Original article

The sanitary conditions of food and drink establishments in Woldia town, Northeastern Ethiopia

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Abstract

Background: A lack of basic infrastructure and a low level of knowledge of hygiene and sanitary practices in catering establishments provide to outbreaks of food-borne diseases. The aim of this study was to assess the sanitary conditions of food and drink establishments in Woldia town, Northeastern Ethiopia.

Methods: A descriptive cross-sectional study was carried out from January to June 2016. Two hundred and eight food and drink establishments were included through a systematic, simple, random selection method after a list of all the establishments was found from the town Trade and Industry Office. Trained enumerators use structured and pre-tested questionnaires to collect data. Data were analyzed using SPSS (version 20). P <0.05 was considered to indicate statistical association.

Results: Of the 208 food and drink establishments, 69% were involved in more than one type of food and drink service. Forty-eight (23%) of the establishments were not licensed. About 88% of the establishments have access to privately owned water pipes. The majority (81.3%) of the establishments had latrine facilities, and 63.5% and 84.6% disposed of their liquid waste and solid waste into open areas, respectively. Acceptable facilities for clients to wash their hands, and for kitchen staff to wash dishes and glasses, were found in 20.6%, 21.6% and 1.7% of establishments, respectively. The storage of food utensils (OR = 2.04; 95% CI: 1.25-3.12), the storage of ready-to-eat foods (OR = 2.94; 95% CI: 1.06-3.45) and cleanliness of food handlers' gowns (OR = 2.02; 95% CI: 1.11-3.05) were better in establishments that were inspected (at least once in the past 6 months) by concerned bodies, compared to establishments that were not inspected.

Conclusions and recommendations: We found that most of the establishments had low level of sanitary conditions. The main problems were the poor state of repair of kitchen and dining room floors; insufficient solid and liquid waste management; the lack of latrine facilities and poor latrine management; the lack of acceptable types of facilities for clients to wash their hands, and for kitchen staff to wash dishes and glasses. Food establishments that were checked frequently by regulatory authorities had good sanitary practice compared to non-inspected establishments. Regulatory bodies should conduct frequent inspection visits of food and drink establishments to encourage and assure good sanitation practices. [*Ethiop. J. Health Dev.* 2018;32 (3):189-196]

Key words: Food and drink establishments, sanitary conditions, sanitary practice, Woldia town

Introduction

Foodborne disease is a main public health problem in both developed and low-income countries (1-5). The problem is more obvious in low-income countries owing to poor food handling and sanitation practices, insufficient food safety laws, weak supervisory systems, and food handlers' low level of education and knowledge (1, 2). "While the burden of foodborne diseases is a public health concern globally, the WHO African and South-East Asia Regions have the highest incidence and highest death rates, including among children under the age of 5 years" (6). In the WHO African Region, more than 91 million individuals are estimated to fall ill and 137,000 die every year due to food-borne diseases. Diarrheal diseases contribute for 70% of food-borne illness in the region (6).

Food safety is of the utmost health concern and insuring food safety to safeguard public health continues a significant challenge in both low-income and industrialized countries (7, 8). Low level of sanitary conditions of catering establishments and weak hygiene practices of food handlers are the major causes of foodborne illness outbreaks (3, 9). Moreover, a lack of basic infrastructure, and inadequate sanitary practices in food establishments, can lead to foodborne diseases outbreak (9-11).

In urban centers in many countries, eating and drinking in food and drink establishments, like restaurants, hotels, cafeterias and 'snack houses', is common. "These establishments prepare, handle and serve large quantities of food and drink to large groups of people within a short period of time". Hence, unless sanitary and hygienic standards are not seriously implemented, they will expose users to the risk of foodborne infection (12). Poverty is the main reason for the consumption of unsafe food in the African region. In addition to this, other factors, for example, "absence of clean water, weak regulatory activities, the rise of population, and poor environmental conditions intensify the situation" (13). The rise of diarrheal disease occurrence among children is an indicator of the food hygiene condition

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and inappropriate food preparation practices in the region (13).

