

## **Determinants of Sanitation and Hygiene Status Among Food Establishments in Addis Ababa, Ethiopia**

Authors: Girmay, Aderajew Mekonnen, Gari, Sirak Robele, Mengistie Alemu, Bezatu, Evans, Martin R, and Gebremariam, Azage Gebreyohannes

Source: Environmental Health Insights, 14(1)

Published By: SAGE Publishing

URL: <https://doi.org/10.1177/1178630220915689>

---

BioOne Complete ([complete.BioOne.org](https://complete.BioOne.org)) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/terms-of-use](https://www.bioone.org/terms-of-use).

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

---

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

# Determinants of Sanitation and Hygiene Status Among Food Establishments in Addis Ababa, Ethiopia

Environmental Health Insights  
Volume 14: 1–9  
© The Author(s) 2020  
Article reuse guidelines:  
sagepub.com/journals-permissions  
DOI: 10.1177/1178630220915689



Aderajew Mekonnen Girmay<sup>1</sup> , Sirak Robele Gari<sup>1</sup>,  
Bezatu Mengistie Alemu<sup>2</sup>, Martin R Evans<sup>3</sup>  
and Azage Gebreyohannes Gebremariam<sup>1</sup>

<sup>1</sup>Ethiopian Institute of Water Resources (EIWR), Addis Ababa University, Addis Ababa, Ethiopia.

<sup>2</sup>College of Health and Medical Sciences, Haramaya University, Haramaya, Ethiopia.

<sup>3</sup>Microbiology Consultant and Laboratory Director, New York, NY, USA.

## ABSTRACT

**INTRODUCTION:** Despite advancements in food science and technology, foodborne disease remains one of the major public health problems. Poor sanitation and hygiene conditions of food establishments are the major causes for the occurrence of foodborne disease. Therefore, this study aimed to investigate core determinants of sanitation and hygiene status among food establishments.

**METHODS:** Institution-based cross-sectional study design was conducted in Addis Ababa city. A stratified random sampling technique was deployed to select 413 study participants. Data were collected through interview and using observational checklist. Sample size was determined by using a single population proportion formula. To analyze the data, binary logistic regression and multivariable logistic regression analysis was conducted. In all analysis, *P*-value less than .05 were considered statistically significant.

**RESULTS:** The study revealed that 57.4% of the food establishments were under poor sanitation status. In the multivariable analysis, presence of trained managers on hygiene and sanitation (adjusted odds ratio [AOR]=6.10 with 95% confidence interval [CI]: 2.41-15.45), presence of renewed licenses (AOR=3.07 with 95% CI: 1.18-7.99), absence of bureaucratic function to obtain permission to renew the food establishment buildings (AOR=2.43 with 95% CI: 1.25-4.70), and presence of at least 10-m distance between toilet and kitchen (AOR=9.19, at 95% CI: 5.63-15.02) were associated significantly with sanitation and hygiene status.

**CONCLUSIONS:** Above average of the food establishments were found to be in poor sanitation and hygiene state. Many core determinant factors that influence sanitation and hygienic status of food establishments were identified. The researchers suggest that formal training on sanitation and hygiene for managers of food establishments should be provided to reduce the occurrence of foodborne diseases. Moreover, strong food and water safety policy and strategy should be promulgated to improve sanitation and hygiene status of food establishments.

**KEYWORDS:** Sanitation, hygiene, food establishment, determinant factor, Addis Ababa

**RECEIVED:** December 26, 2019. **ACCEPTED:** February 28, 2020.

**TYPE:** Original Research

**FUNDING:** The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Ethiopian Institute of Water Resources, Addis Ababa University was the funder to this study. The funders had no role in study design, data collection, analysis, decision to publish, and interpretation of the data or preparation of the manuscript for publication.

**DECLARATION OF CONFLICTING INTERESTS:** The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**CORRESPONDING AUTHOR:** Aderajew Mekonnen Girmay, Ethiopian Institute of Water Resources (EIWR), Addis Ababa University, P. O. Box 81134, AAiT Campus, Addis Ababa, Ethiopia. Email: [aderajewmekonnen1@gmail.com](mailto:aderajewmekonnen1@gmail.com)

## Introduction

Foodborne disease remains a major public health problem worldwide.<sup>1-4</sup> Specially, it is more severe in low-income countries due to poor sanitation, insufficient food safety laws, and weak regulatory systems.<sup>5,6</sup> The African and the South-East Asia Regions have the highest foodborne incidence and highest death rates.<sup>7</sup> Specifically, due to poor water quality and inadequate sanitation facilities, the Sub-Saharan Africa countries have been a great burden of foodborne and waterborne illness.<sup>8-10</sup> Adequate sanitation, together with good hygiene and safe water, is fundamental to good health and to social and economic development.<sup>11</sup> That is why many scholars said “sanitation is more important than independence.”<sup>12</sup> However, the World Health Organization estimated that in developing countries up to 2 million deaths are estimated per year which aggravated due to poor sanitation and hygiene practices.<sup>13</sup> In Africa, it is estimated that 92 million people fall ill from consuming contaminated foods, resulting in 137000 deaths each year.<sup>14</sup> Diarrheal diseases

