



Research Article

Assessment of sanitary status of food and drinks catering establishments: A descriptive observational study in south East Asmara, Eritrea, 2019

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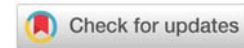
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Abstract

Objective: Lack of basic infrastructure, poor practices of hygiene in food service establishments can contribute to outbreaks of foodborne illnesses. The aims of this study was to explore the sanitary conditions of food and drink catering establishment services in South East Asmara, Eritrea.

Methods: A descriptive observational study was conducted among 139 food and drinks catering establishments in South East Asmara from June to September 2019. Data were collected using semi-structured questionnaire for obtaining socio-demographic information of the manager or owner and observation checklist was used to assess the overall physical sanitary status of the establishment. Factors influencing vermin infestation, kitchen and latrine cleanliness were further investigated. Data analysis was done using SPSS version 22. The descriptive results were summarized using frequencies and percentages in tables and graphs. Dining premises, kitchens and stores were categorized as clean, if the floor, wall, and ceiling of the premises were found clean. Moreover, bivariate and multivariate logistic regression analysis were done to find out the main factors influencing vermin infestation, kitchen and latrine cleanliness.

Results: Out of the total 139 food and drink catering establishments assessed, about one-tenth (8.6%) of the establishments' dining room, a third (33.3%) of the stores and 31.5% of the kitchens were in a poor and unclean sanitary conditions. Good premise floor status (AOR=18.03; 95%CI (2.09-155.1), P<0.05), availability of adequate light (AOR=5.02; 95%CI (1.01, 24.99), P<0.05), running water (AOR=0.26; 95%CI (0.09, 0.72), P<0.05) and dustbin availability (AOR=4.32; 95%CI (1.06, 21.6), P<0.05) were found having significant association with overall cleanliness of the kitchen. Two-third (65%) of the establishments' latrines were clean. Availability of separate latrine for male and female (AOR=2.34; 95%CI (1.06, 5.18), P<0.05), and separate latrine for clients and workers (AOR=3.41; 95%CI (1.10, 10.57) were the main factors potentiating latrine cleanliness. More than a third (37.4%) of the establishments were found to be infested by vermin. Nearer kitchen distance from latrine (AOR=3.65; 95%CI (1.60, 8.35), p<0.05), presence of pets (AOR=4.1; 95%CI (1.17, 14.40), and breeding of insects in the liquid waste disposal (AOR=4.08; 95%CI (3.37, 12.17), p<0.01) had significantly increased the presence of vermin infestation.

Conclusion: The sanitary condition of the food and drinks catering establishments in the study area was found to be poor. There is a need to impose regulations and guidelines governing the basic sanitary requirement of the food and drinks catering establishments.

Abbreviations

ACHS: Asmara College of Health Sciences; AOR: Adjusted Odds Ratio; COR: Crude Odds Ratio; SEA: South East Asmara; FAO: Food and Agriculture Organization; SPSS: Statistical Package Social Science; USA: United States of America; WHO: World Health Organization

Background

Annually, food borne diseases affects up to 30% of the populations in developed countries and kills millions in developing countries [1]. Food borne diseases are common in developing countries due to the prevailing poor food handling and sanitation practices, inadequate food safety laws, weak regulatory systems, lack of financial resources to invest safer equipment, and lack of education for food handlers [2]. It is depicted that around 70% of diarrhea cases in developing countries were attributed to food-borne routes. On the top of its morbidity and mortality, worldwide financial expenses of foodborne diseases is hard to be determined [3]. Due to the increments in the cases of food borne outbreaks, food safety has increasingly gaining attention of authorities worldwide [4]. Occurrence of food borne illnesses can be attributed to many socio-demographic and environmental factors, handling process of food preparation being the main factor [5]. Good hygiene practices include proper storage of food items, maintenance of clean environment during food preparation, and assurance of clean and free of bacteria dishes served [6]. Food safety is defined as the assurance that, when food is consumed in the usual manner does not cause harm to human health and wellbeing [7]. Poor food and drink catering establishments, and irresponsible food handlers are considered as sources of food borne illnesses [8]. Lack of basic infrastructure, poor knowledge about hygiene, absence of potable water, lack of proper storage facility and unsuitable environments for food operations (such as proximity to sewers and garbage dumps) and inadequate facilities for garbage disposal are considered factors compromising food safety [9]. Moreover, poor sanitary practices in food storage, handling, and preparation can create an environment in which bacteria and other infectious agents are more easily transmitted [10-12]. Poor personal hygiene could also contribute to foodborne illness, indicating that food handlers' knowledge and their handling practices is quite important [13]. It is suggested that improper food handling practices contribute to about 97% of food borne illnesses in food services establishments and homes [14]. Therefore, to reduce foodborne illnesses, it is crucial to explore the sanitary and hygienic conditions of food providing services [15]. Ensuring safe food service has been one of the major challenges and concerns for producers, consumers and public health officials [16]. In Eritrea, even though there is no published data available about food safety, it is assumed that every year many people suffer and even die to the intake of contaminated food and water. Based on the records of the ministry of tourism, the total number of customers utilizing food and drink establishments in South East Asmara (SEA) per day was 11,260 [17]. This suggests that the health and wellbeing of such a big number of people subsequently depends on the sanitary status of the catering establishments. The aim of

this study was therefore to obtain current information on the sanitary conditions of food and drinks catering establishment services in South East Asmara (SEA).

