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Food Safety Practice and Associated Factors of Food Handlers Working in Food Industries in Bahir Dar City, Amhara Regional State, Northwest Ethiopia, 2021

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ABSTRACT

BACKGROUND: Food safety has emerged as one of the 10 threats to global health. Ethiopia is among the developing countries with many food industries in recent times. Poor food handling procedures, a lack of basic infrastructure, lack of potable water, lack of financial resources to invest in safer equipment, and lack of training for food handlers have all been reported.

OBJECTIVES: To assess food safety practices and associated factors among food handlers working in food industries in Bahir Dar city administrations.

METHODS: A cross-sectional study was conducted from January to February 2021 among 422 food handlers working in food industries in Bahir Dar city, Ethiopia. A random sampling technique was used to select food industries and study participants. The sample size was proportionately allocated to the selected food industries. Data were collected through face-to-face interviews and observation methods using interviewer-administered questionnaires and an observational checklist respectively. Data was entered into Epi-data v 3.1 and exported to SPSS v 23 for analysis. Bi-variable binary logistic regression was carried out to identify candidate variables at p-value $<.2$ and was entered into the final multivariable binary logistic regression model to control the effect of confounding. Variables with p-values of less than .05 were declared as statistically significant and an odds ratio of 95% CI was used to measure the strength of the association.

RESULT: Food safety practice among food handlers working in food industries was 47.6% (95% CI: 42.8, 52.5). Sex [AOR: 2.92 (CI: 1.77, 4.82)], monthly salary [AOR: 2.02 (CI: 1.18, 3.44)], health supervision [AOR: 3.43 (CI: 1.97, 5.97)], working unit [AOR: 2.44, (CI: 1.45, 4.13], food safety training [AOR: 6.16 (2.97, 12.77)], attitude [AOR: 3.55 (CI: 1.14, 11.05)] were factors significantly associated with food safety practice.

CONCLUSION: Food safety practice among food handlers was low. Sex, working unit, monthly income, regulatory supervision, food safety training, and attitude toward food safety were factors associated with poor food safety practices. In-service training on good hygiene practices, good manufacturing practices, hazard analysis, critical control point, food safety management systems, and supportive supervision should be strengthened.

KEYWORDS: Food safety practice, food industries, food handlers, food safety management system

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Introduction

Food safety is the process of defending the food supply against microbiological, chemical, allergic, and physical hazards that could arise throughout all stages of food production and handling.[1-3] Food safety management systems comprise the implementation of good manufacturing practices, good hygienic practices, hazard analysis, and critical control points in the food industries.[3]

The provision of numerous activities including food supply, production, harvesting, processing, packaging, transportation, distribution, consumption, and disposal makes the food business a fundamental and significant organization in any country. In contrast, the food business faces serious problems with product quality, consumer health, and sanitation.[4] As a matter of public health, all nations must prioritize food safety[5] and in recent years, there have been several extremely serious outbreaks of foodborne illnesses, the outbreaks frequently affect multiple countries and even continents.[5-7] The contributing factors for the outbreak include poor food handling and sanitation practices,[8] lack of basic infrastructure such as kitchen

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sanitation and hygiene[9] the lack of clean water for washing food and utensils,[8] lack of regulatory systems, lack of financial resources to invest in safer equipment, and lack of training for food handlers make this situation even worse in developing countries.[10-13] Additionally, due to several circumstances, such as an aging population, unplanned urbanization and migration, mass food production due to population growth, and altered eating habits, concerns over food safety are growing.[4,14]

One of the top 10 health hazards facing the world today is food safety, which has grown into a global problem with ramifications for both public health and international trade,[14-16] and WHO advisory board has recently declared that the biggest health challenges for the next decade increase into 13 including Climate crisis, Health care delivery in areas of conflict and crisis, Health care equity, Access to treatments, Infectious disease prevention, Epidemic preparedness, Unsafe products, Underinvestment in health workers, Adolescent safety, Improving public trust of health care workers, Capitalizing on technological advancements, Threat of anti-microbial resistance and other medicines, and Health care sanitation.[17]

