



Research article

Determinants of safe food handling practice among food handlers in food establishments, Yeka sub city, Addis Ababa, Ethiopia

Fresenbet Fanta^{a,b}, Meseret Azene^{b,*}, Kifle Habte^c, Hanna Samson^d, Aweke Kebede^c^a National Disaster Risk Management Commission (NDRMC), Addis Ababa, Ethiopia^b Center for Food Science and Nutrition, Addis Ababa University, PO Box: 1176, Addis Ababa, Ethiopia^c Ethiopian Public Health Institute (EPHI), Addis Ababa, Ethiopia^d St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

ARTICLE INFO

Keywords:

Food safety
Food handling practice
Food handlers
Food establishments
Yeka sub city
Addis Ababa

ABSTRACT

Background: Poor food handling practice is a key cause of foodborne diseases notably in developing countries like Ethiopia. This study aimed to assess food safety knowledge, attitude and practice of food handlers, establishments' status and determinants of safe food handling practice. **Methods:** The study utilized institution based cross-sectional study among food handlers working in Cafeterias, Restaurants and Hotels in Yeka sub city, Addis Ababa. A total of 284 food handlers: 69 from Cafeterias, 89 from Restaurants and 126 from non-stared Hotels were enrolled using stratified random sampling technique. Data were collected in observational checklist and through structured-questionnaire via face to face interview. A binary and multivariate logistic regression was used and adjusted for cofounders. A P-value of less than 0.05 was considered statistically significant.

Result: The present study has indicated 42.6% of food handlers had good food handling practice. Food handling practice in the establishments were significantly associated with sex, monthly income, availability of functional pipe water supply, availability of soap and/or detergents and presence of insects or rodents.

Conclusion: Food handlers in the study area were executing in a poor food handling practice, as most of them were not knowledgeable as needed. In fact, revising the salary of food handlers based on their work load could be valid, as there is existing worldwide economic inflation. Likewise enhancing pipe water availability in the food premises and dispatching sufficient soaps and detergents coupled with eradicating ubiquitous insects and rodents are key.

1. Background

Food establishments consist of restaurants, cafeterias and hotels growing fast in both developed and developing countries, which could be influenced by urbanization and population growth [1,2]. There has been increasing proportion of eating away from home [3], due to time pressure to cook and eat at home [4], moreover growing technology and demand to maximize food palatability, preference

* Corresponding author.,

E-mail addresses: ffresenbet@gmail.com (F. Fanta), mazene8@gmail.com, meseret.azene@aau.edu.et (M. Azene), kiflhabte@gmail.com (K. Habte), hannasamsonabi@gmail.com (H. Samson), awekekeb@gmail.com (A. Kebede).<https://doi.org/10.1016/j.heliyon.2023.e12977>

Received 21 April 2022; Received in revised form 7 January 2023; Accepted 10 January 2023

Available online 12 January 2023

2405-8440/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

in texture, taste, diversification and accessibility play roles [5]. According to reanalysis data of Ethiopian Household Consumption and Expenditure Survey (HICES) in 2011, eating away home covered 16% of the urban food budget [3], and food consumed away from home was about 7% in Addis Ababa (A.A) [6].

Eating away can be dangerous as foods have high chance of microbial contamination, due to long value chains, such as transporting bulk raw materials from farm/whole seller to retailers, retail store, transporting to the food establishments, preparation for cooking, storing or refrigerating and serving [7], during these process there may be potential sources of foodborne diseases (FBD) or outbreaks [8]. Worldwide, FBD causes greater health burden leading to high morbidity and mortality [9]. World Health Organization (WHO) reported that, globally around 600 million (1 in 10 people) get sick every year after eating contaminated food [10]. In developing countries like Ethiopia approximately 70% of diarrheal diseases are associated with consumption of contaminated foods [11]. Hence, the annual incidence of FBD was 3.4–9.3% and a five years (1985–1990) median was 5.8% [12].

Globally, the major causes of FBD are poor sanitation facilities, low safe water access, marginalized food handling practice [13,14] and supply of substandard raw materials [15]. Moreover, poor personal and establishments' hygienic practices during food preparation, and serving and lack of adequate trainings in food safety and food service management are critical [1].

The fact that varieties of foods prepared in bulk usually by many people in the establishments causes food contamination [2,16]. Pertinent poor food handling practices, poor food safety knowledge and use of inferior raw materials, not controlling holding temperatures and absence of personal hygiene could inflate the extent of food contamination [17–19]. This go hand in hand with, attitude, practices and experiences of food handlers in good food handling practices, food safety and good personal hygiene practices which have a detrimental effect on food contamination [15,20,21]. Protecting consumers from foodborne illness via routine inspection of premises, giving need based capacity building trainings for food handlers in good manufacturing and handling practices, maintaining good personal hygiene, food safety principles and practicing hazard analysis and critical control point (HACCP) are among vital means of ensuring food safety in food establishments [22].