Methods

Study design and setting

Descriptive observational study design was used to assess the sanitary conditions of food and drink catering establishment services in South East Asmara from June to September 2019.

Study population

The study and source population were all food and drink catering establishments situated in South East Asmara. Establishments which had full-filled the selection criteria were included in the study.

Selection criteria

The included subjects were all type of establishments licensed and registered by the ministry of tourism to provide both food and drink services. Whereas establishments not registered and licensed by the Ministry of Tourism, that serve only bottled drinks, like bars, and whose owners or managers were not willing to be participants in the study were excluded.

Sample size estimation

The sample size was determined using a single population proportion by assuming that 50% proportion of the food and drink establishments practiced safe and clean procedures with 95% confidence interval and 5% margin of error. Using population correction formula and adding non-response rate the sample size was 139 establishments.

Sampling design

The research was done using a stratified random proportionate to size method. The total list of all food and drink establishment services which are found in SEA was obtained from Ministry of Tourism; the establishments were then stratified in to five strata based on the type of service they provided. The five type of establishments were: restaurants, hotels, juice/coffee shops, snack bars and fast food places. Sampling frame was prepared for each stratum. Then the sample was distributed to each stratum proportional to its size.

Finally, simple random sampling was used to select individual sample (Figure 1).

Data collection instrument

A Semi structured questionnaire was used to interview the manager/owner for obtaining socio-demographic information. This was pretested to ensure its consistency, validity and reliability. Observation checklist adopted from extensive literature review and from checklists used by Ministry of Tourism and Ministry of Health was used to assess and/or observe the overall physical sanitary status of the establishment. Observation checklist focused on assessing food premise's physical condition, handling cleanliness and

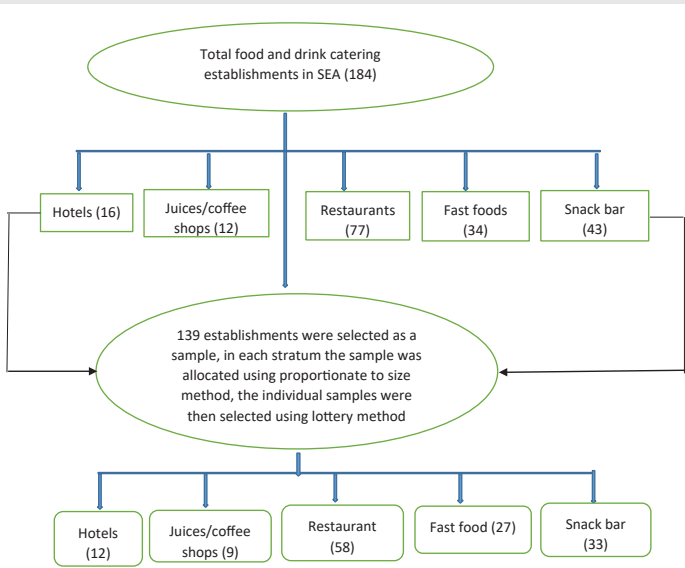


Figure 1: Sample Recruitment Procedures.

arrangement of utensils and provision of sanitary facilities including lavatory, waste handling and disposal facilities and the hygienic practices of food handlers. Factors influencing vermin infestation, kitchen and latrine cleanliness were further investigated.

Data analysis procedure

Data entry was done using CSpro version 6.3, then the data was exported to statistical package for social sciences (SPSS) version 22 for analysis. Socio-demographic information of the managers, environmental factors and physical sanitary status of the food premises, repair conditions and cleanliness of dining rooms, store and kitchen premises, sanitary and lavatory facilities of the establishments, vermin infestation and provision of latrine and final solid waste disposal were described using descriptive statistics. Dining premises, kitchens and stores were categorized as clean, if the floor, wall, and ceiling of the premises were found clean. Binary logistic regression analysis was done to find out the main factors influencing vermin infestation, kitchen and latrine cleanliness. The results are presented in the form of tables and graphs. Adjusted odds ratio (AOR) and crude odds ratio (COR) are reported to show the strength of association and p value ≤ 0.05 was considered as statistically significant.

Ethical consideration

The proposal was approved by the “Ethical and Scientific Committee” of the School of Public health, Asmara College of Health Sciences (ACHS). A formal letter was then written from the head of School of Public Health ACHS to Ministry of Tourism. Clear communications was done with Ministry of Tourism on the objectives and significance of the study, and then the Ministry gave Permission letter to collect data from the selected catering establishments. Confidentiality of the respondents was assured by excluding their name and had the full right to reject or withdrawal participation at any time from the study.