In Ethiopia, there is no documented data about the magnitude of foodborne disease in association with poor sanitary conditions of catering establishments. However, several previous studies conducted in different towns/cities of Ethiopia revealed that there was the high rate of insanitary situations in food and drink establishments. A few sets of reported data from Addis Ababa (5), Awassa (14), Bahir Dar (9), Mekelle (4), Zeway (12) and Awash-Sebat Kilo (15) show the prevailing poor sanitary situations of catering establishments in these urban centers. Common features of catering establishments in these urban centers include a lack of hygiene, insufficient sanitary facilities, a lack of hand-washing facilities, and inappropriate liquid and solid waste management (4, 5, 9, 12, 14, 15). The poor sanitary situations of these food and drink establishments affect the safety of the food and drinks they sell and raise the risk of exposing consumers to foodborne diseases and causing disease outbreaks (3, 4, 9).

Woldia town, the focus of this study, is urbanizing at a fast rate. It is a stop-over for tourists and the public at large travelling to and from Bahir Dar city, Lalibela, Mekelle and Afar Region. Hence, many people make use of the food, drink and accommodation services in the town. The study aimed to assess the sanitary conditions of those food and drink establishments.

Methods

Study area: A descriptive cross-sectional study was carried out from January to June 2016. Woldia is the capital of North Wollo Zone administration and is located in the northeast of Ethiopia, 358km from the regional capital, Bahir Dar, and 521km from the Ethiopian capital, Addis Ababa. Woldia is located at 11°49' 59.99"N latitude and 39°40' 59.99"E longitude, at 2,112 meters above sea level. According to estimates from 2015, the town has a population of around 72,300. The town has eight administrative kebeles. According to the town Trade and Industry Office, in 2016, there were 408 registered food and drink establishments.

Source population and study units: All food and drink establishments in the town were the focus of the study. Such establishments included hotels, cafeterias, restaurants, snack houses 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 to maximize sample size, significance level 5% (α=0.05), $Z^{\alpha}/_{2}$=1.96, the margin of error 5% (d=0.05), and assuming 5% non-response rate. Therefore, the final sample size was calculated and corrected to 208. Since, as noted above, there were 408 such establishments registered in the town. Such establishments were recorded for each kebele and the sample was proportioned and randomly selected.

Data collection tools and quality issues: A pre-tested, structured questionnaire and observation checklist were used to collect data. Two trained, BSc nurses and a sanitarian with a bachelor's degree in environmental health and experience in sanitary inspection activities were involved in data collection. Data were collected on the physical conditions of the catering establishments; sanitary facilities such as water sources; liquid and solid waste management, lavatory facilities, washing facilities for food utensils, and latrines. The legal permission of the establishments to serve food and drink was checked by observing the approved certificate by legal authority.

The quality of data was assured through pre-testing, translation and back translation of the tool to the local language (Amharic), training of data collectors. Finally, collected data were checked for completeness and cleaned for analysis.

Overall sanitary condition measurements: Owing to the absence of standard grading tools, it is challenging to rate the sanitary situations of establishments as poor or good. However, the study selected a few variables to rate sanitary situations (4, 9): "The selected variables were kitchen and dining room floor repair condition, infestation of flies, latrine availability and cleanliness, the availability of standard hand washing lavatories, food utensils washing facility and type, use of detergent and hot water to wash food utensils, the physical condition of solid waste storage containers, proper solid and liquid waste management, the availability of a private pipe water supply, proper storage of ready-to-eat foods and food utensils" (4).

Data processing and analysis: Data processing and analysis were carried out using frequencies and logistic regressions. The results were presented in tables and texts using descriptive statistics.

Operational definitions: The following operational definitions were used in previous literature and the existing guidelines (12, 16).

Food and drink establishments: establishments engaged in the work of providing food and drink services to virtually large groups of customers in the form of breakfast, lunch, dinner or drinks. These establishments are hotels, restaurants, cafeterias, snack houses and juice houses.

Sanitary inspection: a set of actions/activities performed by regulatory bodies to investigate environmental hazards in catering establishments to safeguard the public health.

Food safety: hygienic measures for ensuring food hygiene and wholesomeness in its production, storage, preparation, distribution and sale, until consumption.

Ethical approval: The study was approved by the research review committee of Woldia University. Permission was also obtained from Woldia town municipality office and town administration health bureau. Written consent was found from the establishment owners. Interviews were granted with the full consent of the establishment owners/managers. The participants were insured that the information they gave, and the observational data, would be kept confidential, and participation in the study entailed no risk to them or the establishment.

