

Review Article

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 and it 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 it is not protected against insects, dust etc; which may harbor foodborne pathogens. 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. 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. 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. coli* so the Government or different stake holders should intervene and solve the issue.

Keywords: Street Food, Pathogen, Safety, Food Borne illnesses, Ethiopia

1. Introduction

Street food is food obtained from a street side vendor, often from a makeshift or portable stall and it contribute significantly to the diet of many people in the developing world [1]. Street food feeds millions of people daily with a wide variety of foods that are relatively cheap and easily accessible [2]. Street food is intimately connected with take-out, junk food, snacks, and fast food [3]. Street food is also regarded as tasty [2], distinguishable by its local flavor and can be purchased on the sidewalk, without entry into a building [3]. Most of the foods are not protected against insects, dust etc. which may harbor foodborne pathogens [4]. 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 [4]. Improper waste disposal has 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 [4]. 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* [4].

Food borne illnesses are defined as diseases, usually either infectious or toxic innature, caused by agents that enter the body through the ingestion of food [5]. According to the Centers for Disease Control and prevention (CDC) 31 pathogens are known to cause foodborne illnesses [6]. 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 [5]. 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 [7]. According to [4], 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 [4].

2. Importance of Street Food in Urban Areas

In developing countries, a large proportion of ready to eat foods are sold on the street [8]. According to the Food and Agriculture Organization, 2.5 billion people worldwide eat street food every day [1]. 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 [9]. Street foods have already become a common feature of urban life [10]. The increasing poverty and time constraints to survive in developing countries indicate that the street food phenomenon will only increase [10]. 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 [1].

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 [8]. The contribution to the daily food intake of poor urban dwellers is scarcely quantified in energy and nutrients [10]. Street food operations sometimes involve the entire family in the procurement of raw materials, preparation and cooking of the meals [8]. The role of women in the sector is significant, as they control a large share of market activity and commodity trading [8]. Street food vendors benefit from a positive cash flow, often evade taxation, and can determine their own working hours [8].

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 the safety system is not developed as in developing countries (Table 1). 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 stakeholder's/policy makers to bridge the gap.

Types of street vended food in Ethiopia

Table 1. Types and preparations of street vended food.

NO	Food items	Preparations	Region/Town	Author
1	Kita	commonly made from Corn and Wheat flour and doesn't need any fermentation	Hawassa	[11]
	Ambasha	made from Wheat flour with baking powder		
	Raw fish	-		
2	Potato	Boiled potato then peeled and served with pepper	Jigjiga	[12]
	Awaze	Chili-based thick sauce made from fresh red pepper, ginger, onions and salt and severely blended		
	Fuol*	The boiled bean and then mixed with onion, tomato and other Ethiopian spices		
	Sambusa*	A deep fried triangle of wheat dough Stuffed with lentils, chopped onions.		
3	Pasta*	Boiled 'Macaroni' and then mixed with already prepared tomato stew	Gondar	[13]
	Ades	It is tea made of normal tea plus camel milk and boiled with spice.		
	Donat*	It is a deep fried piece of wheat dough commonly of a circular or flattened sphere shape covered with jam, custard or cream.		
4	Bonbolino*	It is a fried piece of wheat dough commonly of a ring or circular shape without jam, custard or cream.	Bahir Dar	[14]
	Legume	Made from roasted and ground Faba bean or split pea or lentil		
5	Vegetable	A classic dish made from cabbage, potato, carrot and kale flavored with spice	Gondar	[15]
6	Bread	Made from wheat flour after fermentation	Jimma	[16]
7	Injera Firfir	Already prepared Injera from wheat flour cut in to pieces and mixed with prepared sauce then served. (Injera is Ethiopian traditional food)	Addis Ababa	[17]
	Macaroni*	Boiled 'Macaroni' and then mixed with already prepared tomato stew		
	Kitfo*	Minced meat with sauce		
	Egg sandwich*	After fried the egg cut the bread and put it then eat		

*There are many researchers who have done similar types but for the sake of the list the author use only one.

3. Food Hygiene, Handling and Preparation of Street Food

According to [18, 19] street food is prepared by the vendors at home or at the road side stalls and the vending sites are self-allocated and not varnished with sanitary amenities.