caused an estimated 1.3 million deaths and are the fourth leading cause of years of life lost in developing countries.<sup>15</sup> Between 1998 and 2004, an average of 9040 foodborne and waterborne disease outbreaks were reported to the Centers for Disease Control and Prevention and approximately 4675 (52%) of these were attributed to food establishments.<sup>16</sup> Rapid urbanization and changes in lifestyle led people to eat outside of their house frequently and it causes to foster many food establishments which characterized with poor sanitation status like unhygienic kitchen, poor accessibility of water supply, and poor practice of liquid and solid wastes management.<sup>17</sup> However, each food establishment which supplies food for a large number of customers has the responsibility to maintain the safety and wholesomeness of food items although still foodborne disease outbreaks arise from food establishments. Although the federal government of Ethiopia launched food and water safety packages at the capital city, Addis Ababa in 2009, still the city has recurrent foodborne and waterborne outbreaks.<sup>18</sup>



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

A large number of food establishments were found in Addis Ababa. Most of the food establishments have been subjected to poor sanitation and hygiene practice. As a result, recurrent foodborne and waterborne outbreaks especially diarrheal diseases including acute watery diarrhea have occurred and many users of the food establishments are exposed to many health problems. Therefore, this study aimed to assess determinants of sanitation and hygienic condition among food establishments to improve the community health. Furthermore, the finding of this study might assist to make sound decisions that target tackling the health problems of the food establishment customers and residents of the city. This study also has a significant input in the formulation of appropriate strategy for program planning and evaluation to improve the sanitation status. In conclusion, this study has an important contribution to solving community health problems arising from poor sanitation and hygiene practice of food establishments. Furthermore, the new results of this study may also be used by policy makers and other concerned bodies as a reference, on which to base decisions.

## Methods

### *Description of the study area*

The study was conducted in Addis Ababa city. According to the 2017 report of Addis Ababa Food, Medicine and Health Care Administration and Control Authority (AAFMHACA), there are 1141 licensed food establishments in the city. The location map of the Addis Ababa city is depicted in Figure 1.

### *Study design*

An institutional-based cross-sectional study was conducted among food establishments of Addis Ababa city administration from July to August 2019 to assess determinants of sanitation and hygiene status.

### *Study population*

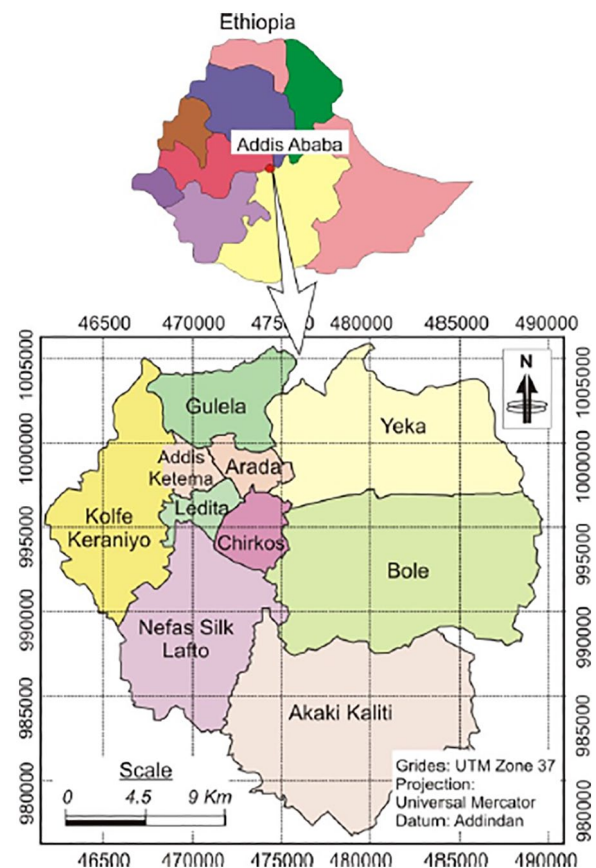
All selected food establishments located in Addis Ababa city administration.

### *Inclusion criteria*

All food establishments that have been provided service for at least 6 months in the city was the inclusion criteria.

