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Street Food Safety, Types and Microbiological Quality in Ethiopia: A Critical Review

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Abstract

Street food is food obtained from a street side vendor, often from a makeshift or portable stall. Street food feeds millions of people daily with a wide variety of foods that are relatively cheap and easily accessible. Street food is intimately connected with take-out, junk food, snacks, and fast foods but most of the foods are not protected against insects, dust etc. which may harbor foodborne pathogens. Food borne illnesses are defined as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food. Pathogens present in street vended foods come from different sources and practices, such as, improper food handling, improper waste disposal, contaminated water and improper storage temperature and reheating. Like other African and World countries there are many food vendors in Ethiopia where they sell both raw and cooked food items along the streets of different cities but it is far more unhygienic due to several reasons. So the objective of this review paper was to assess the existing research about street food safety, types, hygiene knowledge, and preparation and forward suggestion for stakeholders/policy makers to bridge the gap. Majority of street vended foods in Ethiopia are contaminated by bacteria like *salmonella*, *S. aureus*, *E. coliso* the Government should intervene and solve the issue before it is too late.

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Street food, Pathogen, Safety, Food borne illnesses, Ethiopia

Introduction

Street food is food obtained from a street side vendor, often from a makeshift or portable stall (FAO, 2007) and Street foods contribute significantly to the diet of many people in the developing world (FAO, 2007). Street food feeds millions of people daily with a wide variety of foods that are relatively cheap and easily accessible (Tambekar *et al.*, 2011). Street food is intimately connected with take-out, junk food, snacks, and fast food (Lues *et al.*, 2006). Street food is also regarded as tasty (Tambekar *et al.*, 2011), distinguishable by its local flavor and can be purchased on the sidewalk, without entry into a building (Lues *et al.*, 2006). Most of the

foods are not protected against insects, dust etc. which may harbor foodborne pathogens (Rane, 2011). Pathogens present in street vended foods come from different sources and practices. Improper food handling can lead to transfer of pathogens such as *Salmonella*, *E. coli* and *S. aureus* from human body and environment into foods (Rane, 2011). Improper waste disposal have been associated with transmission of enteric pathogens like *Salmonella*, *Shigella* and *E. coli*. Contaminated water has been associated with pathogens such as *E. coli*, fecal streptococci, *Salmonella* and *Vibrio cholera* while vegetables and spices are associated with introduction of spore formers like *Bacilli* and *Clostridium* and pathogens like *L. monocytogenes*, *Shigella*, *Salmonella* etc (Rane,

2011). Improper storage temperature and reheating of food have been associated with production of heat stable toxins produced by pathogens like *C. perfringens* and *B. cereus* (Rane, 2011).

Food borne illnesses are defined as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food (WHO, 2007). According to the Centers for Disease Control and prevention (CDC) 31 pathogens are known to cause foodborne illnesses (CDC, 2011). Among the pathogens found in street vended food *Bacillus cereus*, *Clostridium perfringens*, *Salmonella* and *Staphylococcus aureus* are the most common ones. The high prevalence of diarrhoea diseases in many developing countries suggests major underlying food and water safety problems (WHO, 2007). In 1988, 14 deaths were reported in Malaysia because of foodborne diseases related to street foods, same year 300 persons became ill in Hong Kong after consumption of street vended foods; in 1981 a cholera epidemic in Pune, India was linked to consumption of street vended juice; In 1987 in Singapore, an outbreak of cholera has been also attributed to street foods (FAO, 1990). According to Rane (2011), the poor knowledge and improper food handling of street vendors in basic food safety measures and poor knowledge and awareness among consumers on the potential hazards associated with certain foods could explain the health and safety issues that street foods may pose (Rane, 2011).

Importance of street food in urban areas

In developing countries, a large proportion of ready to eat foods are sold on the street (Mensah *et al.*, 2002). According to the Food and Agriculture Organization, 2.5 billion people worldwide eat street food every day (FAO, 2007). Increased reliance of street food has been identified as one of the characteristics of urban food distribution systems driven by changes in the urban way of life and poverty in developing countries (FAO, 1998). Street foods have already become a common feature of urban life (Hilda, 2002). The increasing poverty and time constraints to survive in developing countries indicate that the street food phenomenon will only increase (Hilda, 2002). With the increasing pace of globalization and tourism, the safety of street food has become one of the major concerns of public health, and a focus for governments and scientists to raise public awareness of (FAO, 2007).

