

Research Paper

Determinants of sanitation and hygiene status among food and drink establishments in Fiche town, Oromia, Ethiopia

Samuel Chane ^{*}, Israel Sebsibe  and Birhanu Adibaru

Department of Biology, Salale University, P.O. Box. 245, Fiche, Ethiopia

*Corresponding author. E-mail: samuelchane19@gmail.com

 SC, 0000-0002-5805-7857; IS, 0000-0003-3267-8134

ABSTRACT

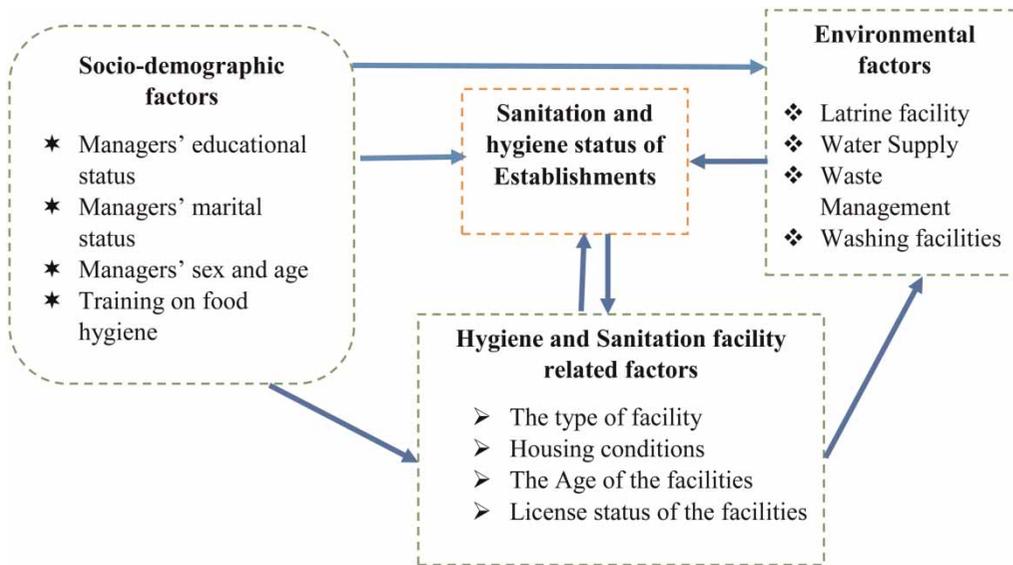
Poor sanitary conditions of food and drink establishments are the major causes for the occurrence of foodborne illness. The aim of this study was to assess the sanitation and hygiene status and its determinants among food and drink establishments in Fiche town. Binary logistic regression was used to identify the predictor variables. A total of 422 catering establishments were assessed. In the present study, 49.8 and 71.8% of the establishments were involved in undesirable practices of disposing liquid and solid waste in open fields, respectively. The present study showed that 11.6 and 15.6% of catering establishments used three-compartment washing facilities for dish and glass, respectively. Presence of trained staff about food hygiene (adjusted odds ratio (AOR) = 4.84, 95% confidence interval (CI) 2.91–8.03), being licensed (AOR = 3.07, 95% CI 1.41–6.67), regulatory inspection (AOR = 2.74, 95% CI 1.60–4.68), and service year of establishments (AOR = 3.02, 95% CI 1.43–6.35) were the determinant factors. The sanitary conditions of catering establishments in the study area were poor. Therefore, concerned regulatory bodies should routinely inspect the food and drink establishments to strengthen the standards of establishments to satisfactory sanitary situations.

Key words: Fiche town, food and drink establishments, foodborne diseases, hygiene and sanitation

HIGHLIGHTS

- The sanitary conditions of catering establishments in the study area were unsatisfactory.
- Majority of establishments did not use hot water for sanitizing dishes and glasses.
- Majority of food and drink establishments had improperly managed latrine facilities.
- Sanitation and hygiene in catering establishments is crucial to prevent foodborne diseases.
- Routine inspection of food and drink establishments is instrumental.

