Food Handlers' Awareness about Food Safety Standards

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Abstract

Background: Food safety is essential for protecting public health. Knowledgeable food handlers can minimize the risk of outbreaks, ensuring that customers are safe from foodborne pathogens**. A descriptive research design** was used **aiming** to assess food handlers' awareness of food safety standards. The study was conducted at the kitchens of the General Authority of Health Care agency in Port Said Governorate. **Sampling:** A convenient sampling technique was employed to select participants, with seventy food handlers included in the study. **Tools:** Two tools were used; **The first tool** was an interview questionnaire for food handlers, which included socio-demographic data, health certificates, vaccination status, training, and food handlers' knowledge regarding food safety standards. **The second tool** consisted of observational checklists completed by the researcher to evaluate food safety practices. **The results** demonstrated that 25.7% of the studied food handlers had a good level of knowledge, while 40% had an inadequate level of practices regarding food safety standards. **Conclusion:** The findings indicated a statistically significant relationship between food handlers' knowledge and their age & job. Additionally, there was a statistically significant relationship between food handlers' practices and their experience. However, no correlation was found between the total level of food handlers' knowledge and their total practices. **Recommendations** include implementing orientation programs alongside on-the-job training, continuous food safety training, and integrating employee appraisal programs with the outcomes of food safety training for food handlers in hospital kitchens. Further research is needed to enhance food handlers' knowledge and practices regarding food safety.

Key word: Food safety, Food Handlers' knowledge, Food Handlers' practices.

Introduction

Food is the most essential resource for life on Earth, but can also be dangerous and a rich source of toxins and pathogens that can cause a wide range of acute and chronic diseases, from cancer to diarrheal disease ***(Alsultan et al., 2023).*** Food hazards are potential dangers associated with the production, processing, and consumption of food that can lead to diseases or injury. These hazards can be categorized into three main types: biological, chemical, and physical ***(Abbas et al, 2023)***.

Food is considered safe when it is free from chemical, biological or physical hazard that may lead to disease or even death to the consumer. Food safety is a conditions and measures that are necessary during production, processing, storage, distribution and preparation of food to ensure that food is safe and fit for human consumption ***(Mohd Yusof et al. ,2018).***

Food hygiene is one aspect of food safety which focuses on implementing food safety measures to minimize the risk of contamination especially in hospitals, where patients are particularly highly susceptible to foodborne diseases. Poor personal hygiene causes more than 90% of the sanitation problems in food service industry and more than 25% of all food borne diseases caused by improper hand washing ***(Todd, 2024).***

Foodborne diseases are diseases caused by infectious or toxic agents in food. The World Health Organization identifies over 200 diseases linked to contaminated food. Key causes of foodborne outbreaks include improper cooking and storage temperatures, as well as unsanitary handling practices ***(Abd El-Aziz et al., 2024).***

Food poisoning mainly results from poor preservation, cross-contamination, and contact with infected individuals Hospital food poisoning is more series since it affects

consumers with disrupted health and poses peculiar problems. Mishandling food promotes pathogen growth and disease, especially among people with weakened immunity ***(Flores et al., 2024).***

Food safety standards are essential guidelines designed to ensure that food is safe for consumption and free from harmful contaminants. These standards encompass various aspects of food production, processing, and distribution, including hygiene practices, temperature control, and proper handling of ingredients (***Fekadu et al., 2024).***

Food handler is defined as "any person who directly handles packaged or unpackaged food, food equipment and utensils, or food contact surfaces. They play a crucial role in maintaining food safety throughout the food supply chain and responsible for ensuring that food is prepared, stored, and served in a manner that prevents contamination and foodborne diseases. This includes following strict hygiene practices, such as washing hands regularly, wearing appropriate protective gear, and maintaining clean work environments ***(Bhattacharya et al., 2019).***

Proper food safety practices, such as safe handling, cooking, and storage, not only safeguard individual well-being but also promote confidence in the food supply chain ***(Salam et al., 2021).***