Results

Socio demographic information of the managers

A total 139 managers were interviewed and 139 food and drink establishments were observed. Majority of the managers were males (69.1%), married (74.8%), younger age (38.8%), and have reached secondary school (48.9%). Though nearly half (47%) of the managers were owners, about 72% have never been trained about food hygiene. Yet, more than half of the managers (52.5%) work as food handlers (Table 1).

Environmental factors and physical sanitary status of the food premises

Out of the total 139 establishments, the highest number of establishments type were restaurants (41.7%), followed by snack bars (23.7%), fast food places (19.4%), hotels (8.6%), and Coffee/Juice shops (6.5%). There was separate rooms for each food premises in majority of the establishments (80.6%), whereas the rest 19.4% didn't have separate kitchen or store for raw food. Majority of the establishments were newly constructed (89.9%), individually owned (87.1%), and had the requirements for hiring food handler (92%). However, only half of the establishments (49.7%) have never been inspected for sanitary conditions (Table 2).

Repair conditions and cleanliness of dining rooms, store and kitchen premises

Among the assessed food and drink establishments, almost all (95%) of the dining room floors were constructed of tiles. The

Table 1: Socio demographic information of the managers, Asmara, Eritrea, 2019 (N=139).

Characteristics		Frequency (n)	Percentage (%)
Sex	Male	96	69.1
	Female	43	30.9
Age	20- 35	54	38.8
	36 - 50	51	36.7
	51 - 65	20	14.4
	66 - 82	14	10.1
Marital status	Single	26	18.7
	Married	104	74.8
	Divorced	8	5.8
	Widowed	1	0.7
Educational level of manager	Illiterate	2	1.4
	Primary*	6	4.3
	Secondary**	68	48.9
Manager position status	College level***	63	45.3
	Owner	62	44.6
	Hired Person	45	32.4
Manager trained about food hygiene?	Delegate	32	23
	Yes	39	28.1
	No	100	71.9
Manager works as a food handler	Yes	73	52.5
	No	66	47.5
The manager as a food handler (n=73)	Cooker only	7	9.59
	Waiter only	9	12.33
	Store man only	6	8.22
	More than one	51	69.86

*Grade 1-5, ** Grade 6-12, *** Grade 12 and above



Table 2: Environmental factors and physical sanitary status of the food premises associated with the establishment N=139.

Characteristics	Frequency (n)	Percentage (%)
Establishment ownership		
Individual	121	87.1
Organization	6	4.3
Association	12	8.6
Building Ownership Private owned		
Private-Rented	37	26.6
Government-owned	34	24.5
New construction (in 5 years)		
Yes	125	89.9
No	14	10.1
Type of establishment Restaurants		
Hotels	12	8.6
Juices/coffee place	9	6.5
Fast food places	27	19.4
Snack bars	33	23.7
Separate room for each food premises		
Yes	112	80.6
No	27	19.4
Sanitary inspection per year		
6 times	4	2.87
4 times	15	10.8
2 times	31	22.3
Only 1 time	20	14.38
Not at all	69	49.65
Action taken after inspection(n=70)		
Warning	24	34.3
Closure	4	5.7
Monetary penalty	14	20
Nothing	28	40
Any requirements for hiring food handler		
Yes	128	92
No	11	8
Requirement for hiring (n=128)		
Certification	15	11.7
Experience	103	80.5
Both	10	7.8

dining room floors (84.2%), walls (95%) and ceilings (94.2%) of the establishments were kept properly clean. Moreover, almost all (98.6%) and 92.1% of the establishments' dining room had adequate lightning and ventilation respectively. However more than half (55.4%) of the establishments had no notice of no smoking and about 47% had lack of dustbin. Among 108 establishments which had separate room for store, the store floor was constructed of tiles in about 83% of the establishments. The store's floor, ceilings and wall were found clean in only 45.4%, 48.1% and 43.5% of the establishments respectively. The stores had adequate ventilation in more than half (54.6%) of the establishments and only 43% had adequate

lighting. However, dustbin was not available in most (96.3%) of the establishments store and all the establishments' store had not notice of no smoking. Considering the kitchen premises, 53% of the establishments' kitchen floor, 54.7% of the wall and 54.7% ceiling were properly cleaned. With regard to the ventilation and lighting of the kitchens, in 45.3% of the establishment's there was adequate ventilation and in 88.5% of the establishment's the kitchen had adequate lighting. However, management of solid wastes was poorly addressed with more than half (54%) of the premises had no covered dustbin available. Dining premises, kitchen and store were categorized as clean, if the floor, wall, and ceiling of the premises are clean. Based on the assumption, 91% of the establishments' dining room, 66.7% of the stores and 68.5% of the kitchens were clean (Table 3).

Table 3: Physical sanitary status of the dining room (N=139) and store premises (N=108), Asmara, Eritrea, 2019.