GRAPHICAL ABSTRACT



ABBREVIATIONS

AOR	adjusted odds ratio
CI	confidence interval
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization
SPSS	Statistical Package for Social Sciences
EDHS	Ethiopia Demographic Health Survey

INTRODUCTION

Foodborne diseases are predominant in all parts of the world especially in urban areas and are the main sources for foodborne illness. Foodborne infectious diseases have been estimated to affect 550 million persons and cause 230,000 deaths globally in 2010 (Pal & Ayele 2020). Growing urbanization and lifestyle changes lead people to dine away from home more often, contributing to the unregulated opening of eating establishments which habitually have scarce sanitation environments like unhygienic kitchen areas, poor accessibility and cleanliness of latrine facilities and lack of trainings on food handling (WHO 2002). It is difficult to quantify the burden of foodborne diseases since most of the hazards that cause foodborne diseases are not transmitted exclusively by food (Hald *et al.* 2016). Similarly, according to a report from Center for Disease Control and Prevention every year in the United States alone an estimated 48 million illnesses; 128,000 hospitalizations and 3,000 deaths are attributed to foodborne illness. According to Paola & Allan (2010), 70% of cases of diarrheal disease in developing nations may be attributed to consumptions of contaminated food.

In African region, even if data regarding foodborne diseases are extremely scarce, the following pathogens are prevalent: *Campylobacter*, *Salmonella*, *Shigella*, *Hepatitis*, *Brucella*, *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli* and *Rotavirus* (DeWaal & Robert 2005). Food safety issues in Africa are mostly centered on illnesses that are linked to poor hygiene; however, food hygiene in homes, schools and markets remains an area of concern. Although outbreaks are frequent in the African region, individual countries have done little to implement surveillance systems for foodborne diseases (Mariam *et al.* 2000; Nigusse & Kumie 2012). Due to poor water quality and inadequate sanitation facilities, the Sub-Saharan African countries have a great burden of foodborne and waterborne illness (WHO/UNICEF 2015). Ethiopia Mini Demographic and Health Survey report of 2019 shows that more than one in four households (27%) in Ethiopia have no toilet facility (35% in rural areas and 10% in urban areas) (EDHS 2021). In Ethiopia, as in other developing countries, adequate and

reliable data on foodborne infectious diseases are lacking. The annual incidence of foodborne illnesses in Ethiopia ranged from 3.4 to 9.3%, the median being 5.8% (Wendafrash 2010).

Each food establishment which supplies food for a large number of customers has the responsibility to maintain the safety and wholesomeness of food items. The poor sanitary situations of these food and drink establishments affect the safety of the food and drinks they sell, raise the risk of exposing consumers to foodborne diseases and causing disease outbreaks (Kumie & Zeru 2007; Kibret & Abera 2012; Menedo *et al.* 2017). Due to the increasing consumption of food in food service establishments, such as hotels, restaurants and snack bars the community is facing different health problems like acute watery diarrhea in Addis Ababa (Meleko *et al.* 2015). Fiche town is urbanizing at a fast rate and many people make use of the food and drink services in the town. There is a limited research finding about the determining factors on sanitation and hygiene status of catering establishments in Ethiopia. Moreover, there have been no investigation with similar title in the study area. Therefore, the present study was proposed to assess the determinants of sanitation and hygiene status among food and drink establishments in Fiche town.

METHODS

Description of the study area

Fiche town is the administrative town of North Shewa Zone of Oromia Region and it has four kebeles. It is located about 114 km north of Addis Ababa, the capital city of Ethiopia. Fiche has a latitude of 9 °48'N, longitude 38 °44'E and an altitude of 2,738 m above sea level, respectively.

Study design and source of population

A community-based cross-sectional design was used to assess the sanitation and hygiene status of food and drink establishments and its associated factors. All food and drink establishments in the town were the focus of the study. Such establishments include hotels, cafeterias, restaurants, snack houses, butcher shop and juice houses, all of which serve food and drink to the public.