Previous studies conducted in Ethiopia reported that poor hygiene practice of food handlers, inadequate sanitary facilities in the establishments, poor waste disposal services, low hygienic environment and lack of licensing and/or appropriate licensing were major problems in food establishments [23,24]. However, there is, no existing data on status of food safety adherence coupled with knowledge, attitude and practice of food handlers in food establishments, and factors associated with food safety, good hygienic practices and good food handling practices, especially at Yeka sub city. However, comparably eating outside home is more expected than other sub cities, as the city has very crowded business centers, has many food establishments and contain many slummy areas. Therefore, the aim of this study were to evaluate food safety knowledge, attitude and practice of food handlers in different food establishments and factors associated with food safety and food handling practice of food handlers as well as the establishments in Yeka sub city, A.A, Ethiopia.

2. Methods

2.1. Study area and period

The study was conducted from May 21, 2019 to August 15, 2019 in Yeka sub city, A.A, Ethiopia. This sub city is located in North East of the capital city, A.A and covers an area of 85.98 km². The total population of the sub city is 368,418 and composed of 13 Woredas [25]. Majority of the people live in the city are below standards of living (88%) [26]. According to Yeka Sub City Food and Drug Administration (FDA) Office, there are 288 registered food establishments: (70 cafeterias, 90 restaurants and 128 non-stared hotels).

2.2. Study design and study population

A cross sectional study was conducted by selecting three types of food establishments: Cafeteria, Restaurants and Non-stared hotels; and also through identification of the position of food handlers (main and assistant chefs) working in Cafeteria: 69, Restaurants: 89 and in non-stared Hotels: 126. Therefore, a total of 284 food handlers in the sub city were enrolled as a study population.

2.2.1. Inclusion criteria

All Food handlers (main and assistant chefs) involved in food preparation who were available during data collection, works in the food establishments (cafeteria, restaurants or non-stared hotels) in Yeka sub city, volunteer to participate, and have a minimum adequate experience (six months and more) were included in the study.

2.2.2. Exclusion criteria

Food handlers who have worked less than 6 months in the food establishments were excluded from the study.

2.3. Sampling strategy

Sample size was calculated by single population proportion formula using 0.05 marginal error (d), $Z = 1.96$, 78% proportion (P) of good food handling practice in food establishments [11] and 10% of non-response rate.

$$n = \frac{(Z2) * P(1 - P)}{d^2}$$

The total sample size in the study was 284. The three food establishments' classification was done based on the type of service they provide for consumers, according to Yeka Sub City FDA office food establishment's classification system. The numbers of food handlers from each food establishments were proportionally allocated and 69, 89 and 126 from cafeterias, restaurants and non-stared hotels were enrolled in the study respectively. Stratified random sampling was followed to include 284 food handlers from each establishment.

2.4. Data collection and data quality control

Food safety knowledge, attitude and practices of food handlers were collected using a pre-tested structured-questionnaire through face to face interview. The questionnaire was developed from previous studies conducted [1,7,27,28]. Additionally, observation checklist was employed for collecting data on food handling practice of food handlers' and hygiene status of the food establishments'. The questionnaire was written in English, then translated into the local language Amharic, and finally to English to ensure that the data was consistent. Data was collected using two BSc Nurses, three Food Science and Nutritionists and two supervisors with MSc in Food Science and Nutrition who have experience in data collection. A two day intensive training was given before the pretest. A pretest structured questionnaire was employed in 5% of the sample size in other randomly selected sub city distant to the study site. The questionnaire was comprised of five parts: (1) the socio-demographic; age, sex, educational status, and work experience, (2) food safety knowledge of food handlers, (3) attitude (using the Likert scale), (4) food handling practice of food handlers and, (5) observation via checklist to evaluate food handling and hygienic practice of food handlers and hygienic status of the establishments. Respondents, who answered 70% or more out of 25 questions assessing knowledge, and 70% and above out of 22 food handling practice questions were considered having good knowledge and practices; but below this cut-off was considered poor. Additionally, respondents who answered 80% or more out of 8 questions administered for attitude were considered having good attitude, otherwise poor attitude, as mentioned in Ref. [7].

2.5. Data management and analysis

Data were coded, entered in to Microsoft Excel sheet and exported to SPSS version 20 software for analysis. Continuous variables were expressed as mean and standard deviation but, categorical variables were expressed in frequency and percentages. Determinants with significant association with food handling practices of handlers were analyzed using multivariate logistic regression using

Table 1
Socio-demographic characteristics of food handlers.