Characteristics	Dining room (n=139) N (%)	Store (n=108) N (%)	Kitchen (n=108) N (%)
Premise floor constructed of			
Tile	132 (95)	90 (83.3)	128 (92.1)
Concrete	1 (0.7)	13 (12)	9 (6.5)
Plastered stone	5 (3.6)	1 (0.9)	1 (0.7)
Wood	1 (0.7)	4 (3.7)	1 (0.7)
Premise Floor cleanliness			
Clean	117 (84.2)	49 (45.4)	74 (53.2)
Moderately clean	17 (12.2)	43 (39.8)	45 (32.4)
Dirty	5 (3.6)	16 (14.8)	20 (14.4)
Premise wall cleanliness			
Clean	132 (95)	47 (43.5)	76 (54.7)
Moderately clean	6 (4.3)	50 (46.3)	38 (27.3)
Dirty	1 (0.7)	11 (10.2)	25 (18)
Premise ceiling cleanliness			
Clean	131 (94.2)	52 (48.1)	76 (54.7)
Moderately clean	7 (5)	43 (39.8)	37 (26.6)
Dirty	1 (0.7)	13 (12)	26 (18.7)
Adequate light			
Yes	137 (98.6)	71 (65.7)	123 (88.5)
No	2 (1.4)	37 (34.3)	16 (11.5)
Adequate ventilation			
Yes	128 (92.1)	59 (54.6)	63 (45.3)
No	11 (7.9)	49 (45.4)	76 (54.7)
Notice of no smoking			
Yes	62 (44.6)	0(0)	0(0)
No	77 (55.4)	108 (100)	139 (100)
Dustbin in the premise			
Yes	65 (46.8)	4 (3.7)	64 (46)
No	74(53.2)	104 (96.3)	75 (54)
Overall cleanliness			
Clean	127 (91.4)	93 (66.7)	95 (68.5)
Unclean	12 (8.6)	46 (33.3)	44 (31.5)



Factors influencing kitchen cleanliness

Good premise floor status, availability of adequate light, running water and dustbin availability were found having significant association with overall cleanliness of the kitchen. A kitchens whose floor was in a good repair condition (well fit and easily to be cleaned) were 18 times more likely to be clean compared to a kitchen whose floor was in a poor repair condition (cracked or detached) (AOR=18.03; 95%CI (2.09–155.1), $P<0.05$). Kitchens which had adequate light were found 5 times more likely to be clean (AOR=5.02; 95%CI (1.01, 24.99), $P<0.05$). Those kitchens which lacked running water were 74% less likely to be clean when compared to those kitchens where running water was available at the time of observation (AOR=0.26; 95%CI (0.09, 0.72), $P<0.05$). Kitchens which were provided with dustbin were 4.3 times more likely to be clean compared to the counterpart (AOR=4.32; 95%CI (1.06, 21.6), $P<0.05$). Despite the fact that wall and ceiling repair conditions and the availability of adequate ventilation were found to have significant association with overall cleanliness of the kitchen at the bivariate level, these factors were no more significant after adjusting the confounding effect (Table 4).

Kitchen cleanliness by type of establishments

The highest proportion of unclean kitchen was hold by snack bars, in which 69.7% of the total participated snack bars had unclean kitchen, followed by Coffee/Juice shop (55.6%) and restaurants (50%). The lowest proportion of unclean kitchen was observed in hotels in which only 16.7% of the total participated hotels had unclean kitchen (Table 5).

Sanitary and lavatory facilities of the establishments

Out of the total establishments, about 70% have lacked running water during inspection, and there was discontinuation of water supply in majority (95%) of the establishments i.e. in 88.7% of them, piped water had been discontinued for more than three months.

Only 20.9% of the establishments were observed to use the conventional three compartments dish washing facility. Additionally, in 23(16.5%) of the establishments there was no distance separating the dish/cup washing place from the latrine that is, they were adjacent to each other. Moreover, only about a third, 41(29.5%), of the establishments placed their sanitized utensils appropriately (dried, closed, and separated), and majority of the establishments (92.1%) were not observed to use hot water while washing dishes (Table 6).

Provision of latrine and final solid waste disposal

About two-third (66.2%) of the establishments had separate latrines for male and female. Urinal was also available in 54% of the establishments and more than half of the establishments (54.2%) had detergent for hand washing. However, dish washing facility and the latrine were built attached in 16.5% of the establishments. In addition 10 % of the establishments had a closed toilet during the observation time and more than onethird (34.5%) of the opened toilets were not clean (Table 7).

Latrine cleanliness

Two-third (65%) of the establishments' latrines were clean, whereas the remaining 35% were unclean (Figure 2).