### *Sample size determination*

The sample size was calculated using a single population proportion formula (EPI INFO version 7.2.2.6); with the assumption of 46.2% proportion (P) of food establishments used hygienic practices observed in kitchen (wash utensils using hot water),<sup>16</sup> acceptable margin of error 0.05 (d), and with 95% confidence level ( $Z_{\alpha/2}$ ), the sample size will be calculated. For



**Figure 1.** Map of Addis Ababa city administration. Source: Girmay et al.<sup>19</sup>

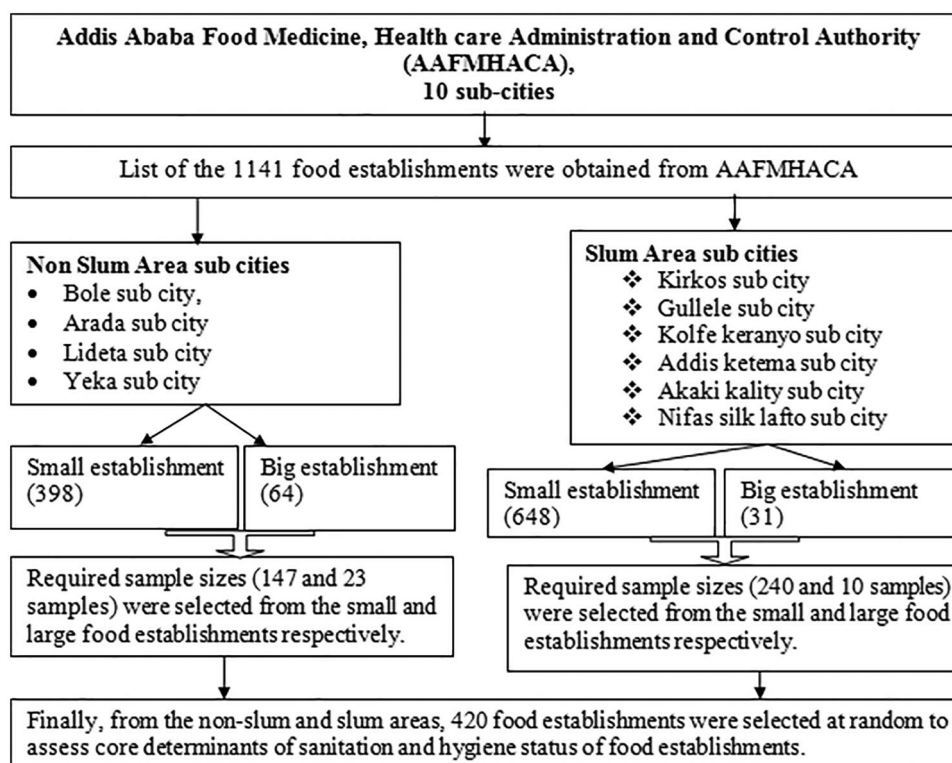
the non-response rate, 10% contingency was also considered. Accordingly, the required sample size was 420.

$$n = \frac{(Z^2) \times P(1-P)}{d^2}$$

where n is the calculated sample size, z is the standard score corresponding to 95% confidence interval (CI), P is the assumed poor sanitary status of the food establishments (46.2%), and d is the marginal error (5%). Then,  $n = \frac{(1.96)^2 \times (0.5)^2}{(0.05)^2}$ ,  $n = 382 + 38 = 420$  Therefore, the sample size (n) for this study was = 420.

### *Sampling procedure*

The study participants were selected using a stratified, simple random sampling technique. To collect data, a listing of the 1141 the licensed food establishments was obtained from AAFMHACA. These 1141 food establishments were stratified into slum and non-slum areas based on their location. Sample allocation was conducted in the slum and non-slum areas in addition to the large and small food establishments. After the food establishments were stratified based on their location and size (large or small), the required sample was selected at random. Based on this, 170 and 250 samples of food establishments were taken from the



**Figure 2.** Systematic structure of the study sampling procedure.

non-slum and slum areas, respectively. From the non-slum area (170), 23 samples from the large and 147 samples from the small food establishments were collected. Besides, from the slum area (250), 10 samples from the large and 240 samples from the small food establishments were collected. Finally, using a simple random sampling technique, 420 food establishments were selected to assess sanitation and hygiene status. A stratified random sampling technique was used in both slum and non-slum areas as well as large and small food establishments of Addis Ababa. The main purpose of stratification was to ensure representativeness for food establishments. In summary, the sampling procedure for this study is depicted in Figure 2.

#### *Data collection procedures*

Data enumerators were identified based on professional capability and technical experience in collecting the required data. Accordingly, 15 health professionals with Bachelor of Science with extensive experience in a similar data collection practices were employed. In addition, 4 Master's degree holders who acted as supervisors were recruited for supervision of data collection. Two-day training was given to the data collectors and supervisors. After written consent was obtained from each food establishment managers, the data were collected using observational checklist and through face-to-face interview using structured questionnaire adopted from similar literatures. Furthermore, a meter was used to measure horizontal distance between toilet and kitchen.

#### *Data quality assurance*

A questionnaire was prepared in English and translated into Amharic and back to English to keep the consistency of questions. The quality of data was ensured through training of data collectors, close supervision, prompt feedback, and daily recheck of completed questionnaire.

#### *Data analysis*

All data were checked for correctness of information and code. Data analyses were performed by using SPSS (Statistical Package for the Social Sciences) software version 20. Descriptive statistics such as frequency for categorical and mean and standard deviation for numerical data were used. Moreover, to analyze the data, binary logistic regression and multivariable logistic regression analysis was conducted. In all analysis,  $P$ -value less than .05 was considered statistically significant.