Sample size determination

The sample size was determined using a single population proportion formula considering the following assumptions: The proportion (P) of 50% with poor sanitary conditions was considered and there was no similar investigation in the town, significance level 5% ($\alpha = 0.05$), $Z_{\alpha/2} = 1.96$, margin of error 5% ($d = 0.05$) and 10% non-response rate.

$$n = \frac{(Z_{\alpha/2})^2 \times P(1 - P)}{d^2} = \frac{(1.96)^2 \times 0.5(1 - 0.5)}{(0.05)^2} = 384$$

Therefore, 422 subjects were taken as a final sample size for this study. List of all establishments in the study area was used as sampling frame and establishments were stratified by the type of service they give in order to make the sampling method more representative. Finally, study participants were selected using the simple random sampling technique.

Data collection procedures

Data were collected using a structured pre-tested questionnaire and observation checklist adopted from related literatures (Menedo *et al.* 2017; Gebremariam *et al.* 2019; Girmay *et al.* 2020). The observation checklist was designed to assess availability, use, cleanliness and maintenance status of sanitary facilities.

Data quality assurance

The questionnaire was first prepared in English, translated to local languages and translated back to English to see for any inconsistency. The quality of data was ensured through training of data collectors and supervisors, close supervision and daily recheck of completed questionnaire. Moreover, a pre-test was performed, correction and modification were undertaken based on the gaps identified during the pre-test.

Data analysis

Consistency and completeness of data were verified during collection, entry and analysis. Data were entered into computer and analyzed using SPSS version 20. Binary logistic regression was used to identify the predictor variables associated with the

outcome variable. Statistical significance test was assured using odds ratio at a cut-off value of 95% confidence interval (CI) and $p < 0.05$.

Operational definition

Hygiene and sanitation status is the dependent variable of this study, which was calculated by taking summation of 16 criteria (Table 1). Each criterion was given a value of 1 for the presence of sanitary facility and 0 for the absence. The sums of these available facilities were calculated and the average score of all criteria was used as a cut-off point to categorize establishments as good or poor (Mendedo *et al.* 2017; Gebremariam *et al.* 2019; Girmay *et al.* 2020). Therefore, food and drink establishments with higher than or equal to the mean value (≥ 11 , $\geq 68.8\%$) were categorized under a good level of sanitation and hygiene status, and those with scores less than the mean value (< 11 , $< 68.8\%$) were considered under a poor level of sanitation and hygiene status.

Ethics approval and consent to participate

The study was carried out after the approval of the research proposal by research and community service directorate of Salale University. Data were collected with the consent of study participants and they were informed about the objective of the study. Informed oral consent was also obtained from each food and drink establishments. The identity of the respondents was protected by code and participants were reassured of the confidentiality of the information they provided.

RESULTS

Socio-demographic characteristics

A total of 422 food and drink establishments were assessed, comprising of 45 (10.7%) hotels, 144 (34.1%) cafes and restaurants, 208 (49.3%) snack houses, 17 (4%) butcheries and 8 (1.9%) juice houses. In the present study, among 422 establishments, 359 (85%) were licensed. Sixty-six (15.6%) of the establishments were involved in more than one type of service. Majority 258 (61.1%) of managers were males and 164 (38.9%) were females. Only 20 (4.7%) of the managers were illiterate. Most of the managers (56.6%) were married (Table 2).

