitudes, and practices along with motivations and incentives that can influence improved food safety-related practices would be an important contribution to existing literature.

The need for integrated research is further reinforced by insights from consumer-focused studies that suggest that consumers' perceptions of safety and microbial quality of food are linked to vendor practices (this review, (145)), which in turn may

influence their purchasing behaviors (81, 145). The reviewed studies also suggest similarities in consumers' and vendors' understanding of motives that govern food choices, the use physical attributes for assessing quality and safety of animal-source foods, and practiced behaviors that eliminated or reduced the risk or level of concern they had about food safety (37, 59, 102) (see also **Box 3**). Caution is warranted in the interpretation of insights related to consumers and consumer-vendor interactions in Ethiopia, as they are based on scant research. Additional studies assessing consumers' emotional drivers, risk perception, and gains/benefits related to food safety, as well as those exploring the intricate interactions between consumers and vendors, are essential to underpin future work on improving food safety in Ethiopia.

Interestingly, we found only one study that assessed the effectiveness of an intervention for changing food safety-related perceptions and practices. This study suggests that culturally tailored training can improve knowledge, attitude, and practices related to milk handling and milk-borne zoonoses. The effect of the training, however, was not sustained over time, and it did not change negative attitudes or incorrect practices in relation to milk safety. The failure to maintain positive changes in practices is a common problem found in food hygiene training evaluations (146), and the inability of training to address certain attitudes may relate the fact that these are culturally deep-rooted and not evidence-driven (37). There is a clear need for more intervention studies, including those with different approaches to influence a sustained change in attitudes and practices.

The studies described 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. The assessment of knowledge is one example, where statements have been developed and empirically tested, but often not validated or compared. It is therefore recommended that EatSafe develop and make accessible standardized tools to facilitate harmonized data collection on food safety across diverse settings and/or populations.

The studies included in this review commonly lacked theoretical underpinnings and simply reported knowledge, behaviors, and/or practices of the populations under study. Theoretical models on (health) behavior or behavioral change, such as the protection motivation theory (147, 148) or theory of planned behavior (149, 150), may provide a better evaluation of food safety perceptions and practices in Ethiopia. EatSafe should consider the need for theory-based studies to identify food safety-related perceptions and practices (either current or intended behavior) and also to better understand the roles of the individual (e.g., socio-demographic or psychological factors such as beliefs and attitude), social (e.g., subjective norms), contextual (e.g., food focus, safety issue), and food environment.

A bigger drawback of the structured survey design, employed by the majority of the studies reviewed, is that it is constrained in its ability to provide deep insights into the behaviors, barriers, and motivations/incentives that can influence the translation of knowledge to practice. Very few studies in this review attempted an in-depth probe into behaviors or to explore food safety-related attitudes/motivations. We recommend EatSafe to complement questionnaire-based information with qualitative methods such as focus group discussions or novel participatory approaches like Photovoice, as done by Trübswasser et al (129), or the use of video cameras (151). In addition, we also suggest well-designed intervention studies targeting behavioral outcomes, or proxy indicators of behavior (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.

The studies illustrate the need for improvements in infrastructure and the enabling environment 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 in the studies. 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). Current research in Ethiopia is heavily skewed towards vendors, leaving a large gap in understanding the perspectives and practices of consumers and/or the influence of one group on the other. In addition to continued focus on consumers, EatSafe should consider examining consumers and vendors jointly to understand how these groups interact, influence, align, and/or differ in perspectives and practices related to food safety. Last but not least, the research reviewed 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.

4.1 STRENGTHS AND LIMITATIONS

This is the first systematic 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 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.

This study also has a number of limitations. First, in order to maintain the feasibility of this systematic scoping review, we focused on the generic term “food safety.” Although we developed our syntax of terms based on existing systematic (scoping) 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 vague 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 systematic scoping reviews. However, the inclusion of such a broad range of articles also limits the scope for fine-grained analysis that other systematic review styles 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 possible that we may have excluded studies reported in local languages. Fourth, our focus on published empirical articles and grey literature from global institutions excluded any potentially relevant theses or reports from local organizations (aside from those that resulted in journal publications). Finally, 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.

5. CONCLUSION

This systematic scoping review highlights a rapidly growing body of food safety literature in Ethiopia. The included articles predominantly feature vendors or food handlers and outcomes related to handling practices, personal hygiene, and environmental sanitation, with education or training seen 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. 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 enable the EatSafe project to influence positive changes in food safety practices and perspectives in Ethiopia. **Box 4** shares recommendations for EatSafe’s future studies based on the current food safety research landscape in Ethiopia.

Based on the results of this review, we also offer several recommendations for the project team to consider when designing EatSafe’s future interventions in Ethiopia. First, the limited research on consumers yielded mixed results for consumer knowledge and attitudes but found that good practices were generally positively associated with knowledge and education. While more research on consumers is needed, this suggests a potential role for education and raising awareness. Among consumers, several factors were found to influence their perception of whether food was safe: whether it came from a “trusted vendor,” hygiene at the point of sale, whether the product appeared untampered with, and whether it was local. These

findings indicate a potentially strong foundation upon which to build regarding both knowledge of best practices vis-à-vis observable hygiene and leveraging relationships with local, trusted vendors and suppliers.

Most studies of vendors considered their practices to be poor, though about one-third found them to be adequate; in contrast, over half of studies found vendors to have adequate knowledge. Thus, the gap between knowledge and practice needs to be addressed, and knowledge likely still needs further improvement. Vendor practices were positively associated with greater knowledge, positive attitude, food safety training, education, regular medical check-ups, and sanitation inspections, suggesting a role for both training/awareness raising and inspection/enforcement. Indeed, consistent recommendations across the studies pointed to the need for food safety and hygiene training, encouraging regular medical check-ups for food handlers, and increased regulatory inspection. Improvement in infrastructure was also a consistent recommendation from the studies, indicating a barrier that EatSafe Ethiopia will need to keep in mind in its intervention design.

Finally, research examining the microbial quality of animal-source foods, fruits and vegetables, and ready-to-eat foods identified high levels of contamination. Intestinal pathogens from food handlers (on their hands, clothes, or food-handling equipment) were also common. These findings emphasize the importance of EatSafe's focus on these foods and markets in Ethiopia and the potential positive impact of its eventual interventions.