Street foods play significant nutritional role for consumers, particularly for middle and low-income

sectors of the population, who depend on street foods for their main food intake (Mensah *et al.*, 2002; Dardano, 2003). The contribution to the daily food intake of poor urban dwellers is scarcely quantified in energy and nutrients (Hilda, 2002). Street food operations sometimes involve the entire family in the procurement of raw materials, preparation and cooking of the meals (Mensah *et al.*, 2002). The role of women in the sector is significant, as they control a large share of market activity and commodity trading (Mensah *et al.*, 2002). Street food vendors benefit from a positive cash flow, often evade taxation, and can determine their own working hours (Mensah *et al.*, 2002).

Like other African and world countries there are many food vendors in Ethiopia where they sell both raw and cooked food items along the streets of different cities of Ethiopia but it is not developed as in developing countries. Safety concern and qualities are affected by urbanization, population growth, countries low income. So the objective of this review paper was to assess the existing research about street food safety, types, hygiene knowledge, and preparation and forward suggestion for stakeholders/policy makers to bridge the gap.

Types of street vended food in Ethiopia

Food hygiene, handling and preparation of street food

Street food is prepared by the vendors at home or at the road side stalls (Muinde and Kuria, 2005). The vending sites are self-allocated and not varnished with sanitary amenities (Mwangi, 2002) (Table 1).

In a study by Azanaw *et al.*, (2019) on bacteriological profile, antimicrobial susceptibility patterns of the isolates among street vended foods and hygienic practice of vendors in Gondar town, Northwest Ethiopia: a cross sectional study by revealed that half of the vendors 12(50%) had no frequent hand washing habit with soap and water during the preparation, collecting and displaying of food. Only 5 (20.8%) of the vendors covered their hair while preparing food and 30.35% in jigjiga (Tesfaye *et al.*, 2016). 45.8%, 47.62% of the food vendors handled foods with bare hands (Azanaw *et al.*, 2019, Tesfaye *et al.*, 2016).

About 124 (94%) of the vendors operated from stalls along the streets, while only 8(6%) of those surveyed were mobile. The vending sites were spread in wooden stalls 63(47.7%), canopies 31(23.5%) and polythene

containers 38(28.8%). The preparation surfaces were dirty in 83.3% of those surveyed. Thirty nine point four (39.4%) claimed that they washed the preparation surface before reuse, while 25% of them reused oil for frying. 86% of the vendors prepared food in unhygienic conditions. Only 12.9% used apron while cooking or serving food, while 75% handled food with bare hands. About 69.7% wore hair covering, and 41.3% wore jewelry while handling foods. Food was mainly served in metal plates (61.9%). While most of them (69.43%) stored their food in covered warmers or utensils, none of them could afford storage in refrigerators when electric is available (Tesfaye *et al.*, 2016).

A study by Asefa *et al.*, (2016) found that 60% of the vendors did not use aprons, 75% handled food with their bare hands, 87.7% had short nails, which were not polished and 65% had their hair not covered. All the vendors handled money while serving food and only 67.5% of them had worn jewelry. Observation result by similar author revealed that 70% of the area around food vending or preparing had open and bad smelling drainage system. The water for washing and rinsing the utensils was dirty and 85% of the vendors interviewed prepare their foods in unhygienic conditions given that garbage and dirty waste were obviously close to the stalls. Of the vendors interviewed, 92.5% did not have garbage containers; hence they disposed their garbage just near the stalls.

A similar study by Mohammed (2019) on bacteriological quality of street vended ready to eat legume and vegetable based foods in Bahir Dar town, Amhara regional state, north western Ethiopia revealed that 21 (58.3%) and 24 (66.7%) did not dress appropriate overcoat and hair cover, respectively. Twenty three (63.9%) of the vendors were observed had no short and cleaned nail and majority of the food handlers achieved their activity without proper and clean dressing. Moreover, observations revealed that 27 (75%) of the vendors did not practice hand washing while preparing and serving street foods, even the remaining 9 (25%) of the vendors wash their hands without the use of soap. Wear of jewelry was observed in 29 (80.6%) of the vendors, all of the vendors handling money when serving food, the majority of the food handlers (88.9%) recycles water for several times without replacement of clean equipment, most of the street food outlets were located near the road and some of them were near the municipal garbage bin for this reason only 11 (30.6%) of the vendors disposed liquid waste into municipal sewage

whereas the remaining 25 (69.4%) of the vendors disposed into the vending area (open dumping).