Table 1 | Availability of hygiene and sanitation facilities among catering establishments in Fiche town, Ethiopia

Availability of facilities	Frequency (n)	Percent (%)
Insect or rodent infestations not found	68	16.1
Availability of standard ceramic stand hand-washing facility	60	14.5
Availability of functional refrigerator	57	13.5
Kitchen room floor repair condition	203	51.3
Properly managed latrine facility	67	21.5
Availability of store room for non-perishable foods	210	49.8
Availability of container for solid waste storage	342	81
Use of hot water for washing glasses	24	5.7
Food handlers wearing appropriate hair cover	223	52.8
Separate latrine for male and female	34	8.1
Practicability of proper storage of food utensils	70	16.6
Proper liquid waste disposal	212	50.2
Availability of three compartments for dish washing	49	11.6
Proper drinking water storage materials	67	15.9
Soap near hand-washing facility in food establishments	107	25.3
Availability of separate dressing room for food handlers	72	17.1

Table 2 | Socio-demographic characteristics of managers ($n = 422$)

Characteristics	Category	Frequency (n)	Percent (%)
Age (years)	<30	162	38.4
	30–34	90	21.3
	35–39	129	30.6
	>40	41	9.7
Sex	Female	164	38.9
	Male	258	61.1
Marital status	Single	140	33.2
	Married	239	56.6
	Divorced	43	10.2
Educational status	Illiterate	20	4.7
	1–6	125	29.6
	7–12	179	42.4
	>12	98	23.2
License status	Licensed	359	85
	Not licensed	63	15
Staff trained about food hygiene	Yes	83	19.7
	No	339	80.3

Sanitary and hygienic status of catering establishments

The sanitary status of the food and drink establishments in the study area was observed and sanitation status of the establishments was 119 (28.2%). Of the total establishments assessed, 396 (93.8%) had kitchens. In the present study, most of establishments, 312 (74%), had latrine facilities. Forty (9.5%) had a flush-type latrine facility. 290 (68.7%) of establishments had private water pipes. On-site solid waste storage receptacles were accessible in 342 (81%) of the establishments. However, only 90 (21.3%) of them had proper types of receptacles.

In the present study, 49.8 and 71.8% of the establishments were involved in undesirable practices of disposing liquid and solid waste in open fields, respectively. In our study, the majority, 414 (98.1%) of establishments had lavatory facilities. Two hundred and twenty-two (53.6%) of the establishments had lavatory facilities consisting of buckets, 60 (14.5%) had water troughs made of standard ceramic stands (fixed washbasin). Detergents are available for washing dishes (88.2%) and washing glasses (89.6%), while 10.7 and 5.7% used hot water for sanitizing their dishes and glasses. Among establishments which were assessed and had kitchens, all (100%) had some kind of dishwashing facilities. Forty-nine (11.6%) establishments used three-compartment dishwashing facilities and 218 (51.7%) used two-compartment facilities (see Supplementary Material).

Determinants of sanitation and hygiene status of catering establishments

Logistic regression analyses were conducted to identify the determining factor of sanitary and hygiene status of catering establishments. Regulatory inspection, availability of trained staff on food hygiene, license status and service year of the establishment were significantly associated with the sanitary status of food establishments, with p value <0.05 at 95% CI (Table 3). Food establishments which had license were 3.07 times more likely to be in a good sanitary status than those which were not licensed (adjusted odds ratio (AOR) = 3.07, 95% CI 1.41–6.67). On the other hand, establishments which received at least one inspection in the last 6 months were 2.74 times more likely to be in a good sanitary status compared to their counterparts (AOR = 2.74, 95% CI 1.60–4.68). Establishments with staffs, who gained trainings on food hygiene, were 4.84 times more likely to have a good sanitary status compared to their counterparts (AOR = 4.84, 95% CI 2.91–8.03). The study also showed that establishments with greater than 10 service years were 3.02 times more likely to be in a good sanitary status, as compared to those with less than 1 service year (AOR = 3.02, 95% CI 1.43–6.35).