Box 4. Recommendations for Future EatSafe Studies

While EatSafe will undertake novel primary research on consumer and vendor motivations and practices, it is essential to ensure that this work is informed by and builds on what has already been done—both in terms of methods used and results obtained. Based on the results of this review, we recommend EatSafe consider the following lessons emerging from this review in the design of its research going forward:

- Address the gap in consumer studies with consumer-focused research and, if feasible, evaluate both consumers and vendors in one study design.
- Examine consumer-vendor interactions to understand the similarities and differences in attitudes and practices on certain food safety issues and/or risk mitigation.
- Focus on specific and diverse ethnic groups and their traditions as determinants of beliefs and/or practices.
- Pay attention to the intersection between gender and food safety, from sampling to data reporting.
- Focus on fresh fruits and vegetables, as well as ready-to-eat street foods.
- Focus on local markets but also consider targeting street food establishments and restaurants as a key hotspot of foodborne illness outbreaks.
- Develop and disseminate pre-tested and validated, standardized tools to facilitate harmonized data collection on food safety across diverse settings and/or populations.
- Interpret self-reported data with caution.
- Consider complementing quantitative methods with qualitative ones (e.g., combining questionnaire-based data collection with participatory focus group discussions, or with novel participatory approaches like Photovoice and the use of video cameras).
- Go beyond the application of the “knowledge, attitudes, and practices” model to include outcomes related to behavioral change using theories and models such as Protection Motivation Theory or the Theory of Planned Behavior.

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7. APPENDICES

7.1 APPENDIX I. DETAILED SEARCH STRINGS PER DATABASE AND GREY LITERATURE

SEARCH STRING
<p>WEB OF SCIENCE</p> <p><i>(all titles screened)</i> Food Safe* OR Foodborn* OR Food-born* OR Microb* OR Fertiliz* OR Herbic* OR Rodentic* OR Antimicrob* OR Enterovir* OR Histamin* OR Erysipelothr* OR Flie* OR Fly* OR Rodent* OR Bird* OR Fomite* OR Spoil* OR Contamina* OR Hygien* OR Coli* OR Salmonella* OR Noro* OR Campylobact* OR Monocytogen* OR Enterobact* OR Burnet* OR Brucel* OR Shig* OR Aflatox* OR Mold* OR Adulter* OR Lister* OR Lyster* OR Acrylami* OR Hazard* OR Pestic* OR Faec* OR Fec* OR Parasit* OR Helminth* OR *Toxi* OR Cronobact* OR Taeni* OR Tremat* OR Echino* OR Fasciolo* OR Heterophy* OR Metagoni* OR Starch* OR Protein* OR Pathogen* OR Zoono* Nocardio* OR Metal* OR Lead* OR Arsen* OR Mercur* OR Cadmi* OR Bovin* OR "hand washing" OR "personal hygiene" OR "clean and sanitization" OR "cross-contamination" OR "temperature control" OR "food handling" OR "raw food*" OR "raw meat*" OR uncook* OR "under cook*", AND Consum* OR Men* OR Man* OR Male* OR Woman* OR Women* OR Female* OR Adolesc* OR Market* "public" OR "social" OR "citizen" OR Vendor* OR Produc* OR Sell* OR "Food handlers" OR Farm* OR Pastoral* OR "Farming household*" OR "Farm household*" OR "primary producer*" OR landholder* OR "street vendor*" OR "wet market*" OR market* OR canteen* OR school* OR hospital OR universit* OR residenc* OR hall* OR restaurant* OR bars* OR kitchen* OR "food truck*" OR "food cart*" OR commerc* OR "fast food*", AND perspectiv* OR practic* OR behavior* OR behaviour* OR knowledg* OR "awareness*" OR belief* OR accepta* OR adopt* OR attitud* OR choice OR choos* OR opinio* OR select* OR decision* OR judgement* OR "decision mak*" OR percept* OR valuation* OR willingness* OR WTP OR willingness-to-pay OR willingness-to-accept OR WTA OR willingness-to-adopt OR willingness-to-try OR prefer*, AND Ethiopia OR "East Afri*" OR "East-Afri*" OR "Eastern Afri*" OR "Eastern-Afri*"</p>
<p>GOOGLE SCHOLAR</p> <p><i>(first 100 of each string; Google interprets each space as an "AND" Boolean operator)</i> "food safety" vendor "Ethiopia" (2000 or after) "food safety" market "Ethiopia" (2000 or after) "food safety" consumer "Ethiopia" -market -vendor (2000 or after)</p>
<p>AGECON</p> <p><i>(first 100 of each string)</i> "food safety" vendor "Ethiopia" (2000 or after) "food safety" market "Ethiopia" (2000 or after) "food safety" consumer "Ethiopia" -market -vendor (2000 or after)</p>
<p>GREY LITERATURE</p> <p><i>(all titles screened)</i> FAO Food Safety: Ethiopia IFPRI: 'Food safety' Ethiopia WHO: MeSH 'food safety' + Ethiopia; 2000 or after WB: 'Food safety' Ethiopia; 2000 or after</p>

ILRI: 'Food safety' Ethiopia
EC: 'Food safety' Ethiopia

LIMITS

Year: 2000
Language: English
Country: Ethiopia

FAO: Food and Agriculture Organization of the United Nations; IFPRI: International Food Policy Research Institute; WHO: World Health Organization; WB: The World Bank; ILRI: International Livestock Research Institute; WTO: World Trade Organization; EC: European Commission

7.2 APPENDIX 2. SUMMARY OF VENDOR STUDIES

Abbreviations used: CSS-cross-sectional survey; PSQI –pre-tested structured questionnaire interview; SSPQI –Semi-structured Pretested Questionnaire Interview; OC – Observation checklist; FST – Food sample testing (*Including where water samples were tested*), SA – Swab Analysis; SC – Structured checklist; DO – Direct Observations; FGD – Focus Group Discussions; SSI- Semi-structured interview; QBS- Questionnaire based survey; DA – Dialogic Approach, II – In-depth Interview; QD –Qualitative Description; PRA – Participatory Rural Appraisal; SSA –Stool Sample analysis; CSC – Customized Scoring Chart; ID - informal discussions; SSI -Semi-structured interviews; QS -Quantitative survey; RUA – Rapid Urban appraisal; FSA – Fingernail Sample analysis; NS –Not Specified; U/R -Urban/Rural, PU -Peri-urban