Food safety training is fundamentally important to improve awareness of the food handlers about their role and responsibility in protecting food from contamination or deterioration and maintain food safety in hospital kitchen ***(Wahdan et al., 2019).***

Significance of the Study:

The World Health Organization reported that annually, up to 600 million individuals worldwide become sick, with 420,000 fatalities attributed to the consumption of contaminated food. In the United States, approximately 48 million people experience foodborne diseases each year, leading to 128,000 hospitalizations and 3,000 deaths ***(Guennouni et al., 2022).***

In Egypt an outbreak began on 24th of July 2018 where it was reported that (12) cases with moderate to severe gastrointestinal symptoms referred to hospital after having dinner in five stars' hotel in Zagazig city. Out of (954) guests attended the dinner, 163 had signs and symptoms (17.1%) with 98 (60%) of them hospitalized and two cases died giving Case Fatality Rate (CFR 0.6%) (Abdalfatah, 2020). Moreover, cross-sectional retrospective and statistical study conducted from January 1st 2015 to January 1st 2017 reported that 131 cases suffering from acute food poisoning presented to emergency department (ED) of Kafr El-Sheikh Governorate hospitals ***(El- Gendy et al, 2018).***

Vulnerable populations, including elderly patients, immunocompromised patients, children younger than five years old and pregnant women are more susceptible to foodborne infections and are more prone to develop severe courses of diseases compared with healthy people. Therefore, healthcare is a setting where foodborne outbreaks (FBO) can cause considerable morbidity and mortality ***(Boone et al., 2021).***

In Egypt, there are little researches directed toward assessing food handlers' knowledge and practices about food safety standards in hospital kitchen. So, the current study designed to fill this gap by assessing food handlers' knowledge and practices regarding food safety standards. By disseminating this research, the researcher aims to enhance community health outcomes and contribute to understanding of food safety standards and holds value for the Egyptian community.

Aim Of The Study

This study aims to assess food handlers' awareness about food safety standards through:

1.Assessing knowledge of food handlers about food safety standards.

2.Assessing practices of food handlers about application of food safety standards.

Research questions:

1.What is the total level of food handlers' knowledge about food safety standards?

2. What is the total level of food handlers practice for about food safety standards?

3. Is there relation between food handlers' knowledge about food safety standards and their practices?

Research Design: A descriptive research design will be utilized to fulfill the aim of this study.

Setting:

This study conducted at General Authority of Health Care agency' kitchens (4 hospital kitchens) affiliated with the Egypt Health Care Authority in Port Said Governorate which are (Al-Slam port-said hospital, June 30 hospital, Al-Naser hospital and Al-Hayat Port-Fouad hospital). The kitchen is a place used for food preparation and cooking, equipped with stove, sink with hot and cold running water, refrigerator, equipment, utensils, worktops, kitchen cabinets, and electric appliances. The main functions of the kitchens are to store, prepare and cook food. It includes 70 workers serve around (1000) customers including employees, resident doctors and nurses, trainees, patients and patients' relatives.

Sample: A convenient sample

Size: All available (70) male and female food handlers at General Authority of Health Care agency' kitchens are the target group of the study.

Tools and Technique of Data Collection:

First Tool: An interviewing questionnaire composed of two parts:

- **Part (I):** Was concerned with:

A. Socio-demographic characteristics of the studied sample which includes (age, sex, educational level, place of work, years of working experience and working activity).

B. Other data about (food safety training, health certificate, and vaccinations).

- **Part (II):** Assess food handlers' knowledge about food safety standards which include: food safe food handling, food hygiene, food borne diseases and prevention of food contamination. It was developed by the researcher after reviewing the recent current literatures.

Scoring system:

According to workers' answer, the correct answer will be scored "1", and incorrect answer or don't know scored "zero". The score of the items summed up and the total divided by the number of the items. The total scoring system of 100% of their knowledge was categorized into:

- Good knowledge (75%-100%)
- Average knowledge (50% -<75%)
- Poor knowledge (<50%).