An estimated 600 million—almost 1 in 10 people in the world—fall ill after eating contaminated food and 420 000 die every year, resulting in the loss of 33 million healthy life years (DALYs). US$ 110 billion is lost each year in productivity and medical expenses resulting from unsafe food in low- and middle-income countries.[18-20] Poor food safety practices in the food processing industries have also resulted in food contamination and approximately 49% of foodborne diseases in consumers as a result of improper food handling practices and a lack of safety management practices, which account for nearly 75% of foodborne illness outbreaks.[6,20-22]

Due to widespread poor food handling and sanitation practices, insufficient food safety laws, weak regulatory systems, a lack of financial resources to invest in safer equipment, and a lack of education for food handlers[23] (#54), foodborne diseases pose a serious threat to public health in Africa, resulting in 700 000 deaths and 91 million illnesses annually.[24,25]

Moreover, in the food industry, food handlers' poor handwashing practices, personal hygiene, cleanliness of the working unit, and use of personal protective equipment during food preparation, preservation, production processes, packaging, and labeling have been responsible for the majority of outbreaks of foodborne diseases.[21,26] As a result, proper personal hygiene and sanitary handling habits are critical to food safety prevention efforts.

Ethiopia's food industry is rapidly expanding including in the administrative city of Bahir Dar.[27] However, ensuring food safety practices among those involved in the food industry has been one of the main issues that producers, consumers, public health officials, and regulatory agencies have been concerned about.[23,28] Ethiopian Food, Medicine, & Health Care Control Administration Authority (EFMHCA) post-marketing surveillance report in the Amhara region showed that the total Aflatoxin in domestically processed selected food items was found to be 312.97 g/kg, and the total coliform count was 2.4×104 cfu/g,[29] indicating how serious the problem is. Little is known about the food safety practices used by food handlers employed in the food industries in the study area as well as nationally. As a result, the goal of this study was to identify food safety practices and associated factors among food handlers employed in food businesses in the city of Bahir Dar, Ethiopia.

Methods

Study setting

The study was conducted in Bahir Dar administrative city. The Bahir Dar city is located 560 km away from Addis Ababa, (Ethiopia's capital city). The district has a longitude of 37°23′26.77″E and a latitude of 11°35′37.10″N with an elevation of 1800 m above sea level. The city administration is divided into 6 sub-cities (Tana, Dagmawi Minilik, Belay Zeleke, Gisheabaye, Fasilo, and Atse-Tewodrose). The Amhara Regional Bureau of Finance and Economic Development's (BoFED) 2021 report states, the total population of the city was 328 071.[30] In the city, there were a total of 39 food industries (24 flour industries, 2 biscuits, macaroni, and spaghetti industries, 6 edible oil industries, 3 water, and soft drink industries, 1 honey processing industry, 2 iodized salt processing industries, 1 sweet food processing industry), 923 food handlers in total are employed in the aforementioned food industries.[31]

Study design

An institution-based cross-sectional study was employed among food handlers working in the food industries of Bahir Dar city administration from January to February 2021 to assess food safety practices.

Sample size and sampling technique

To determine the required number of study participants, the sample size was calculated using a single population proportion formula.[32]

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

We considered good food safety practices at 50% (no previous study), $Z\alpha/_2$ at = 95% confidence level (CL), d = margin of error of 5% and 10% non-response rate, the final sample size calculated was 422. A simple random sampling method was used to select 20% from 39 food industries. The sample sizes were proportionately allocated to the selected food industries and study participants were selected using a simple random sampling technique by obtaining the list of employees from their payroll.

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Population

The source population consisted of all food handlers employed in the food industries in the administrative city of Bahir Dar. While the study population was food handlers employed in the food industries and who were directly involved in food handling activities.

Eligibility criteria

All Food handlers working in the food industries, and directly involved in food handling activities are eligible for enrollment in the study. However, food handlers working in the food industries, who were on annual leave throughout data collection and not regularly involved in the food handling process were not eligible for the study.