In another similar study majority (64.5%) of the street vendors used tap water for preparation of food while 27.3% used well water. On the other hand, 49.1% of street vendors used well water for cleaning utensils. In addition, 43.6% of the vendors cleaned the utensils using hand and water only, 80.9% of street food vendors handled food with their bare hands. Again, 80.91% of the vendors worked in dusty environment and 70.9% in the vicinity of litter (Reda *et al.*, 2017).

Food safety knowledge and attitudes

Knowledge is defined as “a complex process of remembering, relating, or judging an idea or abstract phenomenon (cognitive abilities)” (Gotsch *et al.*, 2012). On the other hand attitude is defined “as a state of mind, feelings, or beliefs about a particular matter (affective abilities) (Gotsch *et al.*, 2012).

In a study conducted by Azanaw *et al.*, (2019) the majority (58.3%) of the food vendors had no information on food borne diseases in contrast to a previous study conducted in Gondar where 57.5% of the food vendors had knowledge on food borne disease (Getu *et al.*, 2013). The majority 19(79.2%) of the study participants had no training in food safety.

Knowledge about food vending was acquired by self-teaching, trial and error in 79(59.8%) of the street vendors. Only 1(0.8%) of the vendors surveyed participated formal training in food handling and vending, while 52(39.4%) of them acquired their knowledge via observation or were taught by their parents (Tesfaye *et al.*, 2016).

Among the 40 street food vendors who were interviewed for knowledge and practice assessment, 16 (40%) of the vendors were knowledgeable and about 60% of the vendors did not know that microorganisms can contaminate foods, only 52.5% of food vendors were familiar with the term “food-borne illnesses”. None of them took formal training on food preparation and safety. All of the vendors who participated in this study acquired food preparing skills from observation and more than half 22(53.7%) of the study participants had not attitude about contamination of foods (Asefa *et al.*, 2016).

Among the 40 street food vendors who were interviewed for knowledge and practice assessment, 17 (42.5%) of

the vendors were not knowledgeable. Street vendors who had no knowledge on food borne diseases were two times more risk (RR=2.41; 95% CI = (1.43-4.06) of food contamination than the knowledgeable once. Those with poor personal hygiene were also four times risk than vendors with good personal hygiene 3.95(95% CI=1.43-10.91) (Getu *et al.*, 2013).

Another study in Ethiopia showed that 92.7% of the vendors did not get training on food hygiene, although 7.3% had exposure on personal hygiene. A significant number (66.4%) of the vendors had no information about food and water-borne diseases whereas 33.6% had information about foodborne and waterborne diseases such as diarrhea and giardia (Reda *et al.*, 2017).

Microbial quality of street foods

Microbiological hazards are considered as a greater challenge to food safety because harmful microorganisms can either proliferate in the food or in the human body once ingested (Tent, 1990). Food safety system in Ethiopia is not as organized and developed as in other developed countries. Besides, problems of growing population, urbanization, and environment and food hygiene issues mean that food systems in the country continue to be stressed, adversely affecting the quality and safety of food supplies (Teferi, 2020).

A study by Temesgen *et al.*, (2016) on bacteriological quality of street foods and antimicrobial resistance of isolates in Hawassa, Ethiopia indicated a total of 71 bacterial isolates which made up eleven genera were detected; raw fish (24%, 17/71) followed by potato (18%, 13/71) and 'awaze' (14%, 10/71). *E. coli* was the most frequent isolate (29.6%) followed by *Salmonella* and *Citrobacter* species (12.7% each) and *Edwardisella*, *M. Morgan* and *Serratia* were present in low rate (1.4% each). The highest rate of *S. aureus* (3/7, 42.8%) was seen in 'awaze' while the highest rate of *Salmonella* Spp. (7/9, 78%) observed in raw fish. Moreover, 31% of street vended foods showed high mean total colony count (1.7×10^5 to 6.7×10^6 CFU/g) compared to what is set for microbiological quality of ready-to-eat street foods. The mean aerobic counts of 'kita' (6.1×10^5 CFU/g), and 'ambasha' (3.0×10^5 CFU/g) were found to be beyond the acceptable level (below 105CFU/g). Similarly, the coliform counts of all tested food items were beyond the acceptable range. Antimicrobial resistant result showed all isolates became 60-100% resistant to ampicillin. *S. aureus* showed 100% resistance to cloxacillin, 28.6% to oxacillin and 14.3% vancomycin. About 88.9% of

Salmonella spp showed resistance to chloramphenicol and 61.9% *E. coli* to doxycycline (Temesgen *et al.*, 2016).