Results

Characteristics of establishments: The town Trade and Industry Office survey identified 408 food and drink establishments, of which 51% were included in this study. A total of 208 food and drink establishments were assessed, comprising of 60 (28.8%) hotels, 52 (25%) cafés and restaurants, 49 (23.6%) snack houses, 30 (14.4%) cafeterias and 17 (8.2%) juice houses. Of the total, 160 (76.9%) were licensed. One hundred and forty-four (69.2%) of the establishments were involved in more than one type of service (Table 1).

Table 1: **Food and drink establishments by category and license status in Woldia, January-June 2016**

Characteristics	Frequency	%
Type of establishments		
Hotels	60	28.8
Cafeterias	30	14.4
Cafés and restaurants	52	25.0
Snack houses	49	23.6
Juice houses	17	8.2
License status		
Licensed	160	76.9
Not licensed	48	23.0
Type of services		
Exclusively food	45	22.0
Exclusively drinks	15	7.2
Food and drinks	74	35.6
Food, drinks and bed	40	19.2
Drinks and bed	30	14.4
Other mixed services*	4	1.9
Service year		
<1 year	42	20.2
1-5 years	133	63.9
6-10 years	29	13.9
>10 years	4	1.9

* Three with butchery services and one with a night club

Physical situations of catering establishments: Of the establishments assessed, 194 (93.3%) had kitchens. The kitchen's floor in 98 (50.5%) establishments were made from concrete. However, only 70 (36.1%) had floor conditions that were in a good state of repair. Ninety-six (49.5%) kitchen floors were plain earth and only a few of the floors were covered with plastic. One hundred and twenty-eight (61.5%) dining rooms were constructed with concrete. However, only 107 (51.4%) had floor conditions that were in a good state of repair. Ninety-seven (50%) kitchens and 131 (63%) dining rooms had openable windows to give adequate light (Table 2).

Table 2: **Physical situations of catering establishments in Woldia, January-June 2016**

Characteristics	Frequency	%
Kitchen, n = 194		
Good floor repair condition	70	36.1
Good ceiling and wall repair condition	75	38.7
Clean ceilings and walls	38	19.6
Adequate ventilation	61	31.4
Adequate lighting	97	50.0
Dining room, n = 208		
Good floor repair condition	107	51.4
Good ceiling and wall repair condition	123	59.1
Clean ceilings and walls	87	41.8
Adequate ventilation	106	51.0
Adequate lighting	131	63.0

The physical conditions of establishments were assessed using the results of routine regulatory body's sanitary supervision visits observation checklists. Sanitation of floors, ceilings and walls, as well as the presence of openable windows, and adequate ventilation in those inspected establishments, were found to be in better situations ($p<0.05$), compared to those establishments that were not inspected (at least once in the past 6 months) (Table 3).

Table 3: **The sanitary conditions of kitchens by sanitary supervision status of establishments in Woldia, January-June 2016 (n = 194)**

Conditions	Sanitary inspection		
	Yes	No	OR (95% CI)
Kitchen wall and ceiling			
Clean	20	18	2.019 (1.120-3.641)*
Unclean	81	75	1.00
Kitchen floor			
Clean	15	21	1.636 (1.328-1.944)*
Unclean	79	79	1.00
Kitchen window openable			
Yes	33	28	1.234 (1.008-1.460)*
No	68	65	1.00
Kitchen ventilation			
Adequate	36	25	1.151 (0.928-1.375)*
Inadequate	65	68	1.00

Note: 1.00=constant; *= p<0.05.

Establishment's sanitary facilities: Most of establishments, 169 (81.3%), had latrine facilities (Table 4). However, only 115 (68%) of the establishments' latrines were open for customers during the assessment. Most of the establishments, 158 (93.5%), used vacuum trucks to empty full latrines.

All the establishments use the municipal pipe water source, with 183 (88%) of establishments had private water pipes. Though, only 37 (19.1%) of the establishments' kitchen had access to washbasins for dish, glassware and hand washing, and only 19 (9.1%) and 10 (4.8%) had used hot water for washing dishes and glassware, respectively (Table 5). On-site solid waste storage receptacles were accessible in 200 (96.2%) establishments. However, only 13 (6.3%) of them had proper types of receptacles. The majority of establishments, 132 (63.5%) disposed of their waste water into open space (Table 4).