Variables measured

Food safety practice (Good vs Poor) was our outcome variable, a binary outcome denoted as "{1}" for participants having poor food safety practice and "{0}" for participants having good food safety practice. On the other side, socio-demographic variables (sex, age, religion, educational level, marital status, monthly salaries, work experience of food handlers), working environment variables (latrine, water source, solid and liquid waste disposal, hand washing facility, detergent availability, food storage, working hour per week, guideline availability of food safety/hygiene, available enforcement of rules), behavioral variable (knowledge, attitude, alcoholic drink, khat chewing), and institutional factors (availability of FSMS, availability of quality control team, availability of required professionals, availability of PPE, availability of training) have been the study's independent variables.

Data management and quality assurance

After receiving verbal informed consent, data were collected utilizing face-to-face interviews and on-the-spot observation methods using an interviewer-administered questionnaire and observational checklist. We adapted the questionnaire and checklist from reputable journal articles and survey reports.[10,18,33] The questionnaire includes socio-demographic, workplace, and institutional characteristics, and variables relating to behavior, knowledge, and attitude. To maintain internal consistency, the questionnaire was first written in English, then translated into Amharic (the local tongue), and then back into English. Four diploma holders with prior data collection expertise collected the data.

Before the actual data collection began, the data collection tools were prepared, and the supervisors and data collectors received 2 days of training to assure the quality of the data. The training concentrated on how to complete the questionnaire, immediate observation, how to contact study participants, and ethical concerns during data collection. Following training, a pre-test was carried out at the adjacent Dangla town administration on 21 questionnaires (5% of the total sample size), to evaluate the consistency and clarity of the questions, the application of the data collection techniques, and the tools. Throughout the data collection period, the principal investigators and supervisors constantly monitored the data collectors. Each day after data collection, the acquired data was examined for consistency, accuracy, completeness, and clarity.

Methods of data processing and analysis

To prepare the data for analysis, data were cleaned, coded, put into Epi-data version 3.1, and exported to SPSS version 23. The frequency results were used to check for missing data. The data were analyzed using descriptive statistics and binary logistic regression, and the results were presented in text, figures, and tables. To reduce the impact of confounding, a multivariable binary logistic regression model was created after bi-variable binary logistic regression was used to identify candidate variables at p-values $<.2$. Finally, statistical significance was determined for independent variables with p-values less than .05. The strength of associations was assessed using an adjusted odds ratio with 95% confidence intervals. The Hosmer-Lemeshow test was used to determine the model's goodness of fit, and a p-value of more than .05 was seen as indicative of a good model fit.

Ethical consideration

Ethical clearance and approval were obtained from Bahir Dar University and the College of Medicine and Health Sciences, with protocol number 00329/2020 and the date of December 10/2020. Before beginning data collecting, the letter of ethical clearance was submitted to the Bahir Dar city administration. A permission letter was also obtained from the Bahir Dar city administrator and the northwest branch office of the Ethiopian Food and Medicine Administrative Authority (EFDA). Verbal, informed consent was obtained from each study participant after the purpose of the study was explained to them and the information was available on the front page of the questionnaire. At all stages of the study, the information received from the respondents was maintained confidentially by removing their names and other forms of personal identification. Participants were advised to decide without any restrictions if they did not want to participate and wanted to leave the study at any point throughout the interview phase.

Operational/term definition

Food safety practice. The respondents were classified as having "poor practice" if they answered less than 70% of the 18 questions measuring their practices in food safety; otherwise, they were classified as having "good practice."[6]

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Food safety knowledge. The respondents were deemed to have "poor knowledge" if they scored the 17 food safety knowledge questions with less than 70% accuracy, but otherwise had "good knowledge."[6]

Food safety attitude. The respondents were considered to have "unfavorable attitudes" if they scored less than 70% on 5 questions about attitude. And those who received a minimum score of 70% were deemed to have a "favorable attitude."[6]

Food safety. Assurance that when food is prepared and/or consumed in line with its intended use, it won't have an adverse health effect on the consumer's health.[1]

Food handler. Those who directly handle food that is packaged or unpackaged, as well as the utensils and tools used to prepare or serve food, or surfaces that come into contact with food.[34]

Regulatory inspection. If a company was audited 3 or more times a year by regulatory agencies, it was considered that was audited frequently.