In a study by [13] revealed that 12 (50%) vendors had no frequent hand washing habit with soap and water during the preparation, collecting and displaying of food. 20.8%, 30.35%

of the vendors covered their hair while preparing food [12, 13]. 45.8%, 47.62% of the food vendors handled foods with bare hands [13, 12].

In a study by [12] About 124 (94%) of the vendors operated from stalls along the streets, only 8 (6%) were mobile (moving place to place). The vending sites; 63 (47.7%) were spread in wooden stalls, 31 (23.5%) canopies and 38 (28.8%) polythene containers. preparation surfaces were dirty in 83.3%. 39.4% washed the preparation surface before reuse, while 25% of them reused oil for frying. 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.

A study by [15] 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 [14] 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 had no short and cleaned nail. Moreover, 27 (75%) vendors did not practice hand washing while preparing and serving street foods, 29 (80.6%) of the vendors Wear of jewelry, all of the vendors handled money while serving food, (88.9%) of food handler 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 [16].

3.1. Food Safety Knowledge and Attitudes

According to [20] knowledge is “a complex process of remembering, relating, or judging an idea or abstract phenomenon (cognitive abilities)”, attitude is defined “as a state of mind, feelings, or beliefs about a particular matter (affective abilities).

In a study conducted by [13, 21] 58.3% and 57.5% of the food vendors had no information on food borne diseases. Moreover, 19 (79.2%) of the study participants had no training in food safety [21]. 79 (59.8%) acquired knowledge about food vending by self-teaching, trial and error, 1 (0.8%) of participated formal training in food handling and vending, while 52 (39.4%) of them acquired their knowledge via observation [12].

In another study 16 (40%) of the vendors were

knowledgeable and 60% of the vendors did not knew that microorganisms can contaminate foods, 52.5% of food vendors were familiar with “food-borne illnesses”. None of them took formal training on food preparation, safety and All the 40 vendors acquired food preparing skills from observation and 22 (53.7%) of participant had no attitude about contamination of foods [15].

17 (42.5%) of the vendors were not knowledgeable. Street vendors who had no knowledge on food borne diseases were two times more risk of food contamination and vendors with poor personal hygiene were also four times risk [21]. Another similar study in Ethiopia revealed that 92.7% of the vendors did not get training on food hygiene, (66.4%) of the vendors had no information about food and water-borne diseases [16].

3.2. Microbial Quality of Street Foods

A greater challenge to food safety is microbiological hazards because harmful microorganisms can either proliferate in the food or in the human body once ingested [22]. Food safety system in Ethiopia is not organized. Besides, there are other problems such as, growing population, urbanization, and environment and food hygiene issues which adversely affecting the quality and safety of food supplies [23].

A study by [11] showed a total of 71 bacterial isolates from this raw fish (24%, 17/71) followed by potato (18%, 13/71) and ‘awaze’ (14%, 10/71). *E. coli* was the highest isolate (29.6%), *Salmonella* and *Citrobacter* species (12.7% each) and *Edwardisella*, *M. Morgan* and *Serratia* (1.4% each). (3/7, 42.8%) *S. aureus* was seen in ‘awaze’; (7/9, 78%) *Salmonella* Spp. observed in raw fish. Moreover, 31% of street vended foods showed high mean total colony count (1.7x10⁵ to 6.7x10⁶ CFU/g). The mean aerobic counts of ‘kita’ (6.1x10⁵ CFU/g), and ‘ambasha’ (3.0x10⁵ CFU/g) were beyond the acceptable level (below 10⁵CFU/g). Moreover, the coliform counts of all tested food items were beyond the acceptable range. Antimicrobial resistant result showed; *S. aureus* 100% resistance to cloxacillin, 28.6% to oxacillin and 14.3% vancomycin; 88.9% of *Salmonella* resistance to chloramphenicol and 61.9% *E. coli* to doxycycline [11].