Variables	Category	Frequency (n)	Percent (%)	Mean ± SD
Sex	Male	45	15.8	
	Female	239	84.2	
Age (years)	<18	1	0.4	26.0 ± 5.01
	18–21	45	15.8	
	22–25	107	37.7	
	26–29	74	26.1	
	>29	57	20.1	
Education	Illiterate	31	10.9	
	Primary	117	41.2	
	Secondary	86	30.3	
	Diploma	50	17.6	
Work experience (years)	<2	114	40.1	1.8 ± 0.8
	2–4	121	42.6	
	5–7	40	14.1	
	8–10	7	2.5	
	>10	2	0.7	
Marital status	Single	193	68	
	Married	85	29.9	
	Divorced	4	1.4	
	Widow/Widower	2	0.7	
Responsibility	Main chef	195	68.7	
	Assistant chef	89	31.3	
Monthly income (in Birr)	500–1000	49	17.3	2070.4 ± 894.6
	1001–1500	50	17.6	
	>1500	185	65.1	
Food safety and hygiene training	Yes	114	40.1	
	No	170	59.9	
Type of food establishments	Cafeteria	94	33.1	
	Restaurant	94	33.1	
	Non-stared hotel	96	33.8	

adjusted odds ratios (AORs) at 95% confidence intervals (CIs), $P < 0.05$. Binary logistic regression analysis was employed and factors with $P \leq 0.25$ were selected for multivariate logistic regression analysis.

2.6. Ethical consideration

Ethical clearance of the work was received from Institutional Review Board (IRB) of College of Natural and Computational Sciences (IRBCNCSs) from Addis Ababa University. Before starting the data collection the objectives, possible risks and benefits of the study were explained for food handlers and establishment owners'. Moreover, rights and responsibilities were clearly described to obtain verbal informed consent.

3. Results

3.1. Socio-demographic characteristics of food handlers

Socio-demographic data of participants are presented in Table 1. From 284 food handlers, 195 (68%) were main chefs and 89 (31.3%) were assistant chefs. On the other hand, nearly one third of each establishment participated with 100% response rate. From the total food handlers, majority (84.2%) were females, and most of the participants were single 193 (68.0%). The mean age of the respondents were 26 years, ranging from 17 to 45 years; about 38% were in the age group 22–25, followed by 26% in the age group of 26–29, however nearly 20% of them were ≥ 30 years old, and the rest were below 19. Most of the study participants (41%) had completed primary education but 11% were illiterate (can't read and write). However, 40% of them had taken food safety training. The mean work experience of the food handlers was 1.8 years; nearly all (99.3%) had worked below 10 years. The average monthly income (in Birr) of food handlers were 2070.4 and most of them (65.1%) earned more than 1500 ETB per month.

3.2. Food handlers food safety knowledge

Majority of the respondents (91.9%) knew that FBD caused by pathogens (bacteria and virus). However, approximately half of food handlers didn't know that healthy people can spread sickness through disease causing agents. Moreover, only half of the respondents knew about the presence of harmful microbes in canned foods. Regarding knowledge on personal hygiene, all food handlers knew about washing hands are vital after using toilet, touching of different body parts and during sneezing. However, most food handlers (83.8%) didn't know that washing hands only with water after handling raw meat was not enough. According to the result shown in Table 2, besides, a third of respondents believe that handling of cooked foods with the same glove after handling of raw food is not a problem.

Concerning knowledge on cross-contamination, all food handlers knew that utensils like cutting boards, meat slicers, and knives

Table 2
Food safety knowledge of food handlers.