STUDY	CITY/TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Abate, 2018 (21)	Woldia	NS	Food handlers	NS	Hotels, Cafeterias, Cafes and restaurants, Snack houses, Juice houses	CSS; PSQI, OC
Abayneh, 2019 (22)	Jimma	NS	Food handlers	Meat	Meat retailer shops	CSS; SA; OC
Abayneh, 2020 (23)	Jimma	NS	Food handlers	Meat	Abattoir, Butcher shops	CSS; FST; SA; SC; DO
Abdi, 2020 (24)	Addis Ababa	U	Food handlers	NS	Hotels, café and restaurants, bar & restaurants, restaurants, bar snacks and 'Menafesha bet'	CSS; PSQI, OC
Adane, 2018 (27)	Dessie	U	Food handlers	NS	Hotel, Restaurant, bar & restaurant, cafeteria and butcher houses, street food shops	CSS; PSQI, OC
Adimasu, 2016 (28)	Gondar	NS	Food handlers	RTE street food (Bread, Donate, Bonbolino)	Street food stalls & establishments at College, Stadium, Arada, Hospital	CSS; PSQI; OC; FST
Alem, 2020 (29)	Woldia	NS	Food handlers	Ready-to-eat street food 'Sambussa', 'Bonbolino' 'Ambasha'	Gonderber, Mugad, Menehariya and Piazza (street vending sites)	CSS; SSPQI; OC; FST
Alemayehu, 2021 (30)	Debre Markos	U	Food handlers	NS	Hotels, Restaurants, Cafeterias, Snack houses	CS;, PSQI; OC

STUDY	CITY/TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Alemu, 2019 (32)	Arba Minch	NS	Food handlers	Vegetables	Local markets (Sikela, shecha, Yetne- bersh and Konso sefer)	CSS; PSQI; FST
Alemu, 2020 (34)	Bahir Dar	U	Food handlers	Fruits and vegetables	Local markets)	CSS; PSQI; FST
Amare, 2019 (35)	Gondar	U	Food handlers	Ready-to-eat street food (Sambusa, Donate, Bombolino, bread)	College area, Arada, Piazza, Hospital, Biliko and Azezo	CSS; PSQI; OC; FST
Angaw, 2015 (38)	Bahir Dar	NS	Food handlers	Ready-to-eat street food (sambusa, fried fish)	Retailing houses, Roadside stalls	CSS; SSI; OC; FST
Bekele, 2017 (48)	Arba Minch	NS	Food vendors	Fruits and vegetables	Local markets	CSS; SSQI; FST
Tesfaye, 2016 (126)	Jigjiga	NS	Food handlers	Ready-to-eat street food (fuol, ades, pasta, sambusa)	NS	CSS; PSQI; DO; FST
Berhanu, 2020 (52)	NS	NS	Food handlers	Milk	Dairy farms, Milk distribution centers, Milk retail outlets	CSS; PSQI; FST
Berhanu, 2021 (51)	Gondar	U	Food handlers	Fruit juice (packed, fresh)	Juice cafes	CSS; OC; FST
Berhe, 2020 (53)	Mekelle, Wukro, Adigrat	NS	Dairy farmers, Milk vendors, Cafeteria owners	Milk	Cafeterias, Dairy farms, Milk retail outlets	CSS; PSQI; OC; FST
Bersisa, 2019 (54)	Bishoftu	NS	Food handlers	Meat	Abattoir, Butcher shops	CSS; QBS; DO; SA
Derbew, 2013 (58)	Gondar	U	Food handlers	Ready-to-eat street food (Fuol, Sambusa, Macaroni, Bonbolino)	Street vending sites	CSS; PSQI; FST
Diriba, 2020 (60)	Dilla	NS	Food handlers	NS	Dilla University Student Cafeteria	CSS; QBS; SSA
Eliku, 2016 (63)	Addis Ababa	NS	Food handlers	Ready-to-eat street food (chips,	NS	CSS; QBS, II; OC

STUDY	CITY/TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
				sambusa, bonbolino)		
Eshetu, 2019 (64)	Nekemte	NS	Food handlers	NS	Hotels, Bars and Restaurants	CSS; QBS; SSA
Fufa, 2018 (66)	Shewarobit	NS	Food handlers	Fruit juices	Restaurants, Cafes	CSS; FST; QBS
Garedew, 2015 (67)	Gondar	U	Food handlers	Meat	Butcher shops	CSS; FST; SA; OC
Gebrehiwot, 2020 (68)	Harar	R	Food handlers	Injera, Sauces	University cafeteria	CSS; OC; QBS ; SA
Gebre-medhin, 2021 (69)	Ambo, Holeta	NS	Food handlers	Meat	Abattoir, Butcher shops, Restaurants	CSS; FST; QBS; OC
Geresu, 2021 (71)	Jimma	NS	Food handlers	Meat	Abattoir, Butcher shops	CSS; SA; PSQI
Geresu, 2021 (72)	Dera, Iteya, Asella, Bekoji, Gobessa	NS	Food handlers	Animal origin foods (kitfo, kurt, dulet, egg sandwich, cream cake, raw milk)	Hotels, Restaurants, Cafeterias, Retail shops	CSS; FST
Geta, 2019 (73)	Debre Markos	NS	Food vendors	Fruit juice	Café and/or restaurants	CSS; FST; QBS
Gezehegn, 2017 (74)	Aksum	NS	Food handlers	NS	Hotels, Restaurants, Snack bars, Juice houses	CSS; PSQI; SSA
Girmay, 2020 (76)	Addis Ababa	NS	Managers	NS	Hotels Small vendors, Bars, Restaurants, Cafes	CSS; OC; QBS
Girmay, 2020 (77)	Addis Ababa	NS	Food handlers	NS	Hotels Small vendors, Bars, Restaurants, cafes	CSS; OC; QBS
Girmay, 2020 (78)	Addis Ababa	U	Food handlers	NS	Hotels Small vendors, Bars, Restaurants, cafes	CSS; OC; QBS
Gutema, 2021 (79)	Bishoftu	NS	Food handlers	Meat	Abattoir, Butcher shops	CSS; SSPQI; OC
Kassa, 2017 (82)	Mekelle	NS	Food handlers	Meat	Abattoir, Butcher shops	CSS; QBS; DO;FST
Kassa, 2017 (82)	Bahir Dar	U	Food handlers	Ready-to-eat meat sauce Water	Vending sites	CSS; FST:OC