Table 4: **Water source and sanitation conditions of catering establishments in Woldia, January-June 2016**

Characteristics	Frequency	%
Water source, n = 208		
Pipe (private)	183	88.0
Pipe (shared)	10	4.8
Pipe from neighbors	15	7.2
Latrine facility, n = 208		
Flush type	45	21.6
Dry pit latrine	124	59.6
Not available	39	18.8
Latrine condition, n = 169		
Properly managed	44	26.0
Improperly managed	125	74.0
Liquid waste final disposal, n = 208		
Open area dumping	132	63.5
To septic tank	69	33.2
To municipal storm water drainage	7	3.4
Solid waste storage receptacle, n = 208		
Proper receptacle available	13	6.3
Improperly stored	187	89.9
Not available	8	3.8
Solid waste collection and disposal, n = 208		
Municipal container	17	8.2
On-site burning	2	1.0
Privately owned carts	13	6.3
Others (e.g. open field dumping)	176	84.6

The majority, 204 (98.1%) establishments had lavatory facilities. However, only 20.6% of lavatory facilities were acceptable. One hundred sixty-six (81.4%) of the establishments had lavatory facilities consisted of buckets, 30 (14.7%) had water troughs made of concrete and fixed with running tap water. Detergents such as soaps were accessible in 126 (61.8%) lavatory facilities during assessment. Among these establishments which were assessed and have kitchens, all (100%) had some kind of dishwashing facilities. However, only 21.6% had acceptable types of dishwashing facilities. Of the total, 174 (83.7%) used bowls and/or buckets for dishwashing, and 34 (16.3%) used conventional fixed types with water taps. Forty-five (21.6%) establishments used three-compartment dishwashing facilities, and 132 (63.5%) used two-compartment facilities. The majority of establishments, 196 (94.2%), were found to use some kind of detergent for dishwashing, while 19 (9.1%) used hot water for sanitizing their dishes (Table 5).

Table 5: **Washing facilities of catering establishments in Woldia, January-June 2016**

Characteristics	Frequency	%
Lavatory facilities, n = 208		
Yes	204	98.1
No	4	1.9
Hand-washing facilities, n = 204		
Fixed washbasin (standard ceramic stands)	30	14.7
Fixed water trough	12	5.9
Manual/bucket	166	81.4
Dishwashing facilities, n = 208		
One compartment	31	14.9
Two compartments	132	63.5
Three compartments	45	21.6
Use of detergent for washing dishes		
Yes	196	94.2
No	12	5.8
Use of hot water for washing dishes		
Yes	19	9.1
No	189	90.9
Glass-washing facilities, n = 177*		
One compartment	31	17.5
Two compartments	143	80.8
Three compartments	3	1.7
Use of detergent for washing glasses, n = 208		
Yes	191	91.8
No	17	8.2
Use of hot water for washing glasses, n = 208		
Yes	10	4.8
No	198	95.2

* Establishments with no glass-washing compartments were not included

One hundred and seventy-seven (85.1%) of the establishments had washing facilities for drinking glassware. However, only 26 (14.7%) of those establishments were equipped with fixed-type water taps for washing drinking cups. One hundred and forty-three (80.8%) of the establishments used two compartments for washing drinking glassware, while only three (1.7%) had washing facilities with three compartments (Table 5).

Overall sanitary conditions: Owing to the absence of standard grading tools, it is challenging to rate the sanitary situations of establishments as poor or good. However, the study uses a few determinants to rate sanitary situations (4, 9): "Availability of acceptable types of client's hand washing lavatories, the availability of a private pipe water supply, kitchen and dining room floor repair condition, infestation of flies, latrine availability and cleanliness, physical conditions of solid waste storage containers and proper solid and liquid waste management, food utensils washing facility and type, use of detergent and hot water to wash food utensils, proper storage of ready-to-eat foods and food utensils were variables selected for characterization of food and drink establishments as good and poor. The presence of these factors as per hygienic provisions was rated as acceptable." (4).

Only 35 (16.8%) of the assessed catering establishments had good sanitary situations. We tested the correlation between these determinants and the sanitary inspection status of establishments. Proper storage of food utensils was observed in 107 (55.2%) of the kitchens during the assessment. The sanitary inspection of catering establishments by regulatory bodies had a positive impact on the sanitary situations of the establishments. It was found that those establishments that had been supervised by regulatory bodies (at least once in the past six months) were more likely to fulfill the requirements of acceptable hygienic and sanitary practices. Accordingly, the storage of food utensils (OR = 2.04; 95% CI: 1.25-3.12), the storage of ready-to-eat foods (OR = 2.94; 95% CI: 1.06-3.45), and cleanliness of food handlers' gowns (OR = 2.02; 95% CI: 1.11-3.05) were found to be in better condition in food and drink establishments ($p<0.05$) that had been inspected, as compared to establishments that had not been inspected (Table 6).