#### *Operational definitions of key terms*

*Sanitation and hygiene status* is the outcome variable of this study, which was computed by taking summation of 24 criteria, indicated in Table 2. Each criterion was given a value of 1 for the presence of sanitary condition or correct response and 0 for the absence or incorrect response. The sum of these conditions was calculated and the mean score of all observations and interview questions was used as a cut-off point to categorize establishments as good or poor sanitation status. Food establishments with equal to



or higher than mean value ( $\geq 16.8$ ) were categorized under good sanitation and hygiene status, whereas food establishments which score below mean ( $< 16.8$ ) were considered as poor sanitary conditions.

*Food establishments:* means institutions that provide food and drinks for selling to customers.

*Large food establishment:* hotels with one or more stars.

*Small food establishment:* small vendors, non-star hotels, bars, restaurants, cafes.

*Slum area:* area with poorer sanitation infrastructure.

*Non-slum area:* area with better sanitation infrastructure.

*Adequate ventilation:* refers to food establishments feeding room which had windows that can be approximately 10% of its floor.

*AOR:* adjusted odds ratio.

*COR:* crude odds ratio.

### Study variables

*Independent or explanatory variables.* The predictor variables of this study were distance between toilet and kitchen, source of water supply, functional shower, functional refrigerator, functional toilet, functional hand-washing, renewed license, regulatory inspection, 3 dishwashing systems, separate kitchen, water storage, utensil cleanliness, bureaucratic function to obtain permission from the authorized body to renew the food establishment buildings, food handlers having health examination certificate, liquid and solid waste management practice, etc.

*Dependent or outcome or response variables.* Outcome of this study was sanitation and hygiene status.

### Ethical consideration

First, a letter of support was obtained from the Ethiopian Institution of Water Resources, Addis Ababa University. Then, ethical approval was obtained from the Ethiopian Public Health Institute Scientific and Ethical Review Board with reference number EPHI 613/138 in June 2019. To collect the data, written consent was obtained from each respondent after the objectives of this particular study were explained. Candidates were informed that their participation was voluntary. Confidentiality and privacy of respondents were ensured throughout the research process. The study design did not harm those taking part and it did not include any identifying information like name or address of respondents and establishments. They were well informed by the data collectors that the study was only for the purpose of academic and institutional research and not for any other business or illegal activities.

Then, data were collected after assuring the confidential nature of responses.

## Results

### *Socio-demographic characteristics of food establishment managers*

The study assessed a total of 413 licensed food establishments, which includes 7.7% hotels with one or more stars, 13.3% non-star hotels, 27.1% bar and restaurants, 7% cafe and restaurants, 38% restaurants, 2.2% groceries, and 4.6% cafe and others. However, only 28.1% of the food establishments had renewed license. Of the total observed food establishments, 92.3% of these were small food establishments. The mean year of service of the food establishments was 6.98 years ranges from 1 to 22 years. Out of the 420 managers representing those food establishments, 413 participated in the study with a response rate of 98.33%. From the total participated managers of the food establishments, 62.5% of them were male. Two thirds of the managers, 66.3%, were found to be above 39 years. The age of participants representing the food establishments ranges from 21 to 78 years, with a mean age of 45.2 years. Nearly all (94.9%) of the food establishment managers were found to have ability at least reading and writing. However, only 31.2% and 32.7% of the food establishment managers and food handlers took training about sanitation and hygiene in the past 1 year, respectively. Furthermore, only 27.6% of the managers owned the food establishment building (Table 1).

### *Sanitation and hygiene status of food establishments*

In this study, the researchers assessed the overall sanitation and hygiene condition of the food establishments. The percentage mean score of availability of sanitation and hygiene facility questions was found to be  $70.1\% \pm 20.19\%$ . Moreover, the mean of correct answer questions to sanitation and hygiene status of food establishments was found to be 16.8. However, based on the cut-off point, only 42.6% of food establishments had good sanitation and hygiene status. Above three fourths (83.3%) of managers of the food establishments faced bureaucratic function to obtain permission from the authorized body to renew the food establishment buildings. Most of the food establishments' (98.1%) source of drinking water was municipality. Furthermore, 91% of the food establishments had private piped water. However, only 28.3% of the food establishments received continuous piped drinking water supply. 90.8% of those had disinfectants for washing water storage equipment. Two thirds (65.6%) of the food establishments had 3 dishwashing systems which assisted to reduce contamination and food-borne disease. However, only 38.4% of the food establishments had a functional shower facility. Nearly all (93.7%) and above three fourths (77.7%) of the food establishments had a functional toilet and a functional refrigerator, respectively. Moreover, 87.2% and 93.5% of the food establishments had a functional