Statements for knowledge assessment	Response n (%)		
	Correct	Incorrect	Don't know
Food borne disease can be caused by either by bacteria or virus	261 (91.9)	18 (6.3)	5 (1.8)
Raw meat always has microbes on the surface	137 (48.2)	62 (21.8)	85 (29.9)
Canned foods may have harmful microbes	143 (50.4)	52 (18.3)	89 (31.3)
Healthy people can cause illness by carrying germs to food	111 (39.1)	48 (16.9)	125 (44.0)
Lettuce and other raw vegetables might have harmful microbes	280 (98.6)	2 (0.7)	2 (0.7)
Cooked foods do not have microbes	97 (34.2)	13 (4.6)	174 (61.3)
You can prepare food with a wound on hand, given the wound is covered with a bandage	75 (26.4)	11 (3.9)	198 (69.7)
It is enough to wash the hands with water alone after handling raw meat	238 (83.8)	3 (1.1)	43 (15.1)
After using the toilet, we should always wash hands with soap and water	284 (100)	0 (0)	0 (0)
Hands should be washed if touching of body parts happen	284 (100)	0 (0)	0 (0)
When wearing gloves, you can handle cooked foods after handling raw meat	157 (55.3)	32 (11.3)	95 (33.5)
Wearing clean uniform and cap while cooking or serving is necessary	282 (99.3)	2 (0.7)	0 (0)
Hands should be properly washed after sneezing or blowing your nose	284 (100)	0 (0)	0 (0)
Foodborne disease can result from storing raw meat and cooked foods in the same refrigerator	89 (31.3)	95 (33.5)	100 (35.2)
Foods can be contaminated with microbes by coming in contact with unsafe foods	280 (98.6)	2 (0.7)	2 (0.7)
Dish drying towel can be a means for causing food borne disease	162 (57.0)	30 (10.6)	92 (32.4)
Ready to eat foods (e.g. FVs) can be prepared on the same cutting board used to prepare meat	250 (88.0)	2 (0.7)	32 (11.3)
Cutting boards, meat slicers and knives should be sanitized after each use	284 (100)	0 (0)	0 (0)
Foods that need to be kept hot should be at 60 °C or above	147 (51.8)	95 (33.5)	42 (14.8)
Leftovers should be reheated to a minimum temperature of 75 °C	122 (43.0)	110 (38.7)	52 (18.3)
Foods should be cooled slowly at room temperature before storing in refrigerator	15 (5.3)	0 (0)	269 (94.7)
Refrigeration kills all bacteria that might cause foodborne illnesses	100 (35.2)	67 (23.6)	117 (41.2)
Frozen foods should not be thawed on the counter or in the sink	16 (5.6)	151 (53.2)	117 (41.2)
After thawing, meat should not be held for 5 h at room temperature	85 (29.9)	73 (25.7)	126 (44.4)
Foods stored at 40 °F are being held in the temperature danger zone	113 (39.8)	111 (39.1)	60 (21.1)

FVs: Fruits and vegetables.

needs to be sanitized before every use. However, 35% of them didn't know FBD can be caused by storing cooked and raw foods in the same refrigerator. Nearly all of the handlers (98.6%) knew about unsafe food can be a cause of food contamination. About a third of food handlers incorrectly answered that holding foods hot should be at 60 °C or above. Moreover, about one fifth of them did not know about temperature danger zone. Overall, food handlers with good knowledge of food safety (those who answered greater than or equal to 70% of the knowledge section assessment) were poor (2.1%).

3.3. Attitudes of food handlers towards food safety

Table 3 summarizes attitude of food handlers towards safe food handling. Most of food handlers had positive attitude to safe food handling. Likewise, 29.9% of the respondents did strongly agree on temperature control as an effective means for reducing food poisoning. Regarding to food safety training; 64.1% of food handlers agreed that food handlers should undergo food safety training, and 53.9% were accepted that lack of food safety training affects food handling practices. Moreover, 59.2% of them agreed that lack of committed supervisor will affects safe food handling practice. Overall, 86.6% of food handlers had good attitude in safe food handling practice.

3.4. Safe food handling practices of food handlers

Table 4 shows safe food handling practices of food handlers. Food handlers always practiced washing of hands after touching unwrapped or raw foods were 244 (85.9%). However, 125 (44%) food handlers never practiced washing hands after using gloves. The present study showed that, 70.4% of them never practiced checking of refrigerator temperature using thermometer. The study has also presented that above two thirds of food handlers always practiced medical checkup assigned by the food establishments and two thirds of them always got sick leave for any sickness. About 96% of food handlers practiced covering head and most (91%) did not practiced wearing jewelers when serving foods.

3.5. Hygiene practices and sanitary status of the food establishments and handlers

According to observed safe food handling practices of food handlers showed that just three fourths of them had no long nails, 41% wear clean uniform, 88% did wear head cap. In addition, half of the respondents did not wear jeweler, almost all did not sneeze/ coughed over uncovered food, 41% washed hands before and after handling food, 95% did not work while having nose discharge (Table 5). However, about four fifth of food handlers worked while having cut/skin problem and 30% used same chopping board for raw and cooked food without cleaning. On the other side, 88% of the establishments had functional piped water for both food handlers and customers, but just half had available soap or detergents for hand washing, and about 10% of them used three compartment dish washing system. Furthermore, about two third of the establishments have separate dressing room for both women and men. On the other hand, only 6% of the establishments had food safety or hygiene guidelines, and 90% of the kitchen had insects/rodents, but just two third of them were supervised either by owner or by supervisor (Table 5).

3.6. Factors associated with food handling practices of food handlers

Factors associated with safe food handling practices of the handlers were analyzed using binary logistic regression. Factors with P value ≤ 0.25 including sex, educational status, monthly income, job responsibility (main and assistant chefs), availability of functional

Table 3
Food handlers' attitude on food safety.