Table 6: **Food handlers' sanitary practices by sanitary supervision status of establishments in Woldia, January-June 2016**

Characteristics	Sanitary supervision		
	Yes	No	OR (95% CI)
Storage of food utensils			
Proper	92	15	2.04 (1.25-3.12)*
Improper	61	40	1.00
Storage of ready-to-eat foods			
Proper	120	40	2.94 (1.06-3.45)*
Improper	24	24	1.00
Food handlers wear gowns			
Yes	95	26	1.43 (1.01-2.21)
No	56	31	1.00
Food handlers' gowns			
Clean	60	18	2.02 (1.11-3.05)*
Not clean	26	17	1.00
Do food handler's finger nails cut short?			
Yes	61	22	1.01 (0.50-2.02)
No	75	50	1.00

Note: 1.00=reference; *=p<0.05.

Discussion

The present study revealed that 23% of food and drink establishments provide services without any valid permit from the regulatory body. The rate of licensed establishments in this study (77%) was higher than previous studies undertaken in Zeway (49.7%) (12), Awassa (70.9%) (14) and Addis Ababa (69.4%) (17). The high rate of licensed establishments in our study area might be due to the integrated endeavor of concerned regulatory authorities and strict rules and regulations of the Trade and Industry Office to encourage establishments to work with legal permission. However, this finding was less than that of studies undertaken in Bahir Dar (89.5%) (9), Awash-Sebat Kilo (86.4%) (15). With the high rate of licensed establishments in Woldia, authors have expected that most of these establishments have satisfactory sanitary conditions. However, the overall good sanitary situations of catering establishments in Woldia was 16.8%, and it was insufficient compared to similar studies conducted in Bahir Dar (21.3%) (9), Addis Ababa (36.7%) (5), and Addis Ababa (41.2%) (3). Nevertheless, the present result was in line with the finding of the study conducted in Mekelle town (17.1%) (4). Though the present study did not assess the correlation of high rates of licenses and overall sanitary conditions of establishments, a previous study had revealed that licensed food establishments had good sanitary conditions as compared with non-licensed one (9).

In our findings, the storage of food utensils (OR = 2.04; 95% CI: 1.25-3.12), the storage of ready-to-eat foods (OR = 2.94; 95% CI: 1.06-3.45) and the cleanliness of food handlers' gowns (OR = 2.02; 95% CI: 1.11-3.05) were found to be better in those establishments that had at lease one sanitary supervision visit by regulatory bodies within the past six months, compared to establishments that were not inspected (p<0.05). This result is echoed by Mendedo *et al.,* who report that "establishments which received at least one inspection visit in the past six months were 4.4 times more likely to be in good sanitary condition compared to those were not visited within the specified period" (AOR = 4.4, at 95% CI: 2.9-6.8) (3). In agreement to this, a study conducted in Mekelle revealed that good sanitary conditions are significantly correlated with sanitary supervisions by concerned authorities (AOR = 2.13 at 95% CI: 1.20-3.80) (4). This implies that regular sanitary supervision visits of catering establishments supported by education can improve and sustain sanitary situations of establishments (3, 4).

Public health safety necessitates catering establishments to achieve basic sanitation provisions. However, in the study area, we observed that these provisions were insufficient, such as a lack of acceptable types of hand-washing facilities, the lack of latrines, improper latrine management, and improper liquid and solid waste management. The situation in Woldia town is poor compared to Bahir Dar (9), Awassa (14) and Addis Ababa (3, 5). In the present study, the majority of the establishments (96.2%) had solid waste containers. Nevertheless, only 6.3% of these establishments had recommended types of solid waste container. This proportion was less than in similar studies conducted in Bahir Dar, in which (33.6%) of establishments had appropriate solid waste collection and storage container (9), and in Addis Ababa (46.8%) (3). The solid waste containers could be made from durable material and kept in a safe manner. Since, improper solid waste container will result in infestation of insects (3). In the present study, 63.5% and 84.6% of the establishments engage in the undesirable practices of disposing of liquid waste and solid waste in open fields, respectively. These proportions are higher than those in a similar study conducted in Awassa, in which 27.9% of the study establishments dispose of liquid waste, and 57.3% dispose of solid waste, in open fields (14). In line with our results, Fisseha *et al.,* report that there are inadequate sanitary facilities, and an improper liquid and solid waste storage and disposal in Addis Ababa (17). Two different studies undertaken in Ethiopia reveal that common features of catering establishments are inadequate sanitary facilities and improper waste management (9, 12).