**Table 1.** Socio-demographic characteristics of food establishment managers (n=413).

STUDY VARIABLES	CATEGORY	FREQUENCY	%	MEAN	STANDARD DEVIATION
Sex of managers	Male	258	62.5		
	Female	155	37.5		
Age group of managers	<25y	11	2.7	45.3	11.34
	25-29y	14	3.4		
	30-34y	53	12.8		
	35-39y	61	14.8		
	>39y	274	66.3		
Educational status of managers	Illiterate	21	5.1		
	At least read and write	392	94.9		
Trained managers about hygiene and sanitation in the past 1 year	Yes	129	31.2		
	No	284	68.8		
Trained food handlers about hygiene and sanitation in the past 1 year	Yes	135	32.7		
	No	278	67.3		
Ownership of food establishment building	Private	114	27.6		
	Rent	299	72.4		
Service year of food establishments	<5y	165	40.0	8.26	16.043
	5-9y	155	37.5		
	10-14y	58	14.0		
	15-19y	23	5.6		
	>19y	12	2.9		
Renewed license by authorized body	Yes	116	28.1		
	No	297	71.9		
Type of food establishment managers owned	One star and above hotels	32	7.7		
	Non-star hotels	55	13.3		
	Bar and restaurant	112	27.1		
	Cafe and restaurant	29	7.0		
	Restaurant	157	38.0		
	Grocery	9	2.2		
	Cafe and others	19	4.6		
Type of food establishments	Small	381	92.3		
	Large	32	7.7		

hand washing facility near the toilet and a separated kitchen, respectively. Meanwhile, 45.8% of the food establishments had no running tap water for food preparation and equipment

washing in the kitchen. In addition, 48.4% of the food establishments did not have at least 10 m horizontal distance between toilet and kitchen.

**Table 2.** Availability of sanitation and hygiene facilities among food establishments (n=413).

S. NO.	CRITERIA FOR SANITATION AND HYGIENE STATUS OF FOOD ESTABLISHMENTS	ANSWERS % (N)	
		PRESENT	ABSENT
1.	Absence of bureaucratic function to obtain permission from authorized body to renew food establishment buildings	16.7 (69)	83.3 (344)
2.	Source of the drinking from municipality	98.1 (405)	1.9 (8)
3.	Private piped water in food establishments	91 (376)	9 (37)
4.	Continuous piped drinking water supply in food establishments	28.3 (117)	71.7 (296)
5.	Disinfectants for washing water storage equipment in food establishments	90.8 (375)	9.2 (38)
6.	Three dishwashing systems in food establishments	65.6 (271)	34.4 (142)
7.	Functional shower facility in food establishments	38.7 (160)	61.3 (253)
8.	Functional refrigerator in food establishments	77.7 (321)	22.3 (92)
9.	Functional toilet in food establishments	93.7 (387)	6.3 (26)
10.	Functional hand-washing facility near toilet in food establishments	87.2 (360)	12.8 (53)
11.	Soap near hand washing facility in food establishments	72.6 (300)	27.4 (113)
12.	Separate kitchen in the food establishments	93.5 (386)	6.5 (27)
13.	Running tap water for food preparation and equipment washing in kitchen	45.8 (189)	54.2 (224)
14.	At least 10-m distance between toilet and kitchen	51.6 (213)	48.4 (200)
15.	Inspection by regulatory body at least within a month	83.8 (346)	16.2 (67)
16.	Septic tank for liquid waste	79.2 (327)	20.8 (86)
17.	Presence of temporary solid waste storage containers in the food establishments	97.8 (404)	2.2 (9)
18.	Solid wastes taken from the food establishments containers within 7 days	85.5 (353)	14.5 (60)
19.	Practice of segregation of combustible and non-combustible solid wastes	66.1 (273)	33.9 (140)
20.	Food handlers having health examination certificate at least within the past 3 months	78.9 (326)	21.1 (87)
21.	Personal protective devices during the time of this questionnaire filled (white gown, hair protective cloth)	65.4 (270)	34.6 (143)
22.	Dressing room to food handlers	38.3 (158)	61.7 (255)
23.	Storage room for non-perishable foods	66.1 (273)	33.9 (140)
24.	Adequate ventilation	69.7 (288)	30.3 (125)
Percentages mean score of correct answer to availability of sanitation and hygiene facilities		70.1% ± 20.19%	

Of the assessed food establishments, 83.8%, 79.2%, and 97.8% had an inspection by regulatory body at least within a month, a septic tank for liquid waste, and a temporary solid waste storage containers/receptacles, respectively. Furthermore, 66.1% of the food establishments had practice of segregation of combustible and non-combustible solid wastes. Although 65.4% of the food handlers had personal protective devices like white gown and hair protective cloth, only 21.1% of the food handlers had health examination certificate at least within the past 3 months prior to the study. Moreover, only 38.3% of the food handlers had a dressing room. From the observed food establishments, 66.1% and 69.7% of these had storage room for non-perishable food items and adequate ventilation, respectively (Table 2).

#### *Determinants of hygiene and sanitation status among food establishments*

In the binary logistic regression analysis, 6 predictor variables—educational status of managers, presence of trained managers about sanitation and hygiene, presence of trained food handlers, presence of renewed license, absence of bureaucratic function to obtain permission from the authorized body to renew the food establishment buildings, and presence of at least 10-m horizontal distance between toilet and kitchen—were significantly associated ( $P$ -value  $< .028$  at 95% CI) with sanitation and hygiene status of the food establishments. To control confounders, the 6 significant explanatory variables were fitted to the condensed model of multivariable analysis.