STUDY	CITY/TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Kebede, 2019 (83)	Axum	U	Food handlers	Fresh fruit juice	Juice houses, Restaurants, Cafeteria	CSS; QBS; FST
Kechero, 2018 (85)	Addis Ababa	NS	Food handlers	Fruit juices vegetable salads	Juice houses	CSS; QBS
Kibret, 2012 (88)	Bahir Dar	U	Food handlers	NS	Hotels, Restaurants, Café, Juice houses	CSS; PSQI; OC, LS
Kuyu, 2018 (91)	Jimma	U	Farmers, Wholesalers, Retailers	Banana fruits	Open market, Wholesale outlets, Retail outlets	CSS; QBS (self-admin); PST
Lalit, 2015 (92)	Mekelle	U	Food handlers	NS	Hotels, Restaurants, Cafeteria or Snack bars, Juice houses	CSS; QBS
Legesse, 2017(94)	Arba Minch	U, R	Food handlers	NS	Hotels, Restaurants, Cafeterias, Butcher shops, Juice house, Pastry shop	CSS; PSQI; DO
Lema, 2020 (95)	Gondar	U	Food handlers	NS	University Cafeteria	CSS; QBS (self-admin); LS;
Mama, 2016 (97)	Arba Minch	U	Food handlers	NS	University Cafeteria	CSS; PSQI
Mama, 2016 (98)	Arba Minch	U	Food handlers	NS	University Cafeteria	CSS; QBS
Marami, 2018 (99)	Haramaya	U	Food handlers	NS	University Cafeteria, Private cafeteria	CSS; PSQI; DO
Mardu, 2020 (100)	Tigray	NS	Food handlers	NS	Prison center	CSS: QBS
Meleko, 2015 (101)	Addis Ababa	U	Food handlers	NS	University Cafeteria	CSS; QBS; OC
Mendedo, 2017 (103)	Addis Ababa	NS	Managers/ Owners	NS	Cafeterias, Hotels, Bars and Restaurants, Juice houses, Pastry shops/ bakeries	CSS; PSQI; OC
Mengeda, 2020 (104)	Guder, Ambo and Ginchi	NS	Food handlers Café/Restaurant managers	NS	Cafes, Restaurants	CSS; QBS; DO
Negero, 2020 (107)	Ginnir	U	Food handlers	NS	Cafes, Restaurants	CSS; QBS; DO
Nemo, 2017 (108)	Jimma	U	Food handlers	Ready-to-eat/ street food (Injera, Sambussa, Firfir, Bread)	Vending sites	CSS; QBS; FST

STUDY	CITY/TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Nigussie, 2018 (109)	Addis Ababa	U	Brewery employees	Beer	Retail outlets, Food market	cross-sectional
Regassa, 2021 (111)	Tigray	U	Food handlers	NS	Restaurants, Hotels, Snack bars, Food bakeries	CSS; QBS; FST
Reta, 2019 (112)	Woldia	U	Food handlers	NS	Food and drinks service establishment	CSS; QBS: OC
Sahile, 2019 (113)	Gondar	NS	Food handlers	Fresh Lettuce, Tomatoes	Roadside markets	CSS
Sebsibe, 2020 (114)	Jimma	U	Food handlers	Meat	Abattoir, Butcher shops	CSS; SC; DO
Tadese, 2021 (116)	Ambo	U	Food handlers, Retailers	Raw beef	Abattoir, Retailer shops	CSS; PSQI; OC
Tadesse, 2019 (117)	Dire Dawa	U	Food handlers	NS	Open/ street market	CSS; PSQI
Tafere, 2017 (118)	Mekelle	U	Food handlers	Fresh fruit juice (avocado, papaya, and mango)	Cafes, Restaurants	CSS; QBS; DO
Tafesse, 2014 (119)	Jigjiga	U	Food handlers	Raw meat (beef and goat)	Open market, Vending sites	CSS; QBS; DO
Tefera, 2014 (120)	Yebu	U	Food handlers	NS	Cafes, Restaurants	CSS; PSQI; DO
Teka, 2017 (122)	Arba Minch	U	Food handlers	Raw and undercooked Nile tilapia	Hotels (kitchens).	CSS;QBS;FST; DO
Tegegne, 2017 (121)	Jigjiga	U	Food handlers	Meat	Abattoir, Retail meat shops	CSS; QBS
Temeche, 2016 (123)	Jimma	U	Food handlers	NS	Hotels	CSS; QBS
Tesfaye, 2020 (124)	Shashemane	U	Food handlers	NS	Vending sites	CSS; PSQI; DO
Tesfaye, 2019 (125)	Bahir Dar	U	Food handlers	Vegetable and legume-based foods, Water	Streets, Taxi ranks and Bus station, Market centers, Other public areas	CSS; OC
Tessema, 2014 (127)	Dangila	U	Food handlers	NS	Hotels, Café, Juice houses, Restaurants	CSS; PSQI; OC
Tsegay, 2017 (130)	Debre Zeit Modjo	U	Food handlers	Meat and milk	Export abattoirs	CSS; QBS

STUDY	CITY/TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Yenealem, 2020 (132)	Gondar	U	Food handlers	Meat	Butcher shops	CSS; PSQI
Yeshanew, 2021 (133)	Mettu	U	Food handlers	NS	Cafeterias, Hotels, Butcher shops, Restaurants, Mass catering serving establishments	CSS; SSA
Yesigat, 2020 (134)	Motta	U	Food handlers	NS	Hotels, Restaurants, Cafeterias	CSS; PSQI; DO
Zerabruk, 2019 (135)	Addis Ababa	NS	Food handlers	Minced meat	Butcher shops	CSS; QBS; OC
Zeru, 2007 (136)	Mekelle	NS	Food handlers	NS	Hotels, Restaurants, Bars, Cafeterias, Butcher shops, Juice shops, Pastry shops.	CSS; PSQI
Alemnew, 2019 (31)	Woldia	NS	Food handlers	NS	University Student's cafeteria (main campus)	CSS; PSQI; SSA
Alemu, 2019 (33)	Chagni	NS	Food handlers	NS	Hotels, Restaurants, Cafeterias, Butcher shops	CSS; QBS; SSA
Girma, 2017 (75)	Jimma	NS	Food handlers	NS	Hospital cafeteria	CSS; PSQI; FSA; SSA
Asires, 2019 (39)	Gojjam	NS	Food handlers	NS	Prisons	CSS; PSQI; DO; SSA
Azanaw, 2019 (45)	Gondar	U	Food handlers	NS	Food establishments	CSS; PSQI
Kebede, 2018 (84)	Dessie	U, R	Food handlers	NS	University cafeteria	CSS; PSQI; SSA
Abera, 2021 (26)	Tarcha, Waka, and Gessa	U	Food handlers	NS	Catering establishments	CSS;PSQI; SSA
Kumma, 2019 (90)	Wolaita Sodo	U	Food handlers	NS	University cafeteria	CSS; PSQI; SSA
Bafa, 2019 (47)	NS	NS	Food handlers	NS	University cafeteria	CSS; QBS; SSA
Chekol, 2019 (56)	Debarq	NS	Food handlers	NS	Hotel, restaurant, cafes, butcher houses, juice houses	CSS;QBS;OC
Belhu, 2020 (49)	Addis Ababa	U	Food handlers	NS	Public hospitals	CSS:QBS:SSA