Factors facilitating latrine cleanliness

A multivariate analysis showed that establishments which had separate latrine for male and female were about 2 times more likely to be clean than those which hadn't (AOR=2.34; 95%CI (1.06, 5.18), $P<0.05$). Likewise, establishments which had separate latrine for clients and workers were about 3 times more likely to be clean as compared to those who had common latrine for clients and workers (AOR=3.41; 95%CI (1.10, 10.57), $P<0.05$). Though significance was not attained at the multivariate level, univariate analysis showed that latrines where running water available during observation were more likely to be clean when compared to those latrines where no running water was available during the time of observation (Table 8).

Infestation of vermin

As indicated in Figure 2, more than one-third (37.4%) of the establishments were found to be infested by vermin. The infesting vermin were either flies (55.8%), cockroaches (26.9%) rats (3.8%) and/or by more than one of the vermin (13.5%).

Table 4: Cleanliness of kitchen in relation to physical status of the kitchen premise, dustbin availability, and availability of adequate light, ventilation and running water availability, Asmara, Eritrea, 2019 (N=139).

Variables	N (%)	Clean Kitchen N (%)	COR (95% CI)	AOR (95% CI)
Good premise floor	121 (87.1)	71 (58.7)	24.14 (3.11, 187.3)***	18.03 (2.09, 155.1)**
Good premise wall	125 (89.9)	70 (56)	7.63 (1.64, 35.5)**	3.74 (0.53, 26.11)
Good premise ceiling	115 (82.7)	67 (58.3)	5.3 (1.85, 15.19)**	2.62 (0.73, 9.46)
Adequate light	123 (88.5)	69 (56.1)	5.53 (1.50, 20.41)**	5.02 (1.01, 24.99)**
Adequate ventilation	76 (54.7)	34 (44.7)	2.7 (1.24, 5.88)**	1.3 (0.46, 3.67)
Unavailable pipe water	93 (66.9)	37 (39.8)	0.28 (0.07, 0.82)**	0.26 (0.09, 0.72)**
Available dustbin	125 (89.9)	69 (55.2)	4.51 (1.20, 11.9)**	4.32 (1.06, 21.6)**

** , ***: P-value < 0.05, P-value < 0.01

Table 5: Kitchen cleanliness by type of establishment, Asmara, Eritrea, 2019 (N=139).

Type of establishment	Kitchen cleanliness		
	N (%)	Clean N (%)	Unclean N (%)
Restaurant	58 (41.7)	29 (50)	29 (50)
Snack bar	33 (23.8)	10 (30.3)	23 (69.7)
Fast food	27(19.4)	19 (70.4)	8 (29.6)
Hotels	12 (8.6)	10 (83.3)	2 (16.7)
Juice/coffee shop	9(6.5)	4 (44.4)	5 (55.6)



Factors affecting vermin infestation

A multivariate logistic regression analysis showed that establishments which had pets and insect breeding around the liquid waste disposal were a times more likely to be infested with vermin in comparison to those which hadn't (AOR=4.1; 95%CI (1.17, 14.40), $p<0.05$) and (AOR=4.08; 95%CI (3.37, 12.17), $p<0.01$) respectively. And kitchens whose distance is less than four meter from the latrine were 3.6 times more likely to be infested with vermin than those with a distance of greater than 4 meters (AOR=3.65; 95%CI (1.60,8.35), $p<0.05$). Establishments with unclean latrine were found more likely to be infested with vermin than those with clean latrine though no significant statistical association was found in the multivariate logistic regression (Table 9).

Food handler's hygienic practices

Among the 139 assessed food and drinks catering establishments, food handlers with appropriate cover-coat and

Table 6: Water supply, utensils washing facility, Asmara, Eritrea, 2019 (N=139).

Characteristics	Frequency (n)	Percentage (%)
Running water available during inspection		
Yes	46	33.1
No	93	66.9
Discontinuation of water supply		
Yes	131	94.9
No	7	5.1
How long discontinued		
One day	1	0.8
Four days	1	0.8
a week	0	0
More than a week	13	9.8
>3 months	118	88.7
Utensils washing equipment		
Fixed basin with water tap	102	73.4
Fixed basin without water tap	20	14.4
Bowls/bucket	1	0.7
One or more of the above	16	11.5
Number of compartments for dish washing		
One	16	11.5
Two	93	66.9
Three	29	20.9
Four	1	0.7
Hot water used for washing dishes		
Yes	11	7.9
No	128	92.1
Detergents used for washing dishes		
Yes	123	88.5
No	16	11.5
Utensils placed appropriately		
Yes	41	29.5
No	98	70.5

Table 7: Provision of latrine and final solid waste disposal, Asmara, Eritrea, 2019 (N=139).