**Table 3.** Multivariable logistic regression analysis of determinants of sanitation and hygiene status among food establishments (n=413).

STUDY VARIABLES		SANITATION STATUS		COR WITH 95% CI	AOR WITH 95% CI
		GOOD	POOR		
Trained managers about sanitation and hygiene in the past 1 year	Yes	76	53	2.64 (1.72-4.04)	6.10 (2.41-15.45)
	No	100	184	1.00	1.00
Renewed license by authorized body	Yes	67	49	2.36 (1.52-3.65)	3.07 (1.18-7.99)
	No	109	188	1.00	1.00
Absence of bureaucratic to obtain permission to renew the food establishments	Yes	157	187	1.00	1.00
	No	19	50	2.21 (1.25-3.90)	2.43 (1.25-4.70)
At least 10-m distance between toilet and kitchen	Present	139	74	8.28 (5.25-13.04)	9.19 (5.63-15.02)
	Absent	37	163	1.00	1.00

Abbreviations: AOR, adjusted odds ratio; COR, crude odds ratio.

However, in the multivariable analysis, only 4 explanatory variables—including presence of trained managers, presence of renewed licenses, absence of bureaucratic to obtain permission to renew the food establishments, and presence of at least 10-m horizontal distance between toilet and kitchen—were significantly associated ( $P$ -value  $< .022$  at 95% CI) with sanitation and hygiene status. The final condensed model of multivariable analysis was conducted to identify the explanatory variables of sanitary condition of the food establishments. Accordingly, food establishments which owned trained managers about sanitation and hygiene were 6.10 times more likely to be in good sanitation and hygienic condition when compared to food establishments that did not have trained managers (AOR = 6.10, with 95% CI: 2.41-15.45). Furthermore, food establishments which have renewed license by authorized body were 3.07 times more likely to be in good sanitation and hygiene condition than those which have not renewed their license (AOR = 3.07 with 95% CI: 1.18-7.99). On the other hand, food establishments which had not faced bureaucratic function to obtain permission from the authorized body for renewal of the food establishment buildings were 2.43 times more likely to be in good sanitation and hygiene condition than those which had faced bureaucratic function (AOR = 2.43 with 95% CI: 1.25-4.70). Besides, food establishments which had at least 10-m horizontal distance between toilet and kitchen were 9.19 times more likely to be in good sanitary condition compared to those which had not (AOR = 9.19 with 95% CI: 5.63-15.02) (Table 3).

## Discussion

The findings of the study revealed that above half (57.4%) of the food establishments were in a condition of poor sanitation and hygiene status. The major reasons might be the presence of bureaucratic function from the authorized body to renew the

food establishment buildings, absence of continuous piped drinking water supply, absence of functional shower facility, and poor liquid and solid waste management practice. Especially, absence of continuous piped drinking water supply could be the leading cause to poor sanitation and hygiene status. Moreover, it might be a main factor to foster foodborne disease in the city.

The finding of this study is lower than a study conducted in Bahirdar town where 78.7% of food establishments had poor sanitation and hygiene status.<sup>20</sup> However, the findings of this study is higher than a study conducted in the Mekelle town, Tigray, north Ethiopia where only 17.1% of the food establishments had good sanitary status.<sup>21</sup> This difference might be due to the rapid development and urbanization in the capital city in addition to socio-economic status of the research areas.

In this study, presence of trained food establishment managers on sanitation and hygiene, presence of renewed license, absence of bureaucratic of housing regulation law to renew the food establishments, and presence of at least 10-m horizontal distance between toilet and kitchen were the predictor variables significantly associated ( $P$ -value  $< .028$  at 95% CI) with sanitation and hygiene status. The finding of the study indicated that the proportion of food establishments which had a renewed formal license certificate was 28.1%. The main reason could be due to ineffective effort of authorized health inspectors (concerned regulatory bodies) and absence of strong law and rule of the trade and industry of the city. Moreover, involuntariness of food establishment managers to renew their license might be a second factor. However, the observed food establishments which renewed their license certificate have improved sanitation status compared to these which had not renewed their license.

The finding revealed that only 31.2% and 32.7% of the food establishment managers and food handlers took training about



sanitation and hygiene in the past 1 year, respectively. Although presence of trained food handlers and managers can reduce foodborne disease and enhanced sanitation and hygiene practice of food establishments,<sup>22</sup> the result of this study indicated that a significant number of food handlers and managers had not received training. This indicated that there is a gap in creation of awareness and attention provision by the Government and concerned bodies to combat foodborne disease.