Another study by [12] indicated that out of 132 street vended food samples analyzed, 72% of the foods were contaminated with pathogenic bacterial. The isolated bacteria were *E. coli* 68 (51.5%), *S. aureus* 85 (64.4%) and 26 (19.7%) *Salmonella* spp. 23/33 (69%) of *S. aureus* was seen in ‘Sambusa’, 24/33 (73.5%) *E. coli* in ‘Pasta’. Moreover, among the total 132 streets vended foods, 98.7% of them had higher aerobic mesophilic count.

A study by [13] revealed that from 72 street vended food samples analyzed 44/72 had bacterial contamination. Out of 44 contaminated food samples, *S. aureus* was isolated 34 (53.96%), 15 (23.8%) *E. coli*, 10 (15.87%) *Enterobacter* species and 4 (6.3%) *Citrobacter* species. Highest numbers of bacterial were isolated from sanbusa (25/63) and donat (22/63) while minimum value Bonbolino (10/63) and bread (6/63) respectively. 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%) [13].

Another study in Bahir Dar town about Bacteriological quality of street vended ready to eat legume and vegetable based foods showed that aerobic mesophilic bacteria was 4.50 log₁₀cfu/g in legume based and 4.54 log₁₀cfu/g in vegetable based food. *S. aureus* isolated in 47 (78.3%), *Staphylococcus aureus*, 4 (13.3%) of legume based and 3 (10%) of vegetable based food [14].

Other study in Gondar by [15] revealed that 82.8% food sample had contaminated by one or more pathogenic bacteria. (35.54%) *S. aureus* and (38.03%) *Salmonella* species were isolated. (19.8%) *S. aureus* was seen in bread and 16.9% *Salmonella* was observed in Bonbolino.

Similar study in Ethiopia by [16] analyzed 160 foods and isolated 1697 bacteria; 457 from firfir, 440 from bread, 400 from Injera and 400 from sambussa. 29.38% of foods were positive for *S. aureus*. The highest (57.5%) found in firfir and the lowest found in sambussa (12.5%); 13.13% positive for *Salmonella* isolates, (27.5%) in firfir and bread (12.5%) and low in injera (7.5%) and sambussa (5.0%). Antimicrobial resistant revealed that *S. aureus* were (100%) resistant to penicillin, (80.85%) clindamycin and (63.83%) tetracycline whereas *Salmonella* were (95.24%) resistance to ampicillin, (76.19%) nalidixic acid and (47.62%) streptomycin. In nutshell *S. aureus* resisted six antibiotics with total proportion of 8.51%.

64.3% foods were contaminated by pathogenic bacterial, these were 25 (44.6%) *E. coli*, and 29 (51.8%) *S. aureus*. Moreover, 8 (66.7%) *S. aureus* was seen in 'Bonbolino' whereas 9 (75%) *E. coli* was observed in 'Macaroni' [21].

3.3. Food Handling Practice of Food Handlers and Associated Factors

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 according to a by [24]. In other similar study 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 [27]. According to a study by [25] the following factors were associated with food safety practice; educational background, food safety training, food safety attitude, and practical three Compartments dishwashing system was. Moreover, 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 [26].

4. Prevalence of Salmonella and Shigella in Food Handlers in Ethiopia

Shigella species was isolated 2.3% in Debre Markos university food handlers [28], (2.7%) in food handlers at Gondar University [29], (3.1%) at Gondar town by [30], 0.4%

from Hawassa [31] and (3%) at Arba Minch University by [32].

3.6% *Salmonella* species was isolated from food handlers in Debre Markos university food handlers [28], (3.5%) in food handlers from Addis Ababa University [33], 6.9% among food handlers at Arba Minch University [32] and Gondar University cafeteria (1.3%) [29], 1.6% Bahir Dar town food handlers [34].

Other than *Salmonella* and *Shigella* there are other food-borne bacterial pathogens in Ethiopia such as *L. monocytogenes*, Tuberculosis, *Escherichia coli*, *Campylobacter* and intestinal parasite [23]. There were 94,991 intestinal parasites and 48,880 diarrheas in Amhara region in 2008 survey. In Oromia region there were 88,442 Gastroenteritis, in Somalia 39,468, 130,570 Gastro-enteritis-duodenitis in southern nation nationalities and peoples of Ethiopia and 36,667 Gastro-enteritis in Addis Ababa [23].