Another study by Tesfaye *et al.*, (2016) indicated that out of 132 street vended food samples analyzed 95(72%) of the foods had pathogenic bacterial contamination. Three different bacterial species were isolated from the foods sample: *E. coli* 68(51.5%), *S. aureus* 85(64.4%) and 26 (19.7%) *Salmonella* spp. *S. aureus* 23/33(69%) was seen in 'Sambusa', while *E. coli* 24/33(73.5%) was observed in 'Pasta' and the highest *Salmonella* incidence was observed in 'Ades'. Moreover, among the total 132 streets vended foods which were enrolled 98.7% of them had aerobic mesophilic count greater than 8 log CFU/g.

Bacteriological profile, antimicrobial susceptibility patterns of the isolates among street vended foods and hygienic practice of vendors in Gondar town, Northwest Ethiopia: a cross sectional study by Azanaw *et al.*, (2019) revealed that from 72 street vended food samples analyzed 44/72 (61.1%) of the food samples had bacterial contamination. From 44 contaminated food samples 63 isolates were identified. *S. aureus* was the most frequent isolate 34 (53.96%) followed by *E. coli* 15(23.8%), *Enterobacter* species 10(15.87%) and *Citrobacter* species 4(6.3%). The highest numbers of bacterial isolates were isolated from sambusa (25/63) and donat (22/63) while the minimum value was seen in bombolino (10/63) and bread (6/63). The antibiotic susceptibility pattern showed that *S. aureus* resistance to penicillin (73.53%), *Enterobacter* species resistant to ampicillin (70%) and ceftazidime (70%) and *Citrobacter* species resistant to ampicillin (75%) (Azanaw *et al.*, 2019).

Bacteriological quality of street vended ready to eat legume and vegetable based foods in Bahir Dar town, Amhara regional state, north western Ethiopia showed that range of aerobic mesophilic bacteria was 3.28 to 5.95 log₁₀cfu/g with a mean value of 4.50 log₁₀cfu/g in legume based and 2.72 to 5.79 log₁₀cfu/g with a mean value of 4.54 log₁₀cfu/g in vegetable based food. 5 (16.7%) in legume based and 6 (20%) in vegetable based food; above the accepted limit (≥ 1000 MPN/g) and unsatisfactory for consumption. The prevalence of *S. aureus* in this study was 47 (78.3%), out of isolates of *Staphylococcus aureus*, only 4 (13.3%) of legume based and 3 (10%) of vegetable based food were hazardous (Mohammed, 2019).

Other study in Gondar by Asefa *et al.*, (2016) revealed that 82.8% food sample had contaminated by one or more pathogenic bacteria. These were total coliforms 11227 cfu/gm, (26.43%), *S. aureus* 15096 cfu/gm, (35.54%) and 16155 cfu/gm, (38.03%) *Salmonella*

species were isolated. The highest incidence of *S. aureus* (19.8%) was seen in bread (S17) and the highest incidence of *Salmonella* 16.9% was observed in bonbolino (S22).

Table.1 Types and preparations of street vended food

S.No	Food items	Preparations	Region/ Town	Author
1	Kita	Thin flat bread commonly made from Corn and Wheat flour and doesn't need any fermentation	Hawassa	Temesgen <i>et al.</i> , (2016)
	Ambasha	Pizza type bread made from Wheat flour with baking powder		
	Raw fish	-		
	Potato	-		
	Awaze	Chili-based thick sauce made from fresh red pepper, ginger, onions and salt and severely blended		
2	Fuol	The boiled bean and then mixed with onion, tomato and other Ethiopian spices	Jigjiga	Tesfaye <i>et al.</i> , (2016)
	Sambusa	a deep fried triangle of wheat dough Stuffed with lentils, chopped onions.		
	Pasta	Boiled 'Macaroni' and then mixed with already prepared tomato stew		
	Ades	It is tea made of normal tea plus camel milk and boiled with spice.		
3	Donat	It is a deep fried piece of wheat dough commonly of a circular or flattened sphere shape covered with jam, custard or cream.	Gondar	Azanaw <i>et al.</i> , (2019)
	Bombolino	It is a fried piece of wheat dough commonly of a ring or circular shape without jam, custard or cream.		
4	Legume	made from roasted and ground Faba bean or split pea or lentil	Bahir Dar	Mohammed (2019)
	Vegetable	A classic dish made from cabbage, potato, carrot and kale flavored with spice		
5	Bread	-	Gondar	Asefa <i>et al.</i> , (2016)
6	Injera Firfir		Jimma	Reda <i>et al.</i> , (2017)
7	Macaroni	Boiled 'Macaroni' and then mixed with already prepared tomato stew	Addis Ababa	Deriba and Mogessie (2000)
	Kitfo	Minced meat with sauce		
	Egg sandwich			