Furthermore, the finding of this study revealed that food establishments with managers who took training on sanitation and hygiene were 6.10 times more likely to have good sanitation and hygiene status when compared to their counter parts (AOR=6.10 with 95% CI: 2.41-15.45). Many studies indicated that knowledge and training of managers and staffs on sanitation and hygiene have a direct relationship on the overall sanitation and hygiene improvement of food establishments.<sup>23,24</sup> This revealed that gaining knowledge through training had a positive effect on ensuring sanitation and hygienic condition of food establishments and food safety practices thereby reducing foodborne illness. This is supported by a study conducted by Hedberg et al<sup>25</sup> which stated that managers who took food hygiene and sanitation training were associated with a reduced risk for foodborne illness. Moreover, different studies showed that managers' knowledge and training about hygiene and sanitation have a direct influence on the sanitation and hygiene condition of food establishments. They play a paramount role by ensuring availability and cleanliness of sanitary facilities, proper waste management, and food safety practices.<sup>20,26</sup>

In this study, the odds of food establishments which have renewed license were 3.07 times more likely to have good sanitation and hygiene status than the odds of those which had not (AOR=3.07 with 95% CI: 1.18-7.99). This could be due to the role of inspection by the regulatory body since food establishment license is renewed after conducting firm regulatory inspection. However, opposite to this study, a study done in Adwa town states that licensing had no significant association with sanitary status.<sup>27</sup> This might be due to the difference in the level of awareness creation and economic status of the cities.

The odds of food establishments which had not received bureaucratic function to obtain permission from the authorized body to renew the food establishment buildings were 2.43 times more likely to have good sanitation and hygiene status than the odds of those which had obtained (AOR=2.43 with 95% CI: 1.25-4.70). This indicated that, to renew the food establishment buildings, the presence of bureaucratic function to obtain permission from the authorized body created an influence on the sanitation and hygiene of the food establishments. However, suitable formal permission to renew the food establishments without bureaucratic could be a basic instrument to improve the sanitation and hygiene status of the food establishments although this needs additional studies. The study also revealed that the odds of food establishments with more than 10 m distance between their toilet and kitchen were

9.19 times more likely to have good sanitation and hygienic condition than the odds of those with 10 m or less (AOR=9.19, at 95% CI: 5.63-15.02). This indicates that distance between toilet and kitchen might be a core determinant factor that influences sanitation and hygiene of food establishments. Moreover, adequate distance between toilet and kitchen can prevent cross contamination and reduced foodborne disease.

## Conclusions

Above average of the food establishments were found to be in poor sanitation and hygiene state. Assessing sanitation and hygiene status of food establishments is an important activity to curbed foodborne diseases. In the finding, presence of trained managers, presence of renewed licenses, absence of bureaucratic function to obtain permission from the authorized body to renew the food establishment buildings, presence of at least 10-m horizontal distance between toilet and kitchen, absence of continuous piped drinking water supply, absence of functional shower facility, and poor liquid and solid waste management practice were the main determinant factors that influence the sanitation and hygienic status of food establishments. The study introduces core determinants useful for increasing community awareness, financing in the water sanitation and hygiene (WaSH) sector as well as enhancing the capacity training programs in water sanitation and hygiene (WaSH), monitoring, evaluation and learning (MEL) system among the food establishments, which have a paramount importance for the sustainability of the sector.

## Recommendation

The researchers suggest that formal and informal training on sanitation and hygiene for managers of food establishments should be provided to reduce the occurrence of foodborne diseases. Strong food and water safety policy and strategy should be promulgated to improve sanitation status of food establishments. The Government should be allocating adequate and continuous water supply to the food establishments to upgrade the sanitation and hygiene status, thereby enhancing the health of the residents. Moreover, the managers/owners of the food establishments should provide attention to fulfill hygienic facilities. The researchers also suggest further study to explore additional determinants of sanitation and hygiene status among the food establishments in the study area.

## Acknowledgements

The researchers would like to thank the Ethiopian Institute of Water Resources, Addis Ababa University, for providing Financial Support. In addition, the authors like to express gratitude to the data collectors, supervisors, and study participants.

## Author Contributions

AMG, SRG, BMA, MRE, and AGG contributed to conceptualization, methodology, investigation, data curation, formal analysis, validation and visualization, writing-review, and

editing and approving. AMG contributed to funding acquisition and writing original draft.