5. Conclusion

The review paper revealed that majority of street vended foods in Ethiopia are contaminated by bacteria like *salmonella*, *S. aureus*, *E. coli* etc. This is because of vender's poor knowledge and practice on food borne illness. Therefore, the following suggestions are made:

- 1) Street vended foods are of great importance in the community, so the governments should give recognition officially.
- 2) Awareness creation to the community about food safety, hygiene and preparation.
- 3) Government, stakeholders and regulatory authorities need to develop guidelines for street food.

References

- [1] FAO. The informal food sector" <http://www.informalfood.unibo.it> 2007-11-23. 2007.
- [2] Tambekar DH, Kulkarni RV, SD. Shirsat and DG. Bhadange. Bacteriological quality of street vended food Panipuri. A case study of Amravati city (ms) India. Bioscience discovery. 2011; 2 (3): 350-354.
- [3] Lues, F. R., Mpele, R. R., Venter, P. & Theron, M. M. Assessing Food Safety and Associated Food Handling Practices in Street Food Vending. International Journal of Environmental Health Research. 2006; 16 (5): 319-328.
- [4] Rane, S. Street Vended Food in Developing World: Hazard, Indian Journal of Microbiology. 2011; 51 (1): 100-106.
- [5] WHO. Food safety and food borne illness Fact sheet No 237. Reviewed March 2007. 2011. <http://www.who.int/mediacentre/factsheets/fs237/en>.
- [6] CDC (Centers for Disease Control). Foodborne Outbreak Online Database (FOOD). <http://wwwn.cdc.gov/foodborneoutbreaks/Default.aspx>. 2011.
- [7] FAO. La venta de alimentos en las Calles: informe de una consulta de expertos de la FAO, Yogyakarta, Indonesia, 5-9 de diciembre 1990. Rome. 1990.