Characteristics	Frequency	Percentage (%)
Distance of dish washing from latrine		
0 m (attached)	23	16.5
up to 4 meters	53	38.1
>4 meters	63	45.3
Type of toilet facility		
Water-Flush type	137	98.6
Dry pit latrine	2	1.4
Drainage/ plumbing connected		
Sewerage system	134	96.4
Drainage	2	1.4
Septic tank	3	2.2
Separate latrine for male and female		
Yes	92	66.2
No	47	33.8
Urinals available		
Yes	64	46
No	75	54
Toilet during Observation		
Yes	125	89.9
No	14	10.1
Yes	120	86.3
No	19	13.7
Hand washing functional		
Yes	102	85
No	18	15
Detergent available for hand washing		
Yes	55	45.8
No	65	54.2
Solid waste collected		
by waste collecting trucks	113	81.3
To municipal container	16	11.5
On site burning	4	2.9
On site burial or to latrine	6	4.3

short trimmed and clean nail were found in 79.1% and 59.7% of the establishments. Likewise, food handlers whose hair was properly covered were observed in only 54.7% institutions. Surprisingly, in about 60% of the establishments', food handlers were observed wearing different kind of finger or hand ornament (Figure 3).

Situation of food storage and preservation

As described in Table 10, Majority (38.8%) of the establishments had complete separation of raw foods and other non-food materials, while 36.7% were found to separate the materials side by side (close to each other) and in the remaining 24.5% institutions the items were found mixed. About half (51.8%) of the establishments stored raw foods on the floor. Majority (97.8%) of the establishments were found to have

at least one refrigerator. Nevertheless, a third (33.1%) of the establishments' perishable and nonperishable foods were found stored together in the same refrigerators. Moreover, only 20% of the refrigerators had fixed thermometers reading below 10°C. Besides, in more than half (55.4%) of the establishments, the distance between the ready to eat foods preservation room and latrine was less than 4 meters. During the study time, spoiled food was observed among 28.7% of the establishments. Storage of perishable and nonperishable foods in the same refrigerators was strongly related to spoilage of food (OR=5.343(1.729, 16.507) 95% CI and p-value of 0.004).

Table 8: Latrine cleanliness in relation to availabilities of separate latrine for male and female, for clients and workers and Insects breeding around the liquid waste disposal facility, Asmara, Eritrea, 2019 (N=139).

Variables	N (%)	Clean latrine	COR (95% CI)	AOR (95% CI)
Separate latrine for male and female	92 (66.2)	67(72.8)	2.56 (1.23,5.34)**	2.34 (1.06,5.18)**
separate latrine for clients and workers	31 (22.3)	26(83.8)	3.44 (1.22,9.65)**	3.41 (1.10,10.57)**
Availability of running water	46 (33.1)	35 (76.1)	2.1 (1.1,4.7)**	1.8 (0.42,3.64)

** ,***: P-value < 0.05, P-value < 0.01

Latrine Cleanliness

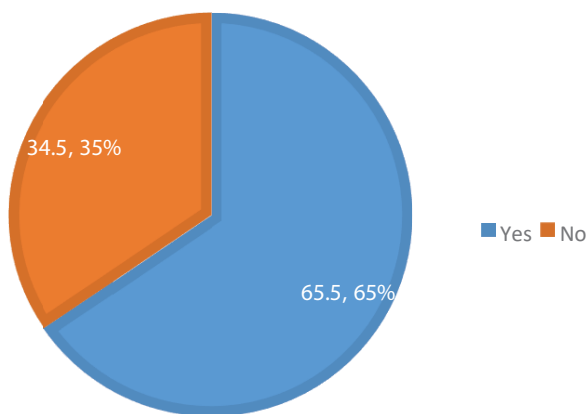


Figure 2: Latrine cleanliness, Asmara, Eritrea, 2019 (N=139).

Table 9: Infestation of vermin in the food premises in relation to presence of pets in the premise, latrine cleanliness, insects breeding around the liquid waste disposal facility, distance of kitchen from latrine, Asmara, Eritrea, 2019 (N=139).

Variables	N (%)	Vermin Infested N (%)	COR (95% CI)	AOR (95% CI)
Presence of pets	14 (10.1)	9 (64.3)	3.4 (1.08,10.88)***	4.1 (1.17,14.40)**
Unclean latrine	48 (34.5)	24 (50)	2.25 (1.09,4.62)**	1.5 (0.67,3.37)
Insects breeding around				
the liquid disposals	22 (15.8)	14(63.6)	3.6 (1.4,9.4)***	4.08 (3.37,12.17)***
Kitchen distance from latrine (0-4meters)	40 (28.8)	37(92.5)	2.89 (1.39,6.03)***	3.65 (1.60,8.35)**

** ,***: P-value < 0.05, P-value < 0.01.

Infestation of vermin

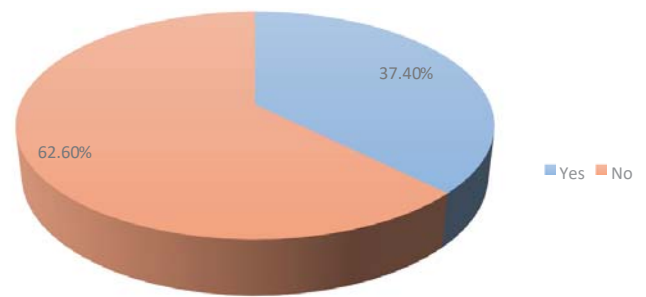


Figure 3: Infestation of vermin.