Second Tool: An Observational checklist:

It was developed by the researcher after reviewing the recent current literatures.

Observational checklist assesses food handler's practices regarding food safety standards which include the following items:

A. Food handlers' practices regarding food hygiene which include; wearing work clothes, hand washing and prevention of food contamination.

B. Food handlers' practices regarding course of work in the kitchen which include; receiving, preparation, thawing, cooking, and distribution of food.

Scoring System:

According to workers' actual practices, each step scored as "one" if the step was done correctly, and scored "zero" if the step not done or incorrectly done. The score of the items summed up and the total divided by the number of the items. The total scoring system of 100% of their practice categorized into:

- Adequate practice (80%-100%)
- Inadequate practice (<80%)

The present study conducting in four phases:

First, preparatory phase: Review of recent current national and international related literature in various aspects of the problem to design the study tools and to be acquainted with the research problem.

Second, the assessment phase: In this phase pre-test questionnaires used to assess food handlers' knowledge and observation checklist to assess practices about food safety standards. The researcher introduced herself to food handlers and asked questionnaires using simple Arabic language.

Content validity and reliability:

The tools validity was ascertained by jury of five experts from the community health nursing department, Faculty of Nursing, Ain Shams University which was recommended from the scientific medical advisory committee, their opinions elicited regarding format layout, accuracy, and consistency of the tools. The reliability tools were tested by Cronbach alpha test and proved to be strongly reliable tools.

Table (1): Cronbach's Alpha reliability analysis

Tool	Reliability	
	Reliability Coefficient	Cronbach's Alpha
Knowledge	0.823	0.889
Practice	0.783	0.722
Total	0.803	0.805

Administrative Design:

To carry out the study in the selected setting, an official permission for data collection was obtained using proper channels of communication from authorized personnel.

Ethical Considerations:

The research approval was obtained from ethical and scientific research committee at Faculty of Nursing, Ain Shams University before starting study. An informed consent was obtained from the food handlers to accept participation in the study and confidentiality of any obtained information was ensured.

Ethical code : 24.12.414

Pilot study:

The pilot study was carried out on (10%) of the study sample to test the clarity, objectivity, feasibility, applicability and practicality of the tools, as well as to estimate the time needed for data collection. According to the results was obtained from data analysis, items correction, modification, omission and addition was done as needed.

Field Work:

The aim and the process of the study was explained to the studied subjects. The study was conducted at a period of (6) months which started from the beginning of September (2022) till the end of February (2023). Each subject was interviewed and observed along the shift from (7am – 7 pm) to collect the necessary data by using tool I and II. The data was collected from all food handlers (70 food handlers) in the kitchen department. The researcher introduced herself to all participants and approval written informed consent was obtained from workers to participate in the study after explanation the purpose of the study to each worker, then they reassured that any information obtained was confidential and used for the research purpose only. The researcher emphasized that the participation of the study was voluntary and anonymity of participants assured through coding data.

Statistical analysis:

Recorded data was analyzed using the statistical package for social sciences, version 23.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

The Comparison between groups with qualitative data was done by using Chi-square test. Pearson's correlation coefficient (r) test was used to assess the degree of association between two sets of variables.

The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:

Degrees of significance of results were considered as follows:

- P-value <0.05 was considered significant.
- P-value <0.001 was considered as highly significant.
- P-value >0.05 was considered insignificant.

Results

Part I:

A. Socio-demographic characteristics:

Table (1) shows that 37.2% of food handlers were in the age category from (30 - < 40) years with mean ± SD (35.33 ± 9.27), (82%) were females, 40% complete diploma level of education and only 15.7% had bachelor's degree and 21.4 % worked as food providers and 45.7% their working experience ranged from 1- < 5 years

Fig. (1): illustrates that; 51% of studied food handlers didn't receive training course about food safety before joining job, 91.4% had health certificate, 100% had vaccination.