DISCUSSION

This study indicated that only 28.2% of the food and drink establishments were in a condition of good sanitation and hygiene status. The possible explanation might be lack of solid waste and liquid waste management practices, unimproved latrines, poor sanitation of dining and kitchen rooms and inadequate hand-washing facilities. The finding of the present study is

Table 3 | Determinants of sanitary status among food establishments in Fiche town, Ethiopia

Variables	Sanitary status		Wald	Sig.	AOR (95% CI)
	Good	Poor			
<i>Regulatory inspection</i>					
Yes	99	195	13.65	0.000*	2.74 (1.60–4.68)
No	20	108	1		
<i>Staff trained about food hygiene</i>					
Yes	47	36	37.30	0.000*	4.84 (2.91–8.03)
No	72	267	1		
<i>License status</i>					
Licensed	111	248	8.08	0.004*	3.07 (1.41–6.67)
Not licensed	8	55	1		
<i>Service year of establishments</i>					
< 1 year	45	144	1		
1–5 years	28	102	0.22	0.635	0.87 (0.51–1.50)
6–10 years	29	39	8.41	0.004*	2.37 (1.32–4.27)
> 10 years	17	18	8.52	0.004*	3.02 (1.43–6.35)

*Statistically significant at $p < 0.05$.

higher than a study conducted in Mekelle (17.1%), Bahir Dar (21.3%) and Woldia (16.8%) (Kumie & Zeru 2007; Kibret & Abera 2012; Abate *et al.* 2018). The present finding is lower than a study conducted in Addis Ababa that reported 36.7 and 41.2% (Degaga 2014; Menedo *et al.* 2017). This variation might be due to the difference in the range of development of study areas, study year and socio-economic conditions of researched site. The present study revealed that 15% of food and drink establishments provide services without a license from the regulatory body. The rate of licensed establishments in this study (85%) is higher than previous studies undertaken in Awassa (70.9%), Zeway (49.7%) and Woldia (76.9%), respectively (Mariam *et al.* 2000; Kumie *et al.* 2002; Abate *et al.* 2018). However, this finding is lower than a study in Awash Sebat Kilo (86.4%) and Bahir Dar town (89.5%) (Kumie *et al.* 2006; Kibret & Abera 2012).

Of the total establishments assessed, 396 (93.8%) had kitchens. From the total establishments that had kitchens, 203 (51.3%) had floor conditions that were in a good state of repair. Two hundred and fifty-seven (61%) of dining rooms had floor conditions that were in a good state of repair. A similar finding undertaken in Woldia town showed 51.4% of dining rooms had floor conditions that were in a good state of repair (Abate *et al.* 2018). In the present study, dining (52.4%) and kitchen room ceilings (68.7%) were not found in good conditions. Of the establishments that had latrine facilities, only 21.5% were properly managed. Our finding is comparable to a study done in Woldia town by Abate *et al.* (2018) who reported 26%. But a higher finding was reported in study undertaken in Zeway (75%) and Addis Ababa (71%) (Kumie *et al.* 2002; Menedo *et al.* 2017). The majority of establishments (81%) had solid waste containers in the town. Yet, only 21.3% of these establishments had recommended types of solid waste container. Our finding is lower than a study conducted in Bahir Dar and Addis Ababa that reported 33.6 and 46.8%, respectively (Kibret & Abera 2012; Menedo *et al.* 2017). Inappropriate receptacles will create favorable conditions for insects such as flies to multiply and contaminate food and utensils (Menedo *et al.* 2017). In this study, 49.8 and 71.8% of the establishments were involved in undesirable practices of disposing of liquid and solid waste in open fields, respectively. The present finding is lower than a study conducted in Woldia, in which 63.5% of the study establishments disposed of liquid waste, and 84.6% disposed of solid waste, in open fields (Abate *et al.* 2018). Likewise, available evidence reveal that inadequate sanitary facilities with improper waste management are common features of food and drink establishments in different parts of Ethiopia (Kumie *et al.* 2002; Kibret & Abera 2012; Abate *et al.* 2018).