Table 10: Situation of Food Storage and Preservation, Asmara, Eritrea, 2019 (N=139).

Characteristics	Frequency (n)	Percentage (%)
Does food and other non-food materials separated		
Completely separated	54	38.8
Side by side (very close to each other)	51	36.7
All mixed	34	24.5
Where is food stored		
Pallets and shelf	67	48.2
Floor	72	51.8
Presence of refrigerator		
Yes	136	97.8
No	3	2.2
Perishable and nonperishable foods storage in refrigerator		
In the same refrigerator	46	33.1
In different refrigerator	93	66.9
Refrigerators with thermometers reading < 10°C		
Yes	28	19.9
No	111	80.1
Distance between foods preservation room and latrine		
< 4 meters	77	55.4
≥ 4 meters	62	44.6
Food status of spoiling		
Spoiled	40	28.7
Not spoiled	99	71.3

Discussion

To reduce food borne illness related to poor hygiene practices, food hygiene procedures and practices in different food establishments should be improved [18]. The study revealed that, majority (91.4%) of the establishments' dining room, about two-third (66.7%) of the kitchens and 68.5% of the store room had good and clean sanitary conditions. Safer food preparation and handling were reported by persons who were females, at least 40 years of age and at least having high school level education in some studies conducted elsewhere [19,20]. Majority of the food handlers in our study were found



to be males, in the age range between 20 and 35 years and a few of them had reached higher educational level. The reason for more number of young males as food handlers' might be due to the higher unemployment rate in other sectors of the country. It is quite advisable that food establishments have separate premises for their different kinds of services. Luckily, the findings of this study showed that a high percentage of the surveyed establishments had separate rooms for kitchen and other services. Besides, majority of the establishments had separate room for store. Similarly, the presence of separate rooms had facilitated good food handling process in a study conducted in Ethiopia [2]. Rooms where food is prepared, stored and served should be of impervious, smooth, and not having cracks or crevices. However, a proportion of the establishments' kitchens floor was cracked and not easy to clean. Likewise, the ceiling status of the kitchen and dining premises was seen to vary, the dining rooms were clean and smooth whereas the kitchens' were rough and dirty. This suggests that more focus is given to the maintenance and repairing of the dining rooms, to attract customers, than the kitchen premises. Moreover, about a third of the kitchens and store rooms were found unclean. It is apparent that sanitary inspections are very important tools in food and drink establishment services for regulating the cleanliness of the premises and preventing food borne diseases. Studies have revealed that, the probability of having good food safety practice was higher among food handlers supervised by health professionals [16,21]. However, findings of this study indicated more than half of the establishments have never been inspected in the former year. This could be the reason for the higher proportion of dirty kitchens. Along with the cleanliness of the premises, adequate ventilation (having open able windows, chimneys and free of disagreeable odor) needs to be provided to remove odors, condensation and to enable comfortable working conditions. Nonetheless, it was shown that less than half of the establishments' kitchen premises lack the minimum ventilation requirement. This might be due to the fact that majority of the kitchens were not built in a planned manner.

The requirement for providing adequate and safe water supplies to public food catering establishments is too obvious and there is no need to justify its importance. Conversely, as the results indicated, almost all establishments' water supply had discontinued for more than three months. It could be due to this reason that majority of the establishments had their main source of water supply from water trucks at the time of observation. As a matter of fact, running tap water under pressure should be easily accessible to all rooms where food is prepared and served, and utensils and food containers are washed. However, out of the total food catering establishments, more than two-third had no access to running tap water inside the facility for food preparation and utensils washing. Food utensils can be washed by hand (manually) or by machine. In Eritrea and particularly in the study site, hand washing was the most common method of washing food utensils. The cleaning of soiled dishes is an important way of preventing communicable diseases. One of the most widely used and accepted methods of washing food utensils is the three compartment sink or vat system. Nevertheless, very low

proportion of the establishments had the conventional three washing compartments. Similarly, the use of boiled water for washing utensils was poorly practiced.