STUDY	CITY/TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Diriba, 2020 (61)	Dilla	NS	Food handlers	NS	University cafeteria	CSS; QBS,SSA
Kemal, 2020 (86)	Bale-Robe	U	Food handlers	NS	Private foods and drinks establishments	CSS; PSQI; SSA
Legese, 2020 (93)	Adigrat	NS	Food handlers	NS	University cafeteria	CSS; QBS; SSA
Molla, 2017 (106)	Wolaita Sodo	U	Food handlers	NS	Restaurants and cafeteria	CSS; SSA
Oumer, 2019 (110)	Dire Dawa	U	Food handlers	NS	Hotels, Restaurants, Cafeterias and Butcher shops	CSS; OC; QBS
Solomon, 2018 (115)	Wolaita sodo	NS	Food handlers	NS	Restaurants and cafeterias	CSSPSQI; SSA
Wendimagegn, 2020 (131)	Adama	U	Food handlers	NS	Hotels and restaurants	CSS; QBS; OC; SSA
Fiseha, 2016 (65)	Wolaita Sodo	NS	Food handlers	NS	Restaurants and cafeteria	CSS; PSQI;SSA
Abera, 2016 (25)	Bahir Dar	NS	Food handlers	NS	University catering	CSS; PSQI; SSA

7.3 APPENDIX 3: SUMMARY OF CONSUMER STUDIES

Abbreviations used: CSS-cross-sectional survey; PSQI –pre-tested structured questionnaire interview; SSPQI –Semi-structured Pretested Questionnaire Interview; OC – Observation checklist; FST – Food sample testing (*Including where water samples were tested*), SA – Swab Analysis; SC – Structured checklist; DO – Direct Observations; FGD – Focus Group Discussions; SSI- Semi-structured interview; QBS- Questionnaire based survey; DA – Dialogic Approach, II – In-depth Interview; QD –Qualitative Description; PRA – Participatory Rural Appraisal; SSA –Stool Sample analysis; CSC – Customized Scoring Chart; ID - informal discussions; SSI -Semi-structured interviews; QS -Quantitative survey; RUA – Rapid Urban appraisal; FSA – Fingernail Sample analysis; NS –Not Specified; U/R -Urban/Rural, PU -Peri-urban

STUDY	CITY/ TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Ayza, 2014 (43)	Boditti	NS	Households	Milk and dairy products	Direct sales	CSS; SSPQI
Assefa, 2011 (40)	Kombolcha	NS	Households (egg consumers)	Eggs	Poultry farm, Open markets	CSS; QBS; FST
Azanaw, 2021 (44)	Gondar	U, R	College students	NS	Public colleges	CSS; SSQI
Berhane, 2018 (50)	Addis Ababa	U	Mothers of children under 5y	NS	None	CSS; DA; II
Dagne, 2019 (57)	Debarq	NS	Mothers	NS	Households	CSS; PSQI
Jabbar, 2010 (81)	Addis Ababa	U	Households	Beef, Raw milk, Local butter	Butcher shops, Supermarkets, Open market	CSS; QBS
Trübswasser, 2020 (129)	Addis Ababa	U	Students (adolescents)	NS	Streets/public areas, Home	QD; photovoice method; FGD

7.4 APPENDIX 4. SUMMARY OF STUDIES WITH CONSUMERS AND VENDORS

Abbreviations used: CSS-cross-sectional survey; PSQI –pre-tested structured questionnaire interview; SSPQI –Semi-structured Pretested Questionnaire Interview; OC – Observation checklist; FST – Food sample testing (*Including where water samples were tested*), SA – Swab Analysis; SC – Structured checklist; DO – Direct Observations; FGD – Focus Group Discussions; SSI- Semi-structured interview; QBS- Questionnaire based survey; DA – Dialogic Approach, II – In-depth Interview; QD –Qualitative Description; PRA – Participatory Rural Appraisal; SSA –Stool Sample analysis; CSC – Customized Scoring Chart; ID -informal discussions; SSI - Semi-structured interviews; QS -Quantitative survey; RUA – Rapid Urban appraisal; FSA – Fingernail Sample analysis; NS –Not Specified; U/R -Urban/Rural, PU -Peri-urban

STUDY	CITY/ TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Azeze, 2017 (46)	Hagere selam, Dale, Hawassa zuria	NS	Small holder producers, Households	Dairy products	Open markets	CSS; SSPQI
Amentie, 2016 (36)	Babile district, Harar, Dire Dawa, Jigjiga	NS	Milk producers, Milk collectors and transporters, Vendors, Consumers	Milk	NS	CSS; FGD; PSQI
Ayele, 2017 (42)	Sebeta	NS	Dairy farm owners, Plant workers, Milk collectors, Hotel/ café workers, Consumers	Milk	Dairy farms, Milk collection centers, Cafes/ hotels	CSS; PSQI; FST; SA
Birke, 2019 (55)	Jimma	NS	Food handlers	NS	Households, Food service establishments (hotels; restaurants; cafeterias; clubs; bars; local drink bars (Tej bets); butcheries; dairy farms; abattoir; bread retail shops; bakeries; fish retail shops; fruits and vegetables street stalls)	CSS; PSQI
Dewe, 2014 (59)	Atsbi, Doyogena, Horro' Menz, Borena, Shinelle	R	Producers (smallholder farmers, pastoralists), Consumers, Mothers	Meat, Milk (sheep, goat)	Households, Markets	QD; PRA; FGD