The use of hot water and some kind of detergent to clean/sterilize food utensils is recommended (Havelaar *et al.* 2013). But, in the present study we found that 10.7 and 5.7% of establishments used hot water for sanitizing dishes and glasses. Our finding is higher than a study conducted in Woldia town that reported 9.1% of establishments used hot water to wash dishes and

4.8% to wash glasses (Abate *et al.* 2018). In contrast to our result, Boro *et al.* (2015) reported that 46.2% of establishments used hot water in the kitchen for washing dishes and drinking cups. This discrepancy might be due to a lack of awareness of food handlers and owners/managers working in those establishments. One of the most widely used and accepted methods of food utensil washing method is the three-compartment sink or washing basin, which can be used to wash, rinse and sanitize food utensils and equipment (WHO 2002; Guzewich 2011). In the present study, 15.6% of establishments had used three compartments for washing drinking glassware which is greater than a study done in Addis Ababa (7.2%) (Menedo *et al.* 2017) and Woldia (1.7%) (Abate *et al.* 2018). However, the present finding is lower than a study done in Zeway (19%) and Mekelle (46%) (Kumie *et al.* 2002; Kumie & Zeru 2007).

In this study, the odds of food establishments which had license were 3.07 times more likely to have a good sanitation and hygiene status than their counterparts (AOR = 3.07, at 95% CI 1.41–6.67). Our finding is in agreement with a study done in Adwa (Gebremariam *et al.* 2019) and Addis Ababa (Girmay *et al.* 2020). In contrast to the present finding, licensing had no significant association with sanitary status in a study done in Bahir Dar town (Kibret & Abera 2012). This discrepancy might be explained by the level of awareness and socio-economic status of the researched sites. Furthermore, the finding of this study revealed that establishments with staffs who gained trainings on food hygiene were 4.84 times more likely to have a good sanitary status compared to who did not take food safety training (AOR = 4.84, at 95% CI 2.91–8.03). A similar finding was reported in a study done in Addis Ababa, Adwa and Addis Ababa, respectively (Meleko *et al.* 2015; Gebremariam *et al.* 2019; Girmay *et al.* 2020). Moreover, different studies showed that knowledge and training of managers and staffs on sanitation and hygiene have a direct relationship on the overall sanitation and hygiene improvement of food establishments (Fawzi *et al.* 2009; Kibret & Abera 2012; Olumakaiye & Bakare 2013; Meleko *et al.* 2015; Pallavi *et al.* 2015). Gaining knowledge through training had a positive effect on ensuring sanitation and hygienic condition of food establishments and food safety practices thereby reducing foodborne illness (Hedberg *et al.* 2006; Teferi *et al.* 2021). But, the present study indicated that a significant number of food handlers had not received training. This emphasizes the need for training to food handlers and managers/owners about food safety and hygiene.

On the other hand, the present finding also showed routine inspection visits by health personnel is significantly associated with sanitary status; establishments which received at least one inspection in the last 6 months were 2.74 times more likely to be in a good sanitary status compared to their counterparts (AOR = 2.74, at 95% CI 1.60–4.68). The present finding is comparable with a study done in different parts of Ethiopia (Kumie & Zeru 2007; Meleko *et al.* 2015; Gebremariam *et al.* 2019). This implies that regular controlling mechanisms of establishments, complemented by health education/awareness by concerned regulatory authorities is vital to maintain catering establishment's safety. The study also showed that establishments with greater than 10 service years were 3.02 times more likely to be in a good sanitary status, as compared to those with less than 1 service year (AOR = 3.02, at 95% CI 1.43–6.35) respectively.

CONCLUSION AND RECOMMENDATIONS

Most of the food and drink establishments in the study area had a poor sanitary status. Regulatory inspection, availability of trained staff on food hygiene, license status and service year of the establishment were significantly associated with the sanitary status of food and drink establishments. A major contributor of poor sanitary conditions includes the following: shortage of standard dish washing compartments, inappropriate management of latrines, poor sanitation of kitchen and dining rooms, inappropriate solid and liquid waste management and poor standard of hand-washing facilities. Therefore, concerned regulatory bodies should routinely inspect the food and drink establishments to strengthen the standards of establishments to satisfactory sanitary situations. Moreover, training about hygiene and sanitation should be given to managers and food handlers.