Factors such as latrine condition, hand washing facilities, solid waste storage and solid waste disposal of the food and drink establishment were highly associated with food safety [1,5,22]. Sanitized utensils must be stored in a clean protected place, and unnecessary and improper handling should be reduced to a minimum level. Only about a third of the establishments placed the sanitized utensils appropriately (dried, closed, and separated), while the majority of the establishments were observed to place the sanitized utensils inappropriately. In a similar way, kitchen cleanliness is highly crucial to ensure the safety of prepared food. With this regard, the findings of our study revealed that, well fitted and clean floor, presence of adequate lightning, availability of running water and dustbin were the main factors easing kitchen cleanliness. However, infestation of vermin was observed in more than a third of the establishments' kitchen. Presence of pets and breeding of insects in the liquid waste disposal had significantly increased the presence of infesting vermin. Additionally, the nearer was the kitchen (< 4 meters) to the latrine, the higher was the possibility of vermin infestation. These factors have negatively affected kitchen cleanliness. Consistently, the presence of insects and rodents had compromised good food handling practice in Dangila town of Ethiopia [2]. Human excreta and sewage is the potential source of almost all enteric infections. Thus all public food service establishments shall provide adequate, safe and conveniently located toilet facilities. Presence of latrine and liquid waste disposal had increased the probability of providing safe food in Gambella region of Ethiopia [20]. According to the finding of this study almost all the establishments had water flush type toilet, which could be due to the fact that, most parts of Asmara are connected to a modern sewerage system. Availability of separate latrine for male and female, separate latrine for clients and workers and the availability of running water were the main factors potentiating latrine cleanliness. Provision of lavatory and hand-washing facilities is also another important requirement that public food premises must have. All food premises should provide adequate and conveniently located lavatory and hand-washing facilities with soap. Some studies reported that the presence of hand washing facility played a vital role for good food handling practice [20]. During the time of this study, hand washing facilities were available in majority of the establishments, but only half of them had detergents for hand washing.

Preparation of hygienic and safe food begins with proper handling of raw food and its storage so as to decrease the growth of the microorganisms already present and to minimize the risk of contamination. Studies indicate that, cross-contamination of raw and cooked ingredients, defects in food preparation and hygiene and subsequent timetemperature abuses were the most common scenarios which lead to foodborne outbreaks in restaurants and fast [18]. Yet, lower proportion of the assessed food and drinks establishments were observed to completely separate raw foods and other non-food materials in our study.



Additionally, perishable and non-perishable food were found together in the same refrigerator in more than a third of the establishments, this procedure had significantly increased the spoilage of food. It was fitting to find out that almost all of the food and drinks catering establishments had at least one refrigerator, but only a fifth of them had fixed thermometers with temperature readings $\leq 10^{\circ}\text{C}$. Our findings are in line with the study conducted in Australia [23], reporting unsafe food preparation practices in majority of the respondents leading to food borne illnesses. Knowledge of food handling, increased educational status and training of food handlers' had a direct association with good food handling practices in studies conducted in many countries [5, 16, 24-28]. The presence of well-maintained and proper food handling practices, such as wearing clean working garment, hair covering, and keeping fingernails short and clean have a beneficial ultimate impact on serving safe food to consumers. Still, more than a third of the establishments' food handlers were not observed to appropriately cover their hair. Avoidance of wearing finger or hand ornament is also an essential prerequisite for a food handler as it is a potential cause of chemical and microbiological food poisoning, but the current study showed that about two-third of food handlers worn finger or hand ornament while serving or preparing food. Improvements of practices during food preparation, storage and cleaning practices, can be obtained through education and training of food handlers involved in preparation, processing and service of meals [29].

Limitations of the study

Limitations of the research stem from the use of descriptive observational study due to its inherent limitation to define cause and effect relationship. No laboratory analysis was made for detecting microbial quality of food utensils. Assessing perceptions or satisfaction level of consumers about the services provided by the establishments might have enriched the findings of the study. Since, the study was only done in a particular site of Asmara, generalization of the findings to that of the country is not feasible. Hence, nationwide research is recommended to fill the abovementioned gaps and to deepen the factors behind the unhygienic practices. Moreover, given the great cultural differences within the country, more research is necessary to determine if similar results would be derived across the country. This study did not try to specify hypothesis regarding food hygiene profile.

Conclusion

The sanitary condition of the food and drinks catering establishments in the study area was found to be poor. The researchers observed unavailability of running water, poor handlers hygienic practice, frequent interruption of water supply, poor food storage and preservation, inconsistent inspection activities, improper solid waste handling and disposal, lack of standard dish washing compartments, unclean kitchen and toilet facilities. There is a need to impose regulations and guidelines governing the basic sanitary requirement of the food and drinks catering establishments. Training of managers and food handlers' should be among the priority promotion and advocacy activity. Memorandum of understanding among

Ministry of tourism; Municipality and Ministry of health is recommended for joint planning, monitoring and evaluation of activities in food and drink establishments.

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Authors' contributions

All authors participated in all phases of the study including topic selection, design, data collection, data analysis and interpretation. Idris M. Idris and Samuel Jirom contributed in writing the critical revision of the manuscript for publication. All authors approved the manuscript for publication.

Ethical approval

The proposal was approved by the "Ethical and Scientific Committee" of the School of Public health, Asmara College of Health Sciences. A formal letter was then written from the head of School of Public Health ACHS to Ministry of Tourism. Clear communications was done with Ministry of Tourism on the objectives and significance of the study, and then the Ministry gave Permission letter to collect data from the selected catering establishments. Confidentiality of the respondents was assured by excluding their name and had the full right to reject or withdrawal participation at any time from the study.

Availability of data and materials

The complete data set supporting the conclusions of this article is available from the corresponding author and can be accessed up on reasonable request.

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