Results

Socio-demographic characteristics

Four hundred twenty-two individuals in this study were surveyed, and 100% completed the interview. The majority (82.9%) were between the age of 19 and 29 years, and nearly half (47.4%) were female by gender. Regarding educational status, 166 (39.3%) were certificate holders and above, and 238 (54.6%) of the respondents were married. About two-thirds (61.4%) of respondents worked in the food production area (Table 1).

Institutional and environmental-related characteristics

Of the 18 food industries assessed, 66.6% had separate food storage rooms, and 72.2% had easily cleanable walls, floors, and ceilings. During the survey, all the food industries had a latrine, shower facilities, and piped water supply sources. However, 3 (16.6%) food industries' handwashing facilities were inside/near the food processing area. Additionally, solid waste storage and liquid waste disposal facilities were present in 77.7% and 88.8%, respectively, of the food industry. Regarding standard operating procedures (SOP), only 8 (44% of the food businesses) had the necessary professionals, even though 72% of the food industries had established SOPs for food safety. Additionally, only 5 (28%) of the food companies provided personal protective equipment for their food handlers, and 78% of those who handled food were not trained in food safety (Table 2).

Table 1. Socio-demographic characteristics of food handlers working in food industries in Bahir Dar city administration, Amhara region, Ethiopia, 2021 (n = 422).

VARIABLE	FREQUENCY	PERCENTAGE
Sex		
Female	200	47.4
Male	222	52.6
Age of respondents in years		
19-29	350	82.9
⩾30-45	72	16.8
Marital status		
Married	184	43.6
Single	238	56.4
Educational status		
Non-formal education	26	6.2
Primary (1-8)	120	28.4
Secondary (9-12)	110	26.1
Certificate and above	166	39.3
Forms of employment		
Permanent	395	93.6
Temporary	27	6.4
Work experience in years		
⩽5	381	90.3
>5	41	9.7
Monthly salary in ETB*		
⩽2000	183	43.4
>2000	239	56.6
Working area		
Production	267	63.3
Packaging	155	36.7
Regular health and safety supervision		
Yes	165	39.1
No	257	60.9
Food safety training	Yes	93
Yes	93	22.0
No	329	78.0

*Ethiopian Birr, 1$ = 52 ETB.

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Table 2. Institutional and working environment of food handlers working in the food industries, Bahir Dar city administration, Ethiopia, 2021 (n=422).

VARIABLES	FREQUENCY	PERCENTAGE
Availability of separate food storage room		
Yes	12	66.6
No	6	33.3
Wall, floor, and ceiling are easy to clean		
Yes	14	77.7
No	4	22.2
Availability of palate in the storage room		
Yes	12	66.6
No	6	33
The functionality of the latrine		
Yes	17	94.4
No	1	5.5
Availability of solid waste storage facilities		
Yes	14	77.7
No	4	22.2
Type of waste storage facilities		
Sack	14	77.7
Pit	4	22.2
Availability of liquid waste disposal facility		
Yes	16	88.8
No	2	11.1
Availability of a handwashing facility present near the food processing		
Yes	3	16.6
No	15	83.3

Food handlers' attitudes, knowledge, and practice regarding food safety

Of the total number of food handlers employed in the food industry, 376 (89.1%) were knowledgeable about food safety. The majority of food handlers 392 (92.2%) have favorable attitude toward the concept that food safety must be upheld during production and packaging. However, less than half (47.6%, 95% CI: 42.8, 52.5) of the respondents have good food safety practices (Figure 1).