Statements for attitude assessment	Response n (%)				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Temperature controls are an effective method of reducing the number of cases of food poisoning	5 (1.8)	7 (2.5)	8 (2.8)	179 (63.0)	85 (29.9)
Checking the expiry date of ingredients should always be obligatory before preparing dish	0 (0)	0 (0)	3 (1.1)	170 (59.9)	111 (39.1)
All food handlers should have a food safety training qualification	0 (0)	4 (1.4)	5 (1.8)	182 (64.1)	93 (32.7)
Lack of food safety training affects safe food handling practice	8 (2.8)	24 (8.5)	13 (4.6)	153 (53.9)	86 (30.3)
Unavailability of food handling guideline can affect food handling practice	4 (1.4)	21 (7.4)	13 (4.6)	178 (62.7)	68 (23.9)
Insufficient dry and wet storage can affect food handling practice	2 (0.7)	8 (2.8)	2 (0.7)	198 (69.7)	74 (26.1)
Having one handmade (fabric) towel is enough for dish washing	111 (39.1)	144 (50.7)	1 (0.4)	27 (9.5)	1 (0.4)
Lack of supervisor commitment affect safe food handling practice	13 (4.6)	32 (11.3)	7 (2.5)	168 (59.2)	64 (22.5)

Table 4
Safe food handling practices of food handlers.

Statements for safe handling practices assessment	Response n (%)		
	Always	Sometimes	Never
Do you wash your hands after touching un wrapped raw foods?	244 (85.9)	35 (12.3)	5 (1.8)
Do you use separate utensils when preparing raw and cooked foods	188 (66.2)	94 (33.1)	2 (0.7)
Do you not thaw frozen foods at room temperature	91 (32.0)	146 (51.4)	47 (16.5)
Do you check the expiry dates of all products	142 (50.0)	82 (28.9)	60 (21.1)
Do you use a thermometer to check temperature of refrigerator	33 (11.6)	51 (18.0)	200 (70.4)
Do you have medical checkup assigned by the food establishment	201 (70.8)	76 (26.8)	7 (2.5)
Do you get sick leave for any sickness	185 (65.1)	98 (34.5)	1 (0.4)
Do you use gloves when serving unwrapped food	60 (21.1)	97 (34.2)	127 (44.7)
Do you wash your hands before using gloves?	122 (43.0)	127 (44.7)	35 (12.3)
Do you wash your hands after using gloves?	146 (51.4)	13 (4.6)	125 (44.0)
Do you wash your hand before touching cooked foods	239 (84.2)	45 (15.8)	0 (0)
Do you wear a hat or head covering when serving food	272 (95.8)	12 (4.2)	0 (0)
Do you wear jewelry when serving food?	10 (3.5)	16 (5.6)	258 (90.8)
Do you disinfect cutting boards after each use	278 (97.9)	6 (2.1)	0 (0)
Do you sanitize utensils after washing them	284 (100)	0 (0)	0 (0)

Table 5
Observed safe food handling practices of handlers and hygienic status of the establishments.

Observational assessments	Responses (%)	
	Yes	No
Having long nails	72 (25.4)	212 (74.6)
Wearing clean uniforms	117 (41.2)	167 (58.8)
Wearing a head cap	250 (88.0)	34 (12.0)
Having jeweler while handling foods	142 (50.0)	142 (50.0)
Sneezing/coughing over uncovered food	8 (2.8)	276 (97.2)
Washing hands after/before handling food	115 (40.5)	169 (59.5)
Working while having discharge from the nose	15 (5.3)	269 (94.7)
Working while having cut/any skin problem	233 (82.0)	511 (8.0)
Using same chopping board for raw & cooked foods without cleaning	84 (29.6)	200 (70.4)
Have functional pipe water supply for food handlers and customers	249 (87.7)	35 (12.3)
Three compartment dish washing system	34 (12.0)	250 (88.0)
Separate dressing rooms available for food handlers	184 (64.8)	100 (35.2)
Soap or detergents available for hand washing	146 (51.4)	138 (48.6)
Food safety/hygiene guidelines available for food handlers	16 (5.6)	268 (94.4)
Availability of insects/rodents	256 (90.1)	28 (9.9)
Supervision by owner/supervisor	187 (65.8)	97 (34.2)

water pipe and soap/detergents, practicing three compartment dish washing, absence of food safety guideline, presence of insects/rodents and food handlers with good attitude were exported to multivariate analysis. However, the multivariate analysis has shown that only sex, monthly income, availability of functional pipe water and soap, and presence of insects/rodents were significantly associated with safe food handling practices, P value < 0.05 at 95% CI (Table 6). Male food handlers were less likely to perform safe food handling practices than females (AOR = 2.63 CI = 1.15, 6.00). In addition, food handlers with monthly income >1500 ETB had

Table 6
Factors associated with safe food handling practices of the food handlers.