STUDY	CITY/ TOWN	URBAN/RURAL	POPULATION	SPECIFIC FOOD	SPECIFIC OUTLET	METHODS
Disassa, 2017 (62)	Asosa and surrounding areas	NS	Farmers, Vendors' household, Consumers, Cafeterias	Milk	NS	CSS; QBS; OC; FST
Gemeda, 2018 (70)	Wollega	NS	Doctors and health Officers, Food Handlers	NS	Hospital	CSS, SSPQI, CSC
Amenu, 2019 (37)	Dharito, Elweya, Surupha, Did Yabello	R	Pastoralists	Milk	Farms, Households	QD; FGD; ID; SSI; DO
Kemal, 2016 (87)	Haramaya	NS	Farmers, Consumers	Raw chicken eggs	Open market, Poultry farms	CSS; FST; QBS
Knight-Jones, 2021 (89)	Harar Dire Dawa	U	Producers, Retailers, Consumers, Regulators	Vegetables Chicken	NS	FGD; II; QS
Makita, 2012 (96)	Debre-Zeit	U, PU	Farmers, Consumers	Milk and home-made yoghurt	Milk collection centers, Cafes, Dairy processing plant, Farm gate, Restaurants	CSS; RUA, QBS
Melesse, 2019 (102)	Addis Ababa	NS	Food processors, food retailers, food handlers (food purchase and/or preparation) in households	NS	Food processing businesses, Retailing houses (supermarkets to informal roadside stalls), Households	CSS; QBS
Minten, 2020 (105)	Addis Ababa	U, R	Dairy farming households, Large commercial farms, Retail shops, Consumers	Milk	Mini markets, Supermarkets, Dairy shops, Regular shops	CSS; FST
Tolosa, 2016 (128)	Jimma	U	Dairy farmers, Milk retailers, Consumers	Milk	Direct sales, Farm gate Self-consumption, Retail shops	CSS; QBS
Atlabachew, 2021 (41)	Debre Berhan	NS	Food handlers	Meat	Butcher shops	CSS; SA; FST; QBS; DO

7.5 APPENDIX 5: CRITICAL APPRAISAL OF INCLUDED SOURCES OF EVIDENCE USING MIXED METHODS APPRAISAL TOOL (MMAT)

PUBLICATION	QUALITY	1.1	1.2	1.3	1.4	1.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Abate, 2018 (21)	**						1	1	3	3	2					
Abayneh, 2019 (22)	**						1	1	3	3	2					
Abayneh, 2020 (23)							3	3	2	3	2					
Abdi, 2020 (24)	***						2	3	1	1	2					
Abera, 2016 (25)	**						1	3	1	1	3					
Abera, 2021 (26)							1	1	1	3	1					
Adane, 2018 (27)	*****						1	1	1	1	1					
Adimasu, 2016 (28)							3	2	2	3	2					
Alem, 2020 (29)							2	2	2	3	3					
Alemayehu, 2021 (30)	****						1	3	1	1	1					
Alemnew, 2019 (31)	**						1	3	2	1	3					
Alemu, 2019 (32)	****						1	1	2	1	1					
Alemu, 2019 (33)	**						3	3	1	3	1					
Alemu, 2020 (34)	**						3	3	1	3	1					
Amare, 2019 (35)	*						3	3	1	3	3					
Amentie, 2016 (36)	*	1	2	2	2	2	1	2	2	3	2	2	3	2	2	3
Amenu, 2019 (37)	*****	1	1	1	1	1										
Angaw, 2015 (38)							3	3	3	3	3					
Asires, 2019 (39)	***						1	3	1	1	2					
Assefa, 2011 (40)							3	3	2	3	3					
Atlabachew, 2021 (41)							3	3	2	3	2					
Ayele, 2017 (42)	**						1	3	1	3	3					
Ayza, 2014 (43)							3	3	3	3	3					
Azanaw, 2021 (44)							3	3	2	3	3					

Azanaw, 2019 (45)	***						1	3	1	1	2					
Azeze, 2017 (46)							3	3	3	3	3					
Bafa, 2019 (47)	***						1	1	2	1	3					
Bekele, 2017 (48)	*						3	3	1	3	3					
Belhu, 2020 (49)							3	3	2	3	3					
Berhane, 2018 (50)	*****	1	1	1	1	1										
Berhanu, 2021 (51)							3	3	3	3	2					
Berhanu, 2020 (52)							3	3	3	3	3					
Berhe, 2020 (53)	*						3	3	1	3	3					
Bersisa, 2019 (54)							3	3	3	3	3					
Birke, 2019 (55)	*						3	3	3	1	3					
Chekol, 2019 (56)	***						1	3	1	1	3					
Dagne, 2019 (57)	*						3	3	3	1	3					
Derbew, 2013 (58)							3	3	3	3	3					
Dewe, 2014 (59)																
Diriba, 2020 (60)	**						3	1	2	1	3					
Diriba, 2020 (61)							3	3	3	3	3					
Disassa, 2017 (62)	**						3	3	1	3	1					
Eliku, 2016 (63)							3	3	3	3	3					
Eshetu, 2019 (64)	**						1	1	3	3	3					
Fiseha, 2016 (65)	**						3	3	1	3	1					
Fufa, 2018 (66)							3	3	2	3	3					
Garedew, 2015 (67)	*						1	3	2	3	2					
Gebrehiwot, 2020 (68)							2	3	3	3	2					
Gebre-medhin, 2021 (69)	*						3	3	2	3	1					
Gemeda, 2018 (70)							3	3	3	3	3					
Geresu, 2021 (71)							3	3	2	3	3					
Geresu, 2021 (72)							3	3	3	3	3					

Geta, 2019 (73)							3	3	2	3	2					
Gezehegn, 2017 (74)	*****						1	1	1	1	1					
Girma, 2017 (75)	**						3	3	1	1	1					
Girmay, 2020 (76)	**						3	1	3	1	3					
Girmay, 2020 (77)	**						3	1	3	1	3					
Girmay, 2020 (78)	**						3	1	3	1	3					
Gutema, 2021 (79)	***						1	3	1	3	1					
Haileselassie, 2013 (80)							3	3	2	3	3					
Jabbar, 2010 (81)	*						3	3	1	3	3					
Kassa, 2017 (82)	**						3	3	1	3	1					
Kebede, 2019 (83)	***						1	3	1	3	1					
Kebede, 2018 (84)	**						3	3	1	3	1					
Kechero, 2018 (85)	**						3	3	1	3	1					
Kemal, 2020 (86)	*****						1	1	1	1	1					
Kemal, 2016 (87)	**						3	3	1	3	1					
Kibret, 2012 (88)	**						3	3	1	3	1					
Knight-Jones, 2021 (89)		1	3	3	2	2	3	3	3	3	2	3	3	2	3	1
Kumma, 2019 (90)	****						1	3	1	1	1					
Kuyu, 2018 (91)	**						3	3	1	3	1					
Lalit, 2015 (92)	****						1	3	1	1	1					
Legese, 2020 (93)	**						3	3	1	3	1					
Legesse, 2017(94)	***						1	3	3	1	1					
Lema, 2020 (95)	*****						1	1	1	1	1					
Makita, 2012 (96)	**						1	3	3	3	1					
Mama, 2016 (97)	****						1	3	1	1	1					
Mama, 2016 (98)	***						1	3	1	3	1					
Marami, 2018 (99)	***						1	3	3	1	1					
Mardu, 2020 (100)	****						1	1	3	1	1					