Out of total 160 food samples analyzed, 457 bacterial strains were isolated from firfir, 440 from bread and 400 from each of injera and sambussa. Totalling 1697 bacterial isolates; 29.38% samples were positive for *S. aureus*.

The highest (57.5%) being found in firfir and the lowest being found in sambussa (12.5%); 13.13% samples were positive for *Salmonella* isolates, (27.5%) in firfir and bread (12.5%) and low in injera (7.5%) and sambussa (5.0%). *S. aureus* were highly resistant to penicillin G (100%) followed by clindamycin (80.85%) and tetracycline (63.83%) and *Salmonella* were resistance to ampicillin (95.24%), nalidixic acid (76.19%) and streptomycin (47.62%). Generally the maximum number of antibiotics resisted by *S. aureus* was six antibiotics with total proportion of 8.51% and in case of salmonella MDR to three antibiotics dominated the resistance pattern (33.33%) according to Reda *et al.*, (2017).

A study by Getu *et al.*, (2013) revealed 36/56 (64.3%) of the foods had pathogenic bacterial contamination. These were *E. coli* 25(44.6%), and *S. aureus* 29 (51.8%). The highest incidence of *S. aureus* 8 (66.7%) was seen in 'Bonbolino' while the highest incidence of *E. coli* 9 (75%) was observed in 'Macaroni'.

Factors associated with food handling practice of food handlers

Study conducted in Gondar town shows age, marital status, service year, monthly income, food hygiene and safety training, attitude, knowledge and depth of knowledge were identified as factors affecting food safety practices (Gizaw *et al.*, 2014). In other similar study in Dangila showed that marital status, monthly income, knowledge, presence of insects and rodents, existence of shower facility and separate dressing room were found to be significantly associated with food handling (Tessema *et al.*, 2014). Study in Dire Dawa shows educational background, food safety training, food safety attitude, and practical three Compartments dishwashing system was statistically significant with food safety practice (Legesse *et al.*, 2017). Research study conducted in Arbaminch town, Food handler whose age greater than 29-34 and ≥ 35 years respectively, having supervisor and medical check up, those who take training on food sanitation in the past were the identified significant factors associated with food handlers practice (Mihret, 2016).

Prevalence of *Salmonella* and *Shigella* in food handlers in Ethiopia

Shigella species was isolated 2.3% in Debre Markos university food handlers (Abeba *et al.*, 2018), (2.7%) in food handlers at Gondar University cafeteria by (Mulat *et al.*, 2013), (3.1%) at Gondar town by (Andargie *et al.*, 2008) 0.4% from Hawassa (Desta *et al.*, 2014), and (3%) at Arba Minch University by (Mohammedaman and Getaneh, 2016). *Salmonella* species was isolated (3.6%) were isolated from stool culture of food handlers. In Debre Markos university food handlers (Abeba *et al.*, 2018), Addis Ababa University (3.5%) in food handlers (Aklilu *et al.*, 2015), 6.9% among food handlers at Arba Minch University, South Ethiopia (Mohammedaman and Getaneh, 2016), Gondar University cafeteria (1.3%) (Mulat *et al.*, 2013) and 1.6% Bahir Dar town food handlers (Abera *et al.*, 2010).

Conclusion

Majority of street vended foods in Ethiopia are contaminated by bacteria like *salmonella*, *S. aureus*, *E. coli* etc according to the revised articles; Because vendors poor knowledge and practice on food borne illness. Therefore the following suggestions are made:

Street vended foods are of great importance in the community, governments should consider their official recognition.

Governments must consider a Code of Hygienic Practice as an essential tool

It is important to educate people on the importance of food safety issues, hygiene and preparation

Government, stakeholders and regulatory authorities should develop guidelines for this specific food service sector.

Data availability

All the data used for this study was included and no other data available.

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