Variable	Category	Safe food handling practice n (%)		COR with 95% CI	AOR CI
		Good	Poor		
Sex	Male	33	12	4.72 (2.32–9.61)**	2.63 (1.15–6.00)*
	Female	88	151		
Salary	500–1000	11 (9.1)	38 (23.3)	1.48 (0.60–3.65)	1.38 (0.52–3.67)
	1001–1500	15 (12.4)	35 (21.5)		
	>1500	95 (78.5)	90 (55.2)		
Availability of functional pipe water	Yes	114 (94.2)	135 (82.8)	3.38 (1.42–8.02)*	3.54 (1.34–9.34)*
	No	7 (5.8)	28 (17.2)		
Availability of soaps/detergents	Yes	80 (66.1)	66 (40.5)	2.87 (1.76–4.68)**	2.03 (1.17–3.50)*
	No	41 (33.9)	97 (59.5)		
Presence of insects and rodents	Yes	18 (14.9)	10 (6.1)	0.37 (0.17–0.84)*	0.28 (0.11–0.70)*
	No	103 (85.1)	153 (93.9)		

*Significant at p < 0.05; **Significant at p < 0.001; AOR = Adjusted odds ratio; COR = Crude odds ratio.

higher odds of good safe food handling practice than with monthly income between 500 and 1000 (AOR = 2.66 CI = 1.16, 6.12). The odds of practicing good safe food handling practice were higher in food handlers who had functional pipe water supply (AOR = 3.54 CI = 1.34, 9.34). Besides, food handlers who had available soap or detergents for hand washing were more likely performing good safe food handling practice than without (AOR = 2.03 CI = 1.17, 3.50). Furthermore, handlers working in the absence of insects or rodents in establishments were more likely performing good safe food handling practice than in the presence (AOR = 0.28 CI = 0.11, 0.70).

4. Discussion

The present study aimed to determine food handling practice of food handlers, determinants in different food establishments and hygienic status of establishments. The study result showed that 42.6% of food handlers had good safe food handling practice. This is in agreement with study conducted in Debarq town, Northwest Ethiopia; good food handling practice was 40.1%. However, the study results lower than previous studies conducted in various regions of Ethiopia; these include 52.5% in Dangila [28], 46.5% in Woldia [29], 78.7% in Bahir Dar [11] and 49.0% in Gondar [30]. Besides, studies conducted in Brazil and Malaysia reported that good food handling practice was found 76.0% and 50.0% respectively [20,31]. On the contrary, studies conducted in Bole sub city, A.A, Ethiopia, good food handling practice was found 27.4% [32]. Moreover, another study conducted in Gamo Gofa Zone, Ethiopia reported that, good food handling practice was 32.6% [17]. These contrasting findings might be due to, difference in the methodology (cutoff points used to classify knowledge, attitude and practice), disparity in educational background of food handlers, socio-demographic status, environmental and premises variation.

The current study revealed that sex and monthly income of food handlers were found to be significantly associated with safe food handling practices. Furthermore, availability of functional water pipe, presence of insects/rodents and availability of soap/detergents were determining factors associated with safe food handling practice ($P < 0.05$ at 95% CI). Our study highlighted that male food handlers who had good food handling practice were 33% but, among females were 88%. In which, the odds of having good safe food handling practice were less likely in males compared to females (AOR = 2.63 CI = 1.15, 6.00). This is supported by previous studies [11, 1320], the reason is females are highly engaged in food handling activities. Given that they are traditionally accountable for serving food for households and more become capable in the preparation and handling [5].

The present study showed that food handlers whose monthly income >1500 Birr were more likely to have good safe food handling practice compared to those between 500 and 1000 Birr (AOR = 2.66 CI = 1.16, 6.12). This is consistent with previous studies, since food handlers with higher monthly income have good handling practice due to better knowledge competency in educational status and work experience [28,29]. This study also revealed that food handlers who were working in an establishment with functional pipe water were more likely performing safe food handling practice compared to their counterparts (AOR = 3.54 CI = 1.34, 9.34). This is well substantiated with previous studies in which presence of water is strongly related with better personal hygiene and sanitation practice [32] and hence, it could prevent FBD [33].

Besides, the study showed that food handlers having soap/detergents for hand washing in the establishments were two fold more likely to perform good handling practice compared to others (AOR = 2.03 CI = 1.17, 3.50). This association is in line with a study conducted in a university student cafeteria [34]. The other point in this study is, those food handlers working at establishment with no insects and/or rodents had 72% more likely to perform good safe food handling practice than with insects/rodents (AOR = 0.28 CI = 0.11, 0.70). There is a call for action for regulatory bodies to make regular inspection which would improve the safety and hygiene practice of food handlers and establishments, otherwise giving warning or taking measurement may be important.