Factors associated with food safety practice

Sex, age, educational status, employment types, work experience, working environment, monthly salary, working hours, regular supervision, knowledge, training, and attitude were factors associated with poor food safety practices in the bi-variable binary logistic regression analysis, with a *p*-value of less than .25. While sex, working unit, monthly salary, regular supervision, food safety training, and attitude were significantly associated with poor food safety practices at a *p*-value <.05 in the multivariable logistic regression analysis. Gender has had a role in food safety practices, as male food handlers were about 3 times more likely than female food handlers to have poor food safety practices [AOR: 2.92 (CI: 1.77, 4.82)]. The study also found that food handlers with monthly wages of 2000 Birr or less (about $39) were twice as likely to practice poor food safety as those with higher monthly salaries [AOR: 2.02 (CI: 1.18, 3.44)]. Similarly to this, food handlers who did not receive regular health supervision were 3.4 times more likely to have subpar food safety practices [AOR: 3.43 (CI: 1.97, 5.97)] than those who did. When compared to food handlers working in the packaging unit, those working in the production unit were 2.44 times [AOR: 2.44 (CI: 1.45, 4.13)] more likely to have poor food safety practices (Table 3).

Discussion

The results of this cross-sectional study showed that there were poor food safety practices, and that sex, working unit, monthly

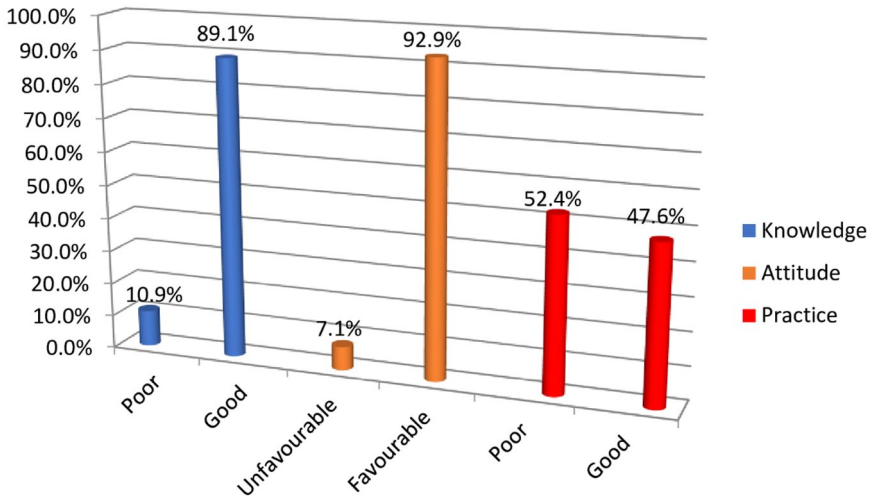


Figure 1. Attitude, knowledge, and practice of food handlers on food safety, Bahir Dar City Administration, Ethiopia, 2021.

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Table 3. Factors significantly associated with food safety practice among food handling workers in Bahir Dar City, Northwest, Ethiopia, 2021.

VARIABLES	PRACTICE		COR WITH 95% CI	AOR WITH 95% CI
	POOR	GOOD		
Sex				
Female	77	123	1.00	1.00
Male	144	78	2.95 (1.98, 4.38)	2.92 (1.77, 4.82)*
Age (y)				
19-29	175	175	1.00	1.00
>29	46	26	1.77 (1.05, 2.99)	1.24 (0.62, 2.48)
Educational status				
Non-formal	17	9	1.78 (0.77, 4.00)	1.65 (0.62, 4.20)
Formal	204	192	1.00	1.00
Employment pattern				
Permanent	202	193	1.00	1.00
Temporary	19	8	2.27 (0.97, 5.26)	1.45 (0.52, 4.01)
Working unit				
Production	158	109	2.12 (1.42, 3.17)	2.44 (1.45, 4.13)*
Packaging	63	92	1.00	1.00
Work experience (y)				
⩽5	194	187	1.00	1.00
>5	27	14	1.86 (0.95, 3.66)	2.18 (0.94, 5.06)
Monthly salaries				
⩽2000	116	67	2.21 (1.49, 3.28)	2.02 (1.18, 3.44)*
>2000	105	134	1.00	1.00
Hours worked/day (h)				
⩽8	205	190	0.31 (0.06, 1.50)	0.51 (0.97, 2.73)
>8	7	2	1.00	1.00
Regular health safety supervision				
Yes	44	121	1.00	1.00
No	177	80	6.08 (3.94, 9.40)	3.43 (1.97, 5.97)*
Food safety training				
Yes	16	77	1.00	1.00
No	205	124	7.96 (4.44, 14.25)	6.16 (2.97, 12.77)*
Knowledge				
Good	180	189	1.00	1.00
Poor	41	12	3.59 (1.83, 7.05)	1.29 (0.58, 2.87)
Attitude				
Favorable	197	195	1.00	1.00
Unfavorable	24	6	3.96 (1.56, 9.90)	3.55 (1.14, 11.05)*