Fig. (2):illustrates that; (21.4%, 25.7%, 31.4%, 28.6%) of food handlers had good level of knowledge regarding different areas of knowledge (safe food handling, food hygiene, food borne diseases and prevention of food contamination) respectively.

Fig. (3):illustrates that (25.7%) of the studied food handlers had good level of knowledge, (50%) had average level and (24.3%) of them had poor knowledge regarding food safety standards.

Fig. (4): illustrates that; (70%,32.9%,58.6%) of food handlers had good practices regarding different areas of food hygiene (wear work cloths, hand washing, prevention of contamination).

Fig. (5): illustrates that; (51.4%, 51.4%, 87.1%, 40%, 90%) of food handlers had adequate total practice regarding (receiving, preparation, thawing, cooking, distribution)

Fig. (6): illustrates that 54.3% of food handlers had adequate total practice regarding food hygiene and 45.7% had inadequate practice. Regarding the course of work; 64.3% of food handlers had adequate practice and 35.7% had inadequate practice.

Fig. (7): clarifies that **(**60%) of food handlers had adequate total level of practices regarding food safety standards and 40% had inadequate practice.

Part III: Relation between the Study Variables:

Table (2): shows that there was significant relation between food handlers' knowledge and their age and job.

Table (3) shows a significant relation between food handlers' practices and their years of experiences.

Table (4) Demonstrate that there was no significant correlation between total level of food handlers' Knowledge, and total practices about food safety standards.

Table (1): Frequency distribution of the studied food handlers regarding their socio-demographic characteristics (age, gender, years of experience, educational qualification, and working activity) (N=70).

Demographic data	No.	%
Age "years"		
20 - <30 years	20	28.6
30 - < 40 years	26	37.2
40 - < 50 years	19	27.1
≥50 years	5	7.1
Mean±SD	35.33±9.27	
Gender		
Male	12	17.1
Female	58	82.9
Years of experience "years"		
< 1 years	6	8.6
1- < 5 years	32	45.7
5- < 10 years	16	22.9
10 - < 15 years	8	11.4
≥15 years	8	11.4
Mean±SD		
Educational Qualification		
Primary	1	1.4
Preparatory	4	5.7
Secondary	26	37.1
Diploma	28	40.1
Bachelor's degree or higher	11	15.7
Working activity (job)		
Nutrition Specialist	8	11.4
Food technician	15	21.4
Chef	11	15.7
Food providers	23	32.9
Assistant chef	11	15.7
Health inspector	2	2.9

B. Other data (training, health certificate, vaccination):

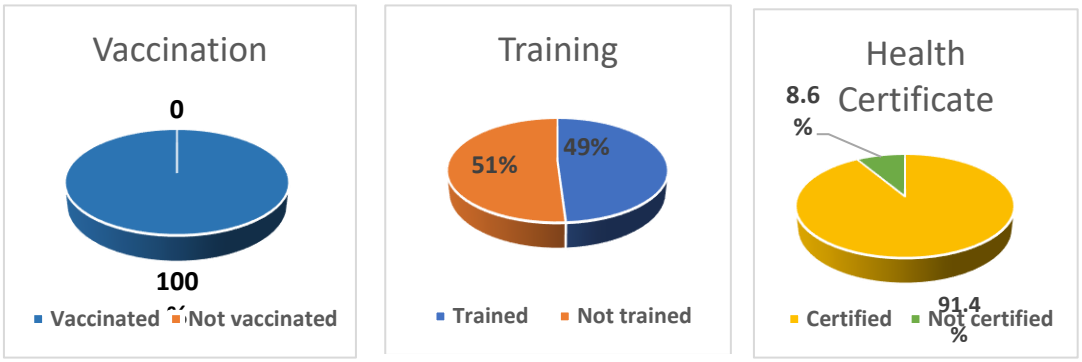

Fig. (1): Percentage distribution of the studied food handlers regarding their (training, health certificate and vaccination). (N=70).