Author contribution statement

Fresenbet Fanta: Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data.

Meseret Azene, Kifle Habte: Analyzed and interpreted the data; Wrote the paper.

Hanna Samson: Performed the experiments; Contributed reagents, materials, analysis tools or data.

Aweke Kebede: Conceived and designed the experiments.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to acknowledge Addis Ababa University for ethical approval of the work and Center for Food Science and Nutrition, A.A University, for facilitating all procedures required for the study. The authors also would like to express their gratitude to Yeka Sub City Food, Medicine and Health Care Administration and Control Office, study participants and owners/managers of food establishments for their support during data collection.

List of abbreviations

A.A	Addis Ababa
AORs	Adjusted odds ratios
CI	Confidence interval
FBD	Foodborne disease
FDA	Food and drug administration
HACCP	Hazard analysis and critical control point
WHO	World health organization

Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.heliyon.2023.e12977>.

References

- [1] B. Gebremariam, B. Asmelash, D. Tetemke, Determinants of sanitary status among food establishments in urban setup in Adwa town, Tigray, Ethiopia: a cross-sectional study, *BMC Res. Notes* 12 (1) (2019) 399.
- [2] A. Kumie, K. Zeru, Sanitary conditions of food establishments in Mekelle town, Tigray, north Ethiopia, *Ethiop. J. Health Dev.* 21 (1) (2007) 3–11.
- [3] B. Minten, T.W. Assefa, G. Abebe, E. Engid, S. Tamru, Synopsis: Food Processing, Transformation and Job Creation: the Case of Ethiopia's Enjera Markets, International Food Policy Research Institute (IFPRI), 2017.
- [4] T.M. Osaili, D.O. Jamous, B.A. Obeidat, H.A. Bawadi, R.F. Tayyem, H.S. Subih, Food safety knowledge among food workers in restaurants in Jordan, *Food Control* 31 (1) (2013) 145–150.
- [5] L. Isoni Auad, V. Cortez Ginani, E. Stedefeldt, E. Yoshio Nakano, A. Costa Santos Nunes, R. Puppini Zandonadi, Food safety knowledge, attitudes, and practices of Brazilian food truck food handlers, *Nutrients* 11 (8) (2019) 1784.
- [6] A. Wolle, K. Hirvonen, A. de Brauw, K. Baye, G.T. Abate, Household Food Consumption Patterns in Addis Ababa, Ethiopia, *Int. Food Policy Res. Inst.* (2020).
- [7] F.A. Chekol, M.F. Melak, A.K. Belew, E.G. Zeleke, Food handling practice and associated factors among food handlers in public food establishments, Northwest Ethiopia, *BMC Res. Notes* 12 (1) (2019) 20.
- [8] P.K. Panchal, P. Bonhote, M.S. Dworkin, Food safety knowledge among restaurant food handlers in Neuchâtel, Switzerland, *Food Protect. Trends* 33 (3) (2013) 133–144.
- [9] J. Garden-Robinson, A Reference Guide for Foodservice Operators, Food and Nutrition Specialist North Dakota State University, NDSU Extension Service, Food Safety Basics, 2012.
- [10] World Health Organization, WHO's First Ever Global Estimates of Foodborne Diseases Find Children under 5 Account for Almost One Third of Deaths, News Release, Geneva, Switzerland, 2015. <https://www.who.int/activities/estimating-the-burden-of-foodborne-diseases>. Accessed 12 December 2020.
- [11] M. Kibret, B. Abera, The sanitary conditions of food service establishments and food safety knowledge and practices of food handlers in Bahir Dar town, *Ethiopian J. Health Sci.* 22 (1) (2012) 27–35.
- [12] H. Ayalew, A. Birhanu, B. Asrade, Review on food safety system: Ethiopian perspective, *Afr. J. Food Sci.* 7 (12) (2013) 431–440.
- [13] S.O. Nee, N.A. Sani, Assessment of knowledge, attitudes and practices (KAP) among food handlers at residential colleges and canteen regarding food safety, *Sains Malays.* 40 (4) (2011) 403–410.
- [14] N.A. Mustaffa, R.A. Rahman, M.H. Hassim, N. Ngadi, Evaluation of knowledge, attitude and practices of food handlers in campus cafeterias, *Chem. Eng. Trans.* 56 (2017) 1297–1302.
- [15] L.A. Teffo, F.T. Tabit, An assessment of the food safety knowledge and attitudes of food handlers in hospitals, *BMC Publ. Health* 20 (1) (2020) 1–2.
- [16] S.T. Odonkor, C.J. Odonkor, An assessment of food safety knowledge and practices in the Ghanaian hospitality industry, *J. Food Qual.* (2020) 2020.
- [17] D. Legesse, M. Tilahun, E. Agedew, D. Haftu, Food handling practices and associated factors among food handlers in arba minch town public food establishments in Gamo Gofa Zone, Southern Ethiopia, *Epidemiology* 7 (302) (2017) 2161–2165.
- [18] H. Ghazali, M. Othman, N.M. Nashuki, N.A. Roslan, I.N. Wahida, Food Hygiene Knowledge, Attitudes and Practices Among Food Handlers in Restaurant in Selayang Area, 2012.
- [19] L.M. Zanin, D.T. da Cunha, V.V. de Rosso, V.D. Capriles, E. Stedefeldt, Knowledge, attitudes and practices of food handlers in food safety: an integrative review, *Food Res. Int.* 100 (2017) 53–62.
- [20] L.T. Rebouças, L.B. Santiago, L.S. Martins, A.C. Menezes, M.D. Araújo, R.C. de Castro Almeida, Food safety knowledge and practices of food handlers, head chefs and managers in hotels' restaurants of Salvador, Brazil, *Food Control* 73 (2017) 372–381.
- [21] D. Lestantyo, A.H. Husodo, S. Irvati, Z. Shaluhayah, Safe food handling knowledge, attitude and practice of food handlers in hospital kitchen, *Int. J. Publ. Health Sci.* 6 (4) (2017) 324–330.
- [22] M. Marais, N. Conradie, D. Labadarios, Small and micro enterprises—aspects of knowledge, attitudes and practices of managers' and food handlers' knowledge of food safety in the proximity of Tygerberg Academic Hospital, Western Cape, S. Afr. J. Clin. Nutr. 20 (2) (2007) 50–61.
- [23] T. Assefa, H. Tasew, B. Wondafraash, J. Beker, Contamination of bacteria and associated factors among food handlers working in the student cafeterias of Jimma University Main Campus, Jimma, South West Ethiopia, *Altern. Integr. Med.* (2015).
- [24] M. Haileelassie, H. Taddele, K. Adhana, Source (s) of contamination of raw and ready-to-eat foods and their public health risks in Mekelle City, Ethiopia, *ISABB J. Food Agric. Sci.* 2 (2) (2012) 20–29.
- [25] Office of the Mayor, Addis Ababa, Yeka Sub-city, Retrieved December 12, 2020, <http://www.addisababa.gov.et/gl/web/guest/yeka-sub-city>, 2017. Accessed 13, December 2020.
- [26] UN-HABITAT, United Nations Human Settlements Program, Urban inequities report: Addis Ababa, *Cities Citizens Ser.* 2 (2003).