1 = reference group.
*$p < .05$.

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wage, routine health supervision, training, and attitude were connected with poor food safety practices. Nearly half (47.6%, 95% CI: 42.8, 52.5) of the food handlers in the current study who work in the food industry follow good food safety practices. The results were lower than those of studies conducted in Tehran (73%),[35] and Jessore, Bangladesh (83.5%) of food handlers had good safety practices[18] which might be due to the different socioeconomic status, educational backgrounds as well as the availability of food safety training. However, the results of this study were better than those of previous studies conducted in Fars, Iran, with only 8% of food handlers practicing good safety practices.[21]

Food handlers need to have a fundamental awareness of the importance of food safety, the spread of foodborne illnesses, and the methods of food contamination to address poor food safety practices.[36] The majority of the participants in the current study had a strong awareness of food safety (87.4%, 95% CI: 83.9-90.4). Compared to research conducted in Jessore, Bangladesh (91.6%), this study's findings were less favorable.[18] According to our findings, 59.2% of respondents who reported they always washed their hands before beginning work is still less than the research conducted in southern Iran where 91.7% reported wash hands before beginning their work.[21] In the current studies, a majority (91.3%) of food handlers claimed to wash their hands after using the restroom, although only 47.6% of them used detergent. About 63.5% of food handlers said that they handled food despite having diarrheal disease. The discrepancy may be brought about by differences in respondents' sociodemographic characteristics and level of food safety training, as well as the regulatory system in place.

Regarding food handlers' personal protective equipment utilization (PPE), the finding of current studies revealed that 36.5% of the food handlers reported that they used a mask, 43.8% used an apron, 46.9% used cap, and only 10.7% used gloves for their day-to-day activities. The findings were lower than studies conducted in Jessore, Bangladesh 91.6% of food handlers reported they washed their hands after visiting the restroom, 83.6% used a mask, 95.5% used an apron, 93.6% used a cape, 84.6% used gloves.[18] The study in Iran also reported that the majority (91.7%) of food handlers washed their hand after visiting the restroom, 56.5% used masks, 95.9% used aprons, 92.8% used a cape, and 69.1% used gloves.[21] The study's setting and better application of food safety laws and regulations may be the causes of this discrepancy.

The study also indicated that all food handlers reported that they abstained from smoking and drinking alcohol while in the workplace. This finding is consistent with research conducted in Bangladesh, where smoking was obtained at 100% and alcohol consumption at 96.4%,[18] and also in Fars, Iran, abstinence from smoking/alcohol consumption was 96.8%.[21]

Food handlers who engage in food handling activities should cut their fingernails to prevent the spread of foodborne infections because unless fingernails are kept clean, it is most conducive to the growth of bacteria.[37] The majority (72.7%) of food handlers in the current study had found that they had trimmed their fingernails and removed all jewellery before starting work. However, the inadequacy of well-planned facilities, lack of management and training, as well as the poor utilization of governmental regulations and laws in the food industries, may cause not to practice food safety as planned.[11]

The majority (90.8%) of food handlers reported that they clean their workspace before getting to work. This result was lower than that of a study conducted in Jessore, Bangladesh, where 99% of food handlers cleaned their workspace before starting work.[18] Regarding medical examinations of food handlers, just 13.5% of food handlers reported they had regular checkups. This result is less than that of research conducted in Bangladesh where regular checkups were found 78.2%.[18] Three hundred twenty-nine food handlers (78%) wore no jewellery while working on food preparation tasks. This finding is in line with studies done in western Romania, where it was shown that 82.14%.[38]