STRENGTH AND WEAKNESS

The study shows the sanitary conditions at the time of data collection and they may vary with time and situations. The strength of the present study was that it used an observation technique to assess sanitary conditions of the establishments, which will reduce the respondent bias.

ACKNOWLEDGEMENTS

The authors thank Salale University for providing financial assistance to data collectors and supervisors in this study. In addition, the authors express their gratitude to data collectors, supervisors and study participants.

AUTHORS' CONTRIBUTIONS

S.C. and I.S. developed the proposal, analyzed the data and wrote the report and the manuscript. S.C. and B.A. organized the overall process. S.C., I.S. and B.A. contributed in proposal writing, data collection and analysis. All authors read and approved the final manuscript.

CONSENT FOR PUBLICATION

All authors agreed to the publication of this manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

REFERENCES

- Abate, M., Tesfa, M. & Adere, A. 2018 The sanitary conditions of food and drink establishments in Woldia town, Northeastern Ethiopia. *Ethiopian Journal of Health Development* **32** (3), 189–196.
- Boro, P., Soyam, V. C., Anand, T. & Kishore, J. 2015 Physical environment and hygiene status at food service establishments in a tertiary care medical college campus in Delhi: a cross-sectional study. *Asian Journal of Medical Science* **6** (4), 74–79.
- Degaga, E. G. 2014 *Assessment of Sanitary Condition of Food Catering Establishments in Addis Ketema Sub City, Addis Ababa City Administration*. MSc Thesis, Addis Ababa University, Addis Ababa, Ethiopia.
- DeWaal, C. S. & Robert, N. 2005 Global and Local: Food Safety around the World. Center for Science in the Public Interest, Washington DC.
- Ethiopian Public Health Institute (EPHI) [Ethiopia] and ICF 2021 *Ethiopia Mini Demographic and Health Survey 2019: Final Report*. EPHI and ICF, Rockville, Maryland, USA.
- Fawzi, M., Gomaa, N. F. & Bakr, W. M. 2009 Assessment of hand washing facilities, personal hygiene and the bacteriological quality of hand washes in some grocery and dairy shops in Alexandria, Egypt. *Journal of Alex University* **84** (1), 2.
- Gebremariam, B., Asmelash, B. & Tetemke, D. 2019 Determinants of sanitary status among food establishments in urban setup in Adwa town, Tigray, Ethiopia: a cross-sectional study. *BMC Research Notes* **12**, 399.
- Girmay, A. M., Gari, S. R., Alemu, B. M., Evans, M. R. & Gebremariam, A. G. 2020 Determinants of sanitation and hygiene status among food establishments in Addis Ababa, Ethiopia. *Environmental Health Insights* **14**, 1–9.
- Guzewich, J. 2011 *WHO Initiative to Estimate the Global Burden of Foodborne Diseases*.
- Hald, T., Aspinall, W., Devleesschauwer, B., Cooke, R., Corrigan, T., Havelaar, A. H., Gibb, H. J., Torgerson, P. R., Kirk, M. D., Angulo, F. J., Lake, R. J., Speybroeck, N. & Hoffmann, S. 2016 World Health Organization estimates of the relative contributions of food to the burden of disease due to selected foodborne hazards: a structured expert elicitation. *PLoS One* **11** (1), e0145839.
- Havelaar, A. H., Cawthorne, A., Angulo, F., Bellinger, D., Corrigan, T., Cravioto, A., Gibb, H., Hald, T., Ehiri, J., Kirk, M., Lake, R., Praet, N., Speybroeck, N., de Silva, N., Stein, C., Torgerson, P. & Kuchenmüller, T. 2013 WHO initiative to estimate the global burden of foodborne diseases. *The Lancet* **381**, S59.
- Hedberg, C. W., Smith, S. J. A. Y., Kirkland, E., Radke, V., Jones, T. I. M. F. & Selman, C. A. & EHS-NET working group 2006 Systematic environmental evaluations to identify food safety differences between outbreak and no outbreak restaurants. *Journal of Food Protection* **69** (11), 2697–2702.
- Kibret, M. & Abera, B. 2012 The sanitary condition of food service establishments and food safety knowledge and practices of food handlers in Bahir Dar town. *Ethiopian Journal of Health Science* **22** (1), 27–35.
- Kumie, A. & Zeru, K. 2007 Sanitary conditions of food establishments in Mekelle town, Tigray, North Ethiopia. *Ethiopian Journal of Health Development* **21**, 3–11.
- Kumie, A., Genete, K., Worku, H., Kebede, E., Ayele, F. & Mulugeta, H. 2002 The sanitary conditions of public food and drink establishments in the district town of Zeway, Southern Ethiopia. *Ethiopian Journal of Health Development* **16**, 95–104.
- Kumie, A., Mezene, A., Amsalu, A., Tizazu, A. & Bikila, B. 2006 The sanitary condition of food and drink establishment in Awash-Sebat Kilo town, Afar Region, Ethiopia. *Ethiopian Journal of Health Development* **20** (3), 201–203.
- Mariam, S. T., Roma, B., Sorsa, S., Worku, S. & Erosie, L. 2000 Assessment of sanitary and hygienic status of catering establishments of Awassa town. *Ethiopian Journal of Health Development* **14** (1), 91–98.
- Meleko, A., Henok, A., Tefera, W. & Lamaro, T. 2015 Assessment of the sanitary conditions of catering establishments and food safety knowledge and practices of food handlers in Addis Ababa University Students' Cafeteria. *Science Journal of Public Health* **3** (5), 733.
- Mendedo, E. K., Berhane, Y. & Haile, B. T. 2017 Factors associated with sanitary conditions of food and drinking establishments in Addis Ababa, Ethiopia: cross sectional study. *Pan African Medical Journal* **28**, 237–13734.