- [27] F. Akabanda, E.H. Hlortsi, J. Owusu-Kwarteng, Food safety knowledge, attitudes and practices of institutional food-handlers in Ghana, *BMC Publ. Health* 17 (1) (2017) 40.
- [28] A.G. Tessema, K.A. Gelaye, D.H. Chercos, Factors affecting food handling Practices among food handlers of Dangila town food and drink establishments, North West Ethiopia, *BMC Publ. Health* 14 (1) (2014) 1–5.
- [29] Reta MA, Lemma MT, Gemeda AA, Lemlem GA. Food Handling Practice and Associated Factors Among Food Handlers Working in Food Establishments in Woldia Town, Northeast Ethiopia.
- [30] J. Azanaw, M. Gebrehiwot, H. Dagne, Factors associated with food safety practices among food handlers: facility-based cross-sectional study, *BMC Res. Notes* 12 (1) (2019) 683.
- [31] U.M. Asmawi, A.A. Norehan, K. Salikin, N.A. Rosdi, N.A. Munir, N.B. Basri, An assessment of knowledge, attitudes and practices in food safety among food handlers engaged in food courts, *Curr. Res. Nutr. Food Sci. J.* 6 (2) (2018) 346–353.
- [32] A.M. Abdi, A. Amano, A. Abraham, M. Getahun, S. Ababor, A. Kumie, Food hygiene practices and associated factors among food handlers working in food establishments in the Bole sub city, Addis Ababa, Ethiopia, *Risk Manag. Healthc. Pol.* 13 (2020) 1861.
- [33] A.M. Girmay, S.R. Gari, B. Mengistie Alemu, M.R. Evans, A.G. Gebremariam, Determinants of sanitation and hygiene status among food establishments in Addis Ababa, Ethiopia, *Environ. Health Insights* 14 (2020), 1178630220915689.
- [34] A. Meleko, A. Henok, W. Tefera, T. Lamaro, Assessment of the sanitary conditions of catering establishments and food safety knowledge and practices of food handlers in Addis Ababa University Students' Cafeteria, *Science* 3 (5) (2015) 733–743.