Meleko, 2015 (101)	**						1	3	3	3	1					
Melesse, 2019 (102)	**						3	3	1	3	1					
Menedo, 2017 (103)	***						1	3	1	3	1					
Mengeda, 2020 (104)	**						1	1	3	3	3					
Minten, 2020 (105)	**											3	1	1	3	3
Molla, 2017 (106)	*						3	3	3	1	3					
Negero, 2020 (107)	***						1	3	3	1	1					
Nemo, 2017 (108)	***						1	1	3	3	1					
Nigussie, 2018 (109)	**						1	3	3	3	1					
Oumer, 2019 (110)	*****						1	1	1	1	1					
Regassa, 2021 (111)	***						1	3	3	1	1					
Reta, 2019 (112)	***						1	3	1	3	1					
Sahile, 2019 (113)							3	3	3	3	3					
Sebsibe, 2020 (114)	**						1	3	3	3	1					
Solomon, 2018 (115)	***						1	3	3	1	1					
Tadese, 2021 (116)	***						1	3	1	3	1					
Tadesse, 2019 (117)	***						3	3	1	1	1					
Tafere, 2017 (118)	*						3	3	3	3	1					
Tafesse, 2014 (119)	*****						1	1	1	1	1					
Tefera, 2014 (120)	****						1	3	1	1	1					
Tegegne, 2017 (121)	***						3	3	1	1	1					
Teka, 2017 (122)	**						3	3	1	3	1					
Temeche, 2016 (123)	***						1	3	1	3	1					
Tesfaye, 2020 (124)	**						3	3	1	3	1					
Tesfaye, 2019 (125)	**						3	3	1	3	1					
Tesfaye, 2016 (126)							3	3	3	3	3					
Tessema, 2014 (127)	**						3	3	3	1	1					
Tolosa, 2016 (128)	**						3	3	1	3	1					

Trübswasser, 2020 (129)	***	1	3	3	1	1										
Tsegay, 2017 (130)	****						1	3	3	3	1					
Wendimagegn, 2020 (131)	***						1	3	3	1	1					
Yenealem, 2020 (132)	*****						1	1	1	1	1					
Yeshanew, 2021 (133)	*						3	3	3	1	3					
Yesigat, 2020 (134)	**						3	3	1	3	1					
Zerabruk, 2019 (135)	**						3	3	1	3	1					
Zeru, 2007 (136)	**						3	1	3	3	1					

¹MMAT checklist: Qualitative studies (1.1 Is the qualitative approach appropriate to answer the research question?, 1.2 Are the qualitative data collection methods adequate to address the research question?, 1.3 Are the findings adequately derived from the data?, 1.4 Is the interpretation of results sufficiently substantiated by data?, 1.5 Is there coherence between qualitative data sources, collection, analysis and interpretation?); Quantitative descriptive studies (4.1 Is the sampling strategy relevant to address the research question?, 4.2 Is the sample representative of the target population?, 4.3 Are the measurements appropriate?, 4.4 Is the risk of nonresponse bias low?, 4.5 Is the statistical analysis appropriate to answer the research question?); Mixed Methods studies (5.1 Is there an adequate rationale for using a mixed methods design to address the research question?, 5.2 Are the different components of the study effectively integrated to answer the research question?, 5.3 Are the outputs of the integration of qualitative and quantitative components adequately interpreted?, 5.4 Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?, 5.5 Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?)

²Rating: 1=yes, 2=no, 3=can't tell

³Quality: ***** 100% criteria met, **** 80% criteria met, *** 60% criteria met, ** 40% criteria met, * 20% criteria met; dash (-) indicates no criteria are met; For mixed method studies, the overall quality is based on the lowest rating of the Qualitative and Quantitative components of the study.

⁴Only peer-reviewed published articles appraised for quality (n = 112)

7.6 APPENDIX 6. PERCEPTIONS, PRACTICES, AND RISK-MITIGATION STRATEGIES

MEAT HANDLING			
PRODUCERS' PERCEPTIONS OF MEAT QUALITY / SAFETY		PRODUCERS' PRACTICES TO IMPROVE QUALITY / SAFETY	CONSUMERS' COPING OR RISK-MITIGATION STRATEGIES
QUALITY ATTRIBUTES	SAFETY ISSUES/ CONCERNS		
Red color indicates good quality	Dark, yellow, or green meat indicates: <ul style="list-style-type: none"> • animal was diseased at time of slaughter • meat was stored for long time 	<ul style="list-style-type: none"> • Slaughtering healthy animals in good body condition • Ensuring animals are not stressed at time of slaughter • Ensuring complete bleeding at slaughter • Avoiding contamination during skinning and butchering • Separation of gut and gut contents, carcass, and offal • Washing the carcass • Preservation of meat by salting and smoking to prevent spoilage 	<ul style="list-style-type: none"> • Boiled or cooked thoroughly • Not consumed
"Good smell" indicates freshness	Foul smell indicates: <ul style="list-style-type: none"> • meat is unsafe to eat • animal might be diseased at time of slaughter • meat is contaminated • meat was stored incorrectly 		<ul style="list-style-type: none"> • Cooked before or after trimming • Cooked thoroughly • Not consumed
Consistent "normal" texture	<ul style="list-style-type: none"> • "Hard substances," lesions, and pus in meat indicate a health risk • "Frothy or jelly-like" substance on meat indicates animal was diseased at time of slaughter; might be a health risk 		<ul style="list-style-type: none"> • Abscesses or "cancer" in the meat are removed (<i>Unclear whether this is due to awareness of health risks, or due to consumer preferences</i>) • Trimmed, remainder cooked • Not consumed or cooked thoroughly
High fat content preferred	Indicates that animal is good quality (<i>less likely to be diseased</i>)		None specified
Lean meat preferred	High fat content is a health risk*		
Presence of small amount of dark blood preferred	None specified		
Chemical-free taste	Change in taste indicates anthelmintics used during finishing; associated with a health risk*		<ul style="list-style-type: none"> • Addition of bile or lemon juice to all food before consumption • Consuming a local alcoholic beverage (<i>areki</i>) immediately after consuming raw meat

Perceptions, practices, and strategies varied between sub-populations; *reported only from one sub-population

Reference: Dewe et al (59)

The majority of consumers were also producers. Their perceptions of quality and safety overlap with those of producers; as consumers, they also tended to adopt habits that allowed them to reduce the perceived risk from meat. Non-producer-consumers had similar perceptions to producer-consumers of food quality and safety attributes, including smell, color, tenderness, and a preference for meat with a high fat content (though a minority of consumers conversely preferred leaner meat, due to perceived health benefits).