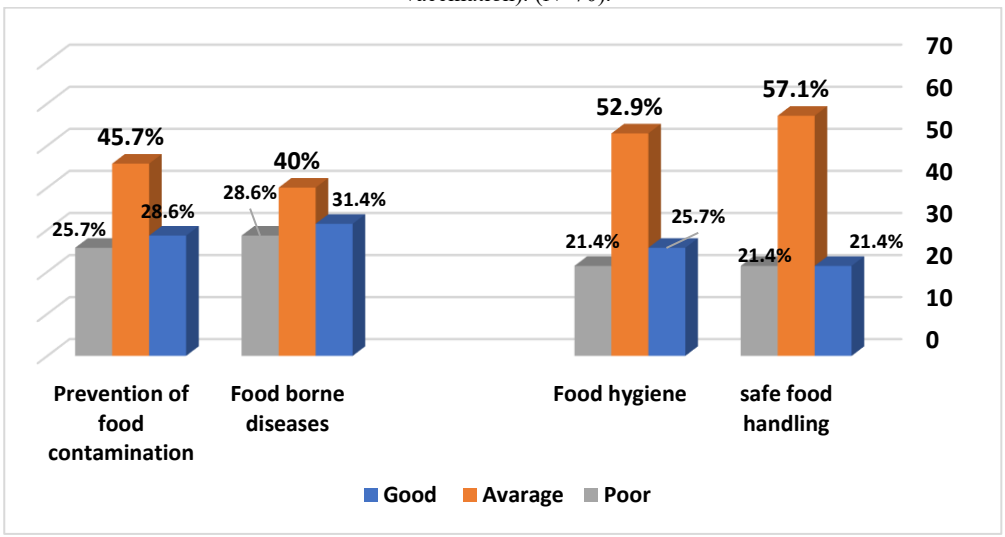

Fig. (2): Percentage distribution of the studied food handlers according to their total level of knowledge regarding different areas of knowledge (safe food handling, food hygiene, food borne diseases and prevention of food contamination) (N=70).

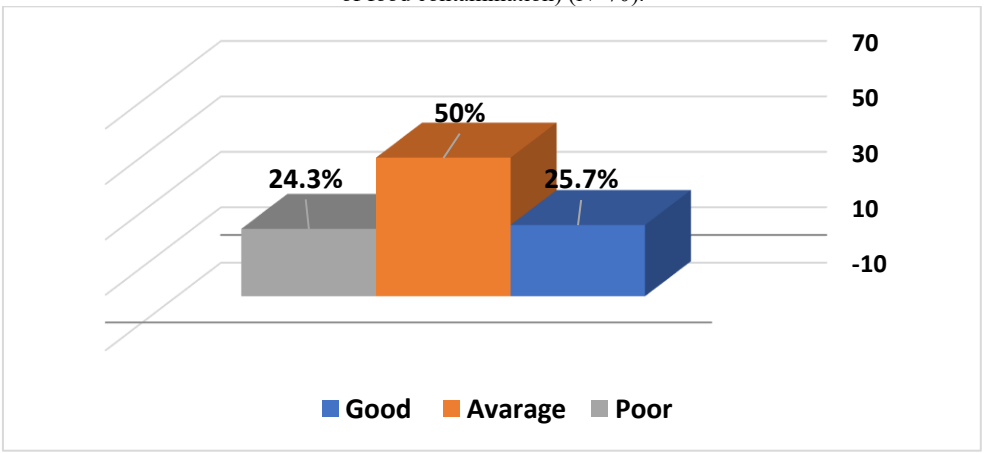

Fig. (3): Percentage distribution of the studied food handlers according to their total level of knowledge regarding food safety standards. (N=70)

Practices of food handlers:

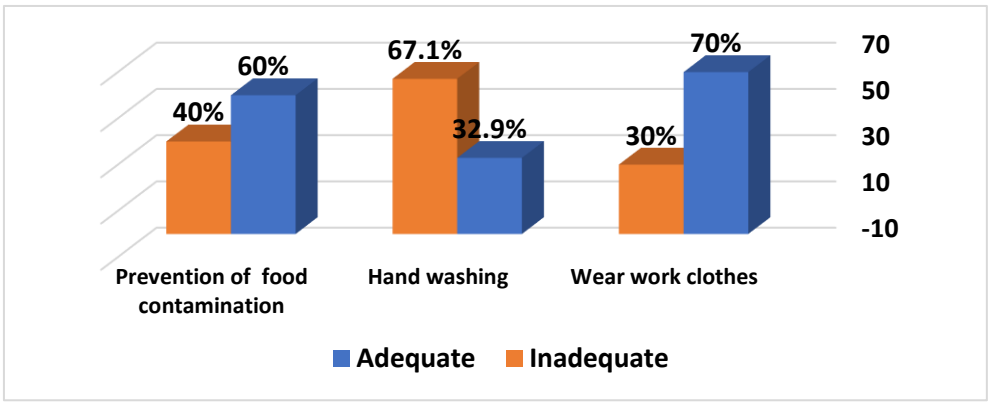

Fig. (4): Percentage distribution of the studied food handlers toward their total level of practices regarding different areas of food hygiene (N=70).

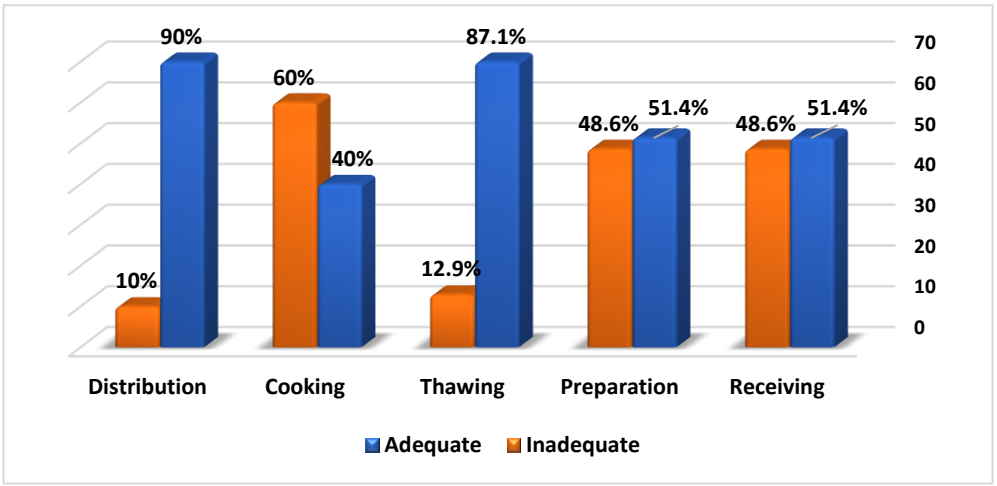

Fig. (5): Percentage distribution of the studied food handlers toward their total of practices regarding different areas regarding course of work in the kitchen which include (Receiving, Preparation, Thawing, Cooking and Distribution of food). (N=70)