## ORCID iD

Aderajew Mekonnen Girmay  <https://orcid.org/0000-0002-7911-4152>

## REFERENCES

1. Pal M, Mahendra R. *Sanitation in Food Establishments*, June 2015:176. Germany: LAP Lambert Academic Publishing.
2. Kassa H, Silverman GS, Baroudi K. Effect of a manager training and certification program on food safety and hygiene in food service operations. *Environ Health Insights*. 2010;4:13-20.
3. Tadesse G, Mitiku H, Teklemariam Z, Marami D. *Salmonella* and *Shigella* among asymptomatic street food vendors in the Dire Dawa city, Eastern Ethiopia: prevalence, antimicrobial susceptibility pattern, and associated factors. *Environ Health Insights*. 2019;13:1178630219853581.
4. Decker BK, Palmore TN. The role of water in healthcare-associated infections. *Curr Opin Infect Dis*. 2013;26:345-351.
5. Tessema AG, Gelaye KA, Chercos DH. Factors affecting food handling Practices among food handlers of Dangila town food and drink establishments, North West Ethiopia. *BMC Public Health*. 2014;14:571.
6. Ayana Z, Yohannis M, Abera Z. Food-borne bacterial diseases in Ethiopia. *Acad J Nutr*. 2015;4:62-76.
7. World Health Organization. *Investing to Overcome the Global Impact of Neglected Tropical Diseases: Third WHO Report on Neglected Tropical Diseases 2015*, Vol. 3. Geneva, Switzerland: World Health Organization; 2015.
8. Osiemo MM, Ogendi GM, M'Erimba C. Microbial quality of drinking water and prevalence of water-related diseases in Marigat Urban Centre, Kenya. *Environ Health Insights*. 2019;13:1178630219836988.
9. Ananth M, Rajesh R, Amjith R, et al. Contamination of household open wells in an urban area of Trivandrum, Kerala State, India: a spatial analysis of health risk using geographic information system. *Environ Health Insights*. 2018;12:1178630218806892.
10. WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. *Progress on Sanitation and Drinking Water: 2015 Update and MDG Assessment*. Geneva, Switzerland: World Health Organization; 2015.
11. Mara D, Lane J, Scott B, Trouba D. Sanitation and health. *PLoS Medicine*. 2010;7:e1000363.
12. Alimi BA. Risk factors in street food practices in developing countries: a review. *Food Sci Human Wellness*. 2016;5:141-148.
13. Chaib F, Lawe-Davies O. *Who's First Ever Global Estimates of Foodborne Diseases Find Children Under 5 Account for Almost One Third of Deaths*; 2017. <https://www.who.int/news-room/detail/03-12-2015-who-s-first-ever-global-estimates-of-foodborne-diseases-find-children-under-5-account-for-almost-one-third-of-deaths>
14. Waithaka PN, Maingi JM, Nyamache AK. Physico-chemical and microbiological analysis in treated, stored and drinking water in Nakuru North, Kenya. *Int J Microbiol Epidemiol Res*. 2014;24:29-37.
15. Hodge J, Chang HH, Boisson S, Collin SM, Peletz R, Clasen T. Assessing the association between thermotolerant coliforms in drinking water and diarrhea: an analysis of individual-level data from multiple studies. *Environ Health Perspect*. 2016;124:1560-1567.
16. Boro P, Soyam VC, Anand T, Kishore J. Physical environment and hygiene status at food service establishments in a tertiary care medical college campus in Delhi: a cross-sectional study. *Asian J Med Sci*. 2014;6:74-79.
17. Elmi M. Food safety: current situation, unaddressed issues and the emerging priorities. *East Mediterr Health J*. 2004;10:794-800.
18. Girmay AM, Evans MR, Gari SR, Gebremariam AG, Reta MT. Urban health extension service utilization and associated factors in the community of Gullele sub-city administration, Addis Ababa, Ethiopia. *Int J Community Med Public Health*. 2019;6:976-985.
19. Girmay AM, Gari SR, Alemu BM, Evans MR, Gebremariam AG. Diarrheal disease and associated behavioural factors among food handlers in Addis Ababa, Ethiopia. *AIMS Public Health*. 2020;7:100-113.
20. Kibret M, Abera B. The sanitary conditions of food service establishments and food safety knowledge and practices of food handlers in Bahir Dar town. *Ethiop J Health Sci*. 2012;22:27-35.
21. Kumie A, Zeru K. Sanitary conditions of food establishments in Mekelle town, Tigray, north Ethiopia. *Ethiop J Health Dev*. 2007;21:3-11.
22. Boro P, Soyam VC, Anand T, Kishore J. Physical environment and hygiene status at food service establishments in a tertiary care medical college campus in Delhi: a cross-sectional study. *Asian J Med Sci*. 2015;6:74-79.
23. Meleko A, Henok A, Tefera W, Lamaro T. Assessment of the sanitary conditions of catering establishments and food safety knowledge and practices of food handlers in Addis Ababa University Students' Cafeteria. *Science*. 2015;3:733-743.
24. Fawzi M, Gomaa NF, Bakr W. Assessment of hand washing facilities, personal hygiene and the bacteriological quality of hand washes in some grocery and dairy shops in Alexandria, Egypt. *J Egypt Public Health Assoc*. 2009;84:71-93.
25. Hedberg CW, Smith SJ, Kirkland E, Radke V, Jones TF, Selman CA. Systematic environmental evaluations to identify food safety differences between outbreak and nonoutbreak restaurants. *J Food Prot*. 2006;69:2697-2702.
26. Olumakaiye MF, Bakare KO. Training of food providers for improved environmental conditions of food service outlets in urban area Nigeria. *Food Nutr Sci*. 2013;4:99-105.
27. Gebremariam B, Asmelash B, Tetemke D. Determinants of sanitary status among food establishments in urban setup in Adwa town, Tigray, Ethiopia: a cross-sectional study. *BMC Res Notes*. 2019;12:399.