MILK HANDLING			
PRODUCERS' PERCEPTIONS OF MILK QUALITY /SAFETY		PRODUCERS' PRACTICES TO IMPROVE QUALITY / SAFETY	CONSUMERS' ¹ COPING OR RISK-MITIGATION STRATEGIES
QUALITY ATTRIBUTES	SAFETY ISSUES/ CONCERNS		
Milk should be from a cow that has not been recently bred	Milk from recently bred cows has an abnormal smell and is considered unsafe*	<ul style="list-style-type: none"> • Avoiding milk from an animal that has recently mated* • Washing hands before milking* • Smoking milk containers with medicinal plants • Sieving milk through fabric* • Boiling milk before drinking • Processing milk into yoghurt and butter quickly* • Using preservatives and spices in the preparation of butter • Lining the butter container with preservative plants 	
Milk from mid- or late-lactation is better quality	None specified		
Milk should be free from dirt and hair	None specified		Sieving through fabric*
Normal appearance indicates good quality	<ul style="list-style-type: none"> • Watery milk is of low quality and can be associated with disease. • Off-white color, or the presence of blood or pus, is a disease risk 		<ul style="list-style-type: none"> • None specified • Not consumed if milk is discolored
Normal smell indicates freshness	Sour-smelling milk or butter is not fresh and can be associated with disease		<ul style="list-style-type: none"> • Boiling • Not consumed if associated with mating
Taste indicates freshness and quality	Sour milk has been stored for long periods of time and might be contaminated, which can be associated with disease*		<ul style="list-style-type: none"> • Boiling • Rarely occurs due to speed of consumption
Milk should appear uniform after boiling	Inconsistent milk has been stored for a long time after boiling and can be associated with disease*		None specified

*Perceptions, practices, and strategies varied between sub-populations; *reported only from one sub-population*

Reference: Amenu et al (37)

The majority of consumers were also producers. Their perceptions of quality and safety overlap with those of producers; as consumers, they tended to adopt habits that allowed them to reduce the perceived risk. Non-producer-consumers had similar perceptions to producer-consumers of food quality and safety attributes, including smell, color, and uniform consistency.

The Borana pastoralist vendors studied here were also consumers, so perceptions, practices, and mitigation strategies apply for both groups.

ASPECT	PERCEPTIONS ON MILK HANDLING AND HYGIENE PRACTICES	OBSERVED RISKY PRACTICES	POTENTIAL RISK MITIGATION STRATEGIES
Milk handling and risks to human health	<p>Aware that post-milking handling and processing practices can affect the hygienic quality of milk and milk products.</p> <ul style="list-style-type: none"> They believe that milk from a “healthy animal” is “healthy” (<i>“The milk has ‘disease’, when the udder is ‘diseased’.”</i>) Most contamination and subsequent lowering of milk quality happens after milking (<i>“If humans don’t make it bad, milk cannot be bad”</i>). Women were responsible for handling and processing of milk or milk products (<i>“The quality of milk is within the hands of women [women are responsible for hygienic keeping]”</i>) 	<ul style="list-style-type: none"> There was no attempt by the pastoralists to remove dirty matter from the udder before milking Hand milking was used, and the people milking the animals were observed to not wash their hands before milking or between milking of different animals in a herd. Lactating animals were housed in enclosures full of manure Use of traditional containers or plastic jerry-cans, which are difficult to clean, for milking, storage, or transportation of milk 	<p>Fermentation and smoking of milking and storage containers</p> <p>Strong belief that proper smoking of milk utensils is an important way of ensuring the good quality, safety, and shelf life of milk and dairy products (<i>“If you don’t smoke milking vessels or storage containers, milk curds quickly and becomes sour. If you smoke storage containers but not milking vessels, milk goes bad. If you smoke both, both will have good aroma and you add good aroma to the milk.”</i>)</p>
Milk boiling and consumption behavior	<p>Boiling of fresh milk was not a common practice due to long-time tradition and the perception that boiling milk destroys nutrients (<i>“Boiled milk is dead milk.”</i>; <i>“Fresh milk has more benefits; Boiled milk has no ‘qarruu’ [thick, creamy part of milk on top] and does not give any [nutritional] benefit. If you smoke containers and drink raw milk and give raw milk to children, there is a quick nutritional improvement in children. The same is true for adults. Boiled milk is</i></p>	<ul style="list-style-type: none"> Selling raw milk for direct consumption on market days The same cup, after being rinsed with unclean water, was shared among different customers for drinking milk or yoghurt Due to the semi-solid nature of the yoghurt, pouring is not easy when selling in markets, which means the women selling use their hands to assist pouring 	<p><i>“What makes [milk] bad is containers which have not been properly smoked. If the container is sufficiently smoked, milk is not spoiled. If the storage containers and milking vessels have not been properly smoked, putting milk into foul-odor containers can result in disease. Smoking [a container] has benefit; it gives good flavor to the milk.”</i></p>

ASPECT	PERCEPTIONS ON MILK HANDLING AND HYGIENE PRACTICES	OBSERVED RISKY PRACTICES	POTENTIAL RISK MITIGATION STRATEGIES
	<i>not nutritious. That is why we don't want to boil milk."</i>	<ul style="list-style-type: none"> • Milk-selling points were mainly on dusty roadsides or the side of large livestock markets 	<i>Containers which haven't been sufficiently smoked make milk bad."</i>
Milk-borne diseases	<p>Low awareness of milk-borne diseases; high emphasis on the nutritional and medicinal value of consuming milk. (<i>"We haven't seen sickness on this. We haven't seen any problem with the milk from our animals. We use it to raise our children. We don't know one can get disease from milk."</i>)</p> <p>Gastritis because of consumption of soured milk, general gastro-intestinal disturbances, delay in wound healing when drinking milk is stored in a non-smoked container, and brucellosis ("sallessa") were among the health problems perceived to be associated with the consumption of milk or milk products. (<i>"People drinking soured milk can get stomach problems."; "In Borana there was a saying in the past that when a wound is not healing quickly, the person had consumed milk from a non-smoked container."</i>)</p>		