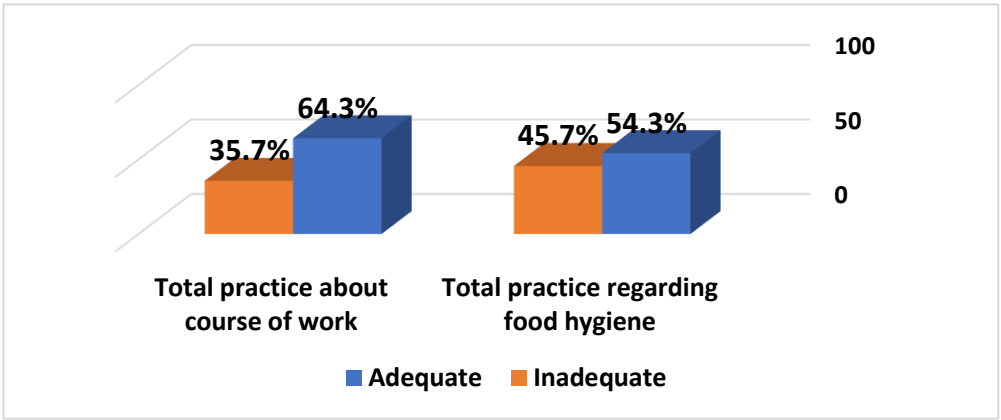

Fig. (6): Percentage distribution of the studied food handlers toward their practices total level of regarding food hygiene and course of work. (N=70).

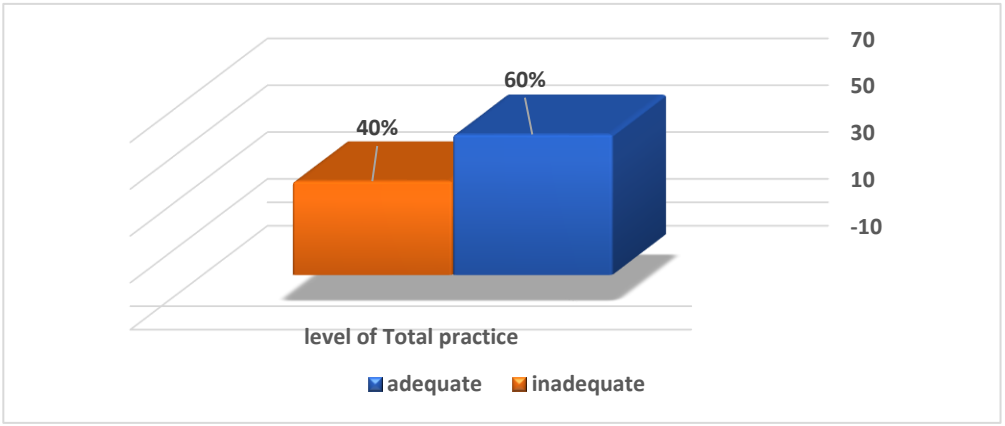

Fig. (7): Percentage distribution of the studied food handlers according to their total level of practice about food safety standards "Pre and Post program implementation" (N=70).

Table (2): Relation between food handlers' knowledge and their socio-demographic data (N=70)

Variables	Chi-square test	
	x^2	p-value
Age	13.335	0.038*
Gender	0.665	0.717
Years of experience	11.685	0.166
Educational Qualification	10.867	0.209
Working activity (job)	29.290	0.002*

*p-value >0.05 NS; *p-value <0.05 S*

Table (3): Relation between food handlers' practices and their socio-demographic data (N=70).

Variables	Chi-square test	
	x^2	p-value
Age	2.204	0.531
Gender	0.268	0.605
Years of experience	11.840	0.019*
Educational Qualification	5.511	0.239
Working activity (job)	10.379	0.065

*p-value >0.05 NS; *p-value <0.05 S*

Table (4): Correlation matrix between total score of food handlers' Knowledge, and total practices about food safety (n=70).