- [8] Mensah, P., Yeboah-Manu, D., Owusu-Darko, K. & Ablordey A. Street Foods in Accra, Ghana: How Safe are They? Bulletin of World Health Organization. 2002; 80 (7): 546-554.
- [9] FAO (1998). The state of food and agriculture, Rome.
- [10] Hilda Vant Riet. 2002. The role of street foods in the diet of low-income urban residents, the case of Nairobi. PhD Thesis. 2002; 86- 92.
- [11] Temesgen Eromo, Haimanot Tassew, Derese Daka, Gebre Kibru. Bacteriological Quality of Street Foods and Antimicrobial Resistance of Isolates in Hawassa, Ethiopian Journal of Health Science. 2016; 26 (6).
- [12] Tesfaye Wolde, Yohannes Mekonnen, Melese Abate, Henok Sileshi. Microbiological Safety of Street Vended Foods in Jigjiga City, Eastern Ethiopia. Ethiopian Journal of Health Science. 2016; 26 (2).
- [13] Azanaw Amare, Tifito Worku, Birukitait Ashagirie, Marie Adugna, Alem Getaneh and Mulat Dagneu. 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. MC Microbiology. 2019; 19: 120. <https://doi.org/10.1186/s12866-019-1509-4>.
- [14] Mohammed Tesfaye. Bacteriological quality of street vended ready to eat legume and vegetable based foods in Bahir Dar town, Amhara regional state, north western Ethiopia. Asian Journal of Science and Technology. 2019; 10 (08): 9959-9968.
- [15] Asefa Adimasu, Bimerew Mekonnen, Tadesse Guadu, Zemichael Gizaw and Tsegaye Adane. Bacteriological Quality Assessment of Selected Street Foods and Their Public Health Importance in Gondar Town, North West Ethiopia. Global Veterinaria. 2016; 17 (3): 255-264.
- [16] Reda Nemo, Ketema Bacha and Tsige Ketema. Microbiological quality and safety of some-street vended foods in Jimma Town, Southwestern Ethiopia. African Journal of Microbiology Research. 2017; 11 (14): 574-585.
- [17] Deriba and Mogessie. *Salmonella*, *Shigella* and growth potential of other food-borne pathogen in Ethiopian street vended foods. East African medical journal. 2001; 78 (11).
- [18] Muinde, O. K., & Kuria, E. Hygienic and sanitary practices of vendors of street foods in Nairobi, Kenya. African Journal of Food Agriculture & Nutritional Development. 2005; 5 (1): 1-14.
- [19] Mwangi A. M. Nutritional, hygienic and socio-economic Dimensions of Street Foods in Urban Areas: The Case of Nairobi. Wageningen University. Dissertation No. 3157. Page: 47- 79. 2002.
- [20] Gotsch, RA., Keck, CW., Spencer, HC. Knowledge, Skills, and Attitudes (KSAs) for the Public Health Preparedness and Response Core Competency Model, CDC, Office of Public Health Preparedness and Response. Association of Schools of Public Health. 2012.
- [21] Getu Derbew, Samuel Sahle, Mengistu Endris. Bacteriological Assessment of Some Street Vended Foods in Gondar, Ethiopia. Internet Journal of Food Safety. 2013; 15: 33-38.
- [22] Tent, H. Research on food safety in 21st century. Food Control. 1999; 10: 239-247.
- [23] Teferi SC. A Review on Food Hygiene Knowledge, Practice and Food Safety in Ethiopia. Scientific Journal of Food Science and Nutrition. 2020; 5 (1): 023-029.
- [24] Gizaw Z, Gebrehiwot M, Teka Z. Food Safety Practice and Associated Factors of Food Handlers Working in Substandard Food Establishments in Gondar Town, Northwest Ethiopia. International Journal of Food Science Nutrition Diet. 2014; 3: 138-146.
- [25] Legesse DE, Tilahun MA, Agedew ES. Food Handling Practices and Associated Factors among Food Handlers in Arba Minch Town Public Food Establishments in Gamo Gofa Zone, Southern Ethiopia. 2017; 7: 302.
- [26] Mihret Getachew. Food safety practice and associated factors among food handlers in selected types of food establishments of dire Dawa, Ethiopia. MPH thesis, Haramaya University. 2016.
- [27] Tessema AG, Gelaye KA, Chercos DH. Factors affecting food handling Practices among Food handlers of Dangila town food and drink establishments, North West Ethiopia. BMC Public Health. 2014; 14: 571. DOI: 10.1186/1471-2458-14-571.
- [28] Abeba M, Getachew M, Alemayehu R. Prevalence and antimicrobial susceptibility pattern of *Salmonella* and *Shigella* among food handlers in catering establishments at Debre Markos University, Northwest Ethiopia. Int. J. Infect. Dis. 2018; 75: 74-79.
- [29] Mulat D, Moges T, Feleke M, Mucheye G. Bacterial profile and antimicrobial susceptibility pattern among food handlers at Gondar University Cafeteria, Northwest Ethiopia. J Infect Dis Ther 2013; 1: 105.
- [30] Andargie G, Kassu A, Moges F, Tiruneh M, Huruy K. Prevalence of bacteria and intestinal parasites among food-handlers in Gondar Town, Northwest Ethiopia. J Health Popul Nutr 2008; 26: 451-5.
- [31] Desta M, Asrat D, Weldeamanuel Y, Nigusie D. Prevalence of intestinal parasites and *Salmonella* and *Shigella* among food handlers at food service establishments in the main campus and Health Sciences College of Hawassa University, Hawassa, Ethiopia. Ethiop J Health Dev 2014; 28 (1): 29-34.
- [32] Mohammedaman M, Getaneh A. Prevalence, antimicrobial susceptibility patterns and associated risk factors of *Shigella* and *Salmonella* among food handlers in Arba Minch University, South Ethiopia. BMC Infect Dis 2016; 16: 686.
- [33] Aklilu A, Kahase D, Dessalegn M, et al. Prevalence of intestinal parasites, *Salmonella* and *Shigella* among apparently health food handlers of Addis Ababa University student's cafeteria, Addis Ababa, Ethiopia. BMC Res Note 2015; 8: 17.
- [34] Abera B, Biadegelgen F, Bezabih B. Prevalence of *Salmonella* Typhi and intestinal parasites among food handlers in Bahir Dar Town, Northwest Ethiopia. Ethiop J Health Dev 2010; 24: 47-50.