Even though the Ethiopian Food and Drug Authority, the Ministries of Health and Agriculture, and other non-governmental organizations have been reported as providing training on good hygiene practices (GHP), good manufacturing practices (GMP), and hazard analysis and critical control points (HACCP).[39,40] the current study's findings show that, while food handlers' attitudes and knowledge of food safety were positive, their level of practice was poor. People with good knowledge are thought to have a more favorable attitude and behavior toward food safety, as well as to interact positively with one another. Despite having good knowledge and favorable attitude, the food handlers in the current study exhibit insufficient food safety practices. This could be due to long hours worked, low monthly pay,[41] a lack of facilities to support food safety practices or insufficient inspection by the relevant body.[42]

According to the results of the current study; Sex, working unit, monthly wage, regular supervision, training, and attitude were significantly associated with poor food safety practices associated with poor food safety practice, sex, working unit, monthly salary, regular supervision, training, and attitude were significantly associated with food safety practice. Gender plays a key role in ensuring the food's safety. Our research found that male food handlers were more likely than female food handlers to have poor safety practices. This might have been because women are more sensitive to food-handling practices than men.[43]

Working unit has also been proven to have a substantial impact on food safety practices where individuals working on the packing unit were more likely than those working in the production unit to have poor food safety practices. This may be because food handlers who work in the production area tend to be more educated (as it requires better education and knowledge on how much each component to be while preparing the packed food) and may believe that the production area requires greater attention than the packaging area. The results of our

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study also showed that training was strongly related to the practice of food safety. Food handlers who haven't received food safety training are more likely to perform unsafe food handling than those who have the training. It is agreed that providing adequate food safety training to everyone who handles food in the food business is essential to protect customers from foodborne diseases and other health risks that could occur from eating contaminated food. Furthermore, training is crucial for the long-term commercial viability of food industries as well as for public health. Training also helps food industries to become more efficient, competitive, and lucrative by raising performance standards, promoting the brand, enhancing employee morale, and decreasing waste.[44] Therefore, Workers in the food industry need to receive efficient and consistent food safety training to ensure food safety practices.

Regular regulatory supervision was significantly associated with food safety practices. Food handlers who didn't receive regular supervision had a higher likelihood of poor food safety practices than those who did. This is because inspections are typically undertaken within a regulatory framework, and compliance motivators including the public revelation of inspection results or reports, closures, monetary penalties, and other enforcement actions might aid to guarantee that standard operating procedures are being followed.[45] So supportive supervision provides practical support to food handlers on how to handle food and protect it from contamination.[46]

Food safety practices were strongly associated with food handler attitudes. Food handlers with an unfavorable attitude toward food safety were more likely to have poor food safety practices than those with a favorable attitude. People who are more worried about the causes of food-borne disease, the frequency of severe episodes, and the consequences for their health made them engage in more protective behaviors.[47] Because one of the main drivers of behavior adoption is the development of attitudes, and acting in a particular manner toward a group of things.[48]

Conclusion

According to the findings of this study, food safety practice among food handlers employed in the food industry was poor. Sex, working unit, regulatory supervision, monthly salary, and attitude toward the food safety practice were the main factors associated with poor food safety practices. Regular regulatory inspections, in-service training, good hygiene practices (GHP), good manufacturing practices (GMP), hazards analysis and critical control points (HACCP), and the food safety management system (ISO:22000:2018) should all be strengthened to improve food handlers' food safety practices and bring them into compliance with the standard.

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Author Contributions

MA was in charge of conception, study design, data collection, analysis, and interpretation, as well as the development and revision of the manuscript. AM, AB, and DB assisted with the conception and design of the study, creation of the data collection tools, interpretation of the findings, and preparation and editing of the paper. The final manuscript was examined and approved by all authors.

Data and Material Availability

The corresponding author can provide the datasets used and/or analyzed during the current work upon request.

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