Total Level of knowledge	Total Level of practice	
	R	0.186
	P- value	0.582

p-value >0.05 is insignificant

Discussion

Regarding socio-demographic characteristics of food handlers and other data (training, health certificate and vaccination):

Current study showed that more than one third of food handlers were in the age category from (30 - < 40) years with mean ± SD (35.33 ± 9.27), almost the majority of the studied food handlers were females. This indicates that food handling was one of the popular businesses among women and the best choice for them. This finding also revealed that almost one half of food handlers had an experience ranged from 1 to 5 years, less than half of food handlers complete diploma level of education and approximately one third of food handlers worked as food providers **(Table1).** Half of the studied food handlers had received training course about food safety before joining job, great majority of studied food handlers had health certificate, all of the studied food handlers had vaccination (COVID and hepatitis B vaccine). **(Fig.1)**

The current study findings was in agreement with the study by ***Guennouni et al., (2022)*** who studied "knowledge and practices of food safety among health care professionals and handlers working in the kitchen of a Moroccan University hospital" (n=72) who =reported that around two third of the study sample were between 26 and 40 years of age, around two quarters of the studied food handlers were females, more than half of food handlers received food safety courses that included information on food poisoning, contamination and cross contamination, and food storage. However, disagree with him regarding education level, whereas around half of the studied sample had a doctoral degree.

The current finding was in the same line with the study by ***Salam et al., (2021)*** who studied "The effect of training of food handlers in hospitals kitchen in Khartoum State" (n=56) who found that most participants had four years of experience and held medical certificates. However, disagree with his conclusion, as none of the hospitals implemented any educational courses on food safety or hygiene

The current study finding was consistent with the study by ***Wahdan et al., (2019)*** "Assess the effect of an educational program on food safety practices in food preparation and handling procedures in governmental hospitals of an Egyptian Governorate" (n=202) who reported that more than half of the studied sample were female, more than two-thirds of the studied group below university level of education, half of food handlers in governmental hospitals of an Egyptian governorate had previous food safety training courses.

Moreover, the current study finding was congruent with the study by **Mohite et al., (2022)** who studied "To Determine the Level of Food Handlers' Understanding of Food Safety and Hygiene with the Goal of Publishing a Guidebook" (n=50) and revealed that approximately two thirds of food handlers had received vaccinations against food-borne diseases. Also, was in agreement with the study by **Saad et al., (2018)** "Training Program among Hospital Food Handlers 'Regarding Food Borne Diseases" (n=40) who discovered that three quarter of food handlers were domestic staff (workers). However, discordant with him, as the majority of the studied sample lacks a health certificate and was not vaccinated.

The current study finding was agreed with the study by ***Thelwell-Reid et al., (2014)*** "Food Safety Knowledge and Self-Reported Practices of Food Handlers in Jamaica" (n=1.109) who reported that more than half of food handlers were employed as food workers, this may be due to the nature of the work area. And also, was in the same line with the study by ***Nik Rosmawati et al., (2015)*** "Validity and Reliability of Food Safety Knowledge and Practices Questionnaire among Food Handlers″ (n=94) who stated that most of food handlers had received typhoid immunization within three years.

However, this finding disagreed with the studies conducted by ***Hassan et al., (2022)*** who studied " Development and assessment of health education program regarding food safety among food handlers at Ain Shams university hospitals" (N=75) who found that more than one third of food handlers were in the age category from 45-59 years with mean ± SD 41.60 ± 11.3, around half of the food handlers had an experience ranged from16 to 25 years. And also, the current study was inconsistent with the study by ***Al Banna et al., (2022)*** "Assessment of Food Safety Knowledge, Attitudes and Practices of Food Service Staff in Bangladeshi Hospitals: A Cross-Sectional Study." (n=191) who reported that great majority of the study sample were males. The current study finding was incongruent with the study by ***Al-Kandari et al., (2019)*** "Food safety knowledge ,attitudes and practices of food handlers in restaurants in Kuwait (n=402). Also, disagreed with the study by ***Ahmed & Sayed, (2021)*** " Effect of Educational Guidelines Regarding Safety Food Measures on Food Handlers Practices at Fayoum University Restaurants" (n=80) who reported that more than one third of food handlers worked as main cook.

Regarding Food handler's knowledge:

The present study illustrated that more than half of the studied food handlers had

average total level of knowledge regarding food safety standards **(Fig.3)**. More than one quarter of the studied food handlers had good knowledge while only one quarter had poor knowledge