- Nigusse, D. & Kumie, A. 2012 Food hygiene practice and prevalence of intestinal parasites among food handlers working in Mekelle university student's cafeteria. *Journal of Social Science* **1** (4), 065–071.
- Olumakaiye, M. & Bakare, K. 2013 Training of food providers for improved environmental conditions of food service outlets in urban area Nigeria. *Food Nutrition Science* **4** (7), 99–105.
- Pal, M. & Ayele, Y. 2020 Emerging role of foodborne viruses in public health. *Biomed Research* **5**, 01–04.
- Pallavi, B., Vishal, C. S., Tanu, A. & Jugal, K. 2015 Physical environment and hygiene status at food service establishments in a Tertiary Care Medical College Campus in Delhi: a cross-sectional study. *Asian Journal of Medical Science* **6** (4), 74–79.
- Paola, P. & Allan, O. 2010 Employees' food safety knowledge and practices in foodservice operations serving high risk populations. *Journal of the American Dietetic Association* **120** (10), 1–10.
- Teferi, S. C., Sebsibe, I. & Adibaru, B. 2021 [Food safety practices and associated factors among food handlers of Fiche Town, North Shewa Zone, Ethiopia](#). *Journal of Environmental and Public Health* **2021**, 7, Article ID 6158769.
- Wendafrash, A. 2010 *Food Safety and Codex Activities in Ethiopia*. Foodborne diseases, Addis Ababa, pp. 21–26.
- World Health Organization 2002 *Global Strategy for Food Safety: Safer Food for Better Health*. World Health Organization, Geneva, Switzerland.
- World Health Organization/UNICEF 2015 *Joint Monitoring Programme for Water Supply and Sanitation. Progress on Sanitation and Drinking Water: 2015 Update and MDG Assessment*. World Health Organization, Geneva, Switzerland.

First received 14 August 2021; accepted in revised form 7 May 2022. Available online 19 May 2022