In our study, the majority of establishments (81.2%) had latrine facilities. This finding is in agreement with the results of a study done in Addis Ababa (84.6%) (5), and less than the results of similar studies carried out in Mekelle (97%) (4) and Bahir Dar (93.2%) (9), and in a further study conducted in Addis Ababa (92.2%) (3). On the other hand, of the establishments that had latrine facilities, only 26% were properly managed. This result was lower than other similar studies undertaken in Addis Ababa, in which 71% of establishments had appropriately managed toilet facilities (3), and Zeway (75%) (12). Even though, the accessibility of toilet facility does not insure satisfactory sanitary situations of establishments, improper managed toilet facilities would create suitable conditions for insects to multiply, and this resulting in food and utensil contamination (3, 4).

Using non-tap water for cleaning and processing of food in establishments (and households) can intensify food contamination and increase illness among consumers (18-20). Although the use of hot water and some kind of detergent to clean/sterilize food utensils is recommended, in the present study we found that less than 10% of establishments use hot water for washing dishes and drinking cups/glasses. This might be due to a lack of knowledge/awareness on the part of establishment managers/owners and food handlers. In contrast to this result, Boro *et al.*, in Delhi, India, report that 46.2% of establishments used hot water in the kitchen for washing dishes and drinking cups (21).

The present study shows that only 1.7% of establishments had used three-compartment for washing drinking glassware. This proportion is less than the other results of similar studies done in Mekelle (46%) (4), Zeway (19%) (12) and Addis Ababa (7.2%) (3). The use of three-compartment washing facilities for washing drinking glassware, dishes, and other food utensils is recommended sanitary practice to insure cleanses/sanitize of utensils and to avoid disease transmission (3, 22, 23).

Poor sanitary circumstances in food and drink establishments are also consistent with physical situations of the kitchen (3-5, 21). In the present study, 93% of the establishments had kitchens. However, less than 50% of the kitchens had a good floor, wall, ceiling, and adequate ventilation. Of these, only 31.4% of kitchens had openable windows. The presence of soot on walls and ceilings, disease vectors (especially cockroaches), and uncovered food items, are important sanitary faults that can contaminate food at its point of departure for consumption by customers (16).

This study has the following strengths and weaknesses: we used a pre-tested structured questionnaire and observation checklist for detailed assessments of the sanitary status of the establishments. Additionally, performing observations to assess the sanitary situations of the establishments would have reduced the likelihood of respondent bias. Furthermore, the sanitary conditions of the establishments were inspected, and their sanitary status was rated with the help of the sanitarian. However, owing to it cross-sectional study nature, this result shows only the sanitary conditions of establishments at the time of the assessment, which will vary with time and circumstances.

Conclusions and recommendations:

The study concludes that the establishments in the study area have inadequate sanitation. Merely, the study identified the following main sanitary problems: poor state of repair of the kitchen and dining room floors; lack of latrine facilities in a few establishments and improper management of latrines; inappropriate solid and liquid waste management; a poor standard of hand-washing facilities in the majority of establishments; inadequate use of hot water for cleaning food utensils; and improper storage of food utensils.

The authors recommend that concerned bodies should routinely inspect the food and drink establishments to strengthen the obedience of establishments to satisfactory sanitary situations. Inspection visits by a concerned body can promote and ensure proper sanitation facilities and practices, such as proper latrines, solid and liquid waste management, appropriate storage of food utensils, use of hot water for proper cleaning/sterilizing of food utensils. We also recommend further study using qualitative and quantitative study approach to investigate the main determinants of the inadequate sanitary conditions of food and drink establishments in Woldia town, and to assess the levels of knowledge, hygiene and sanitary practices of food handlers.

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Author's contributions

MA carried out the conception of the research idea, took the lead in protocol development, managed the project, and was involved in data analysis and manuscript preparation for publication. MT participated in protocol development, data collection, data analysis, report writing and manuscript review. AA was involved in protocol development, data analysis, report writing and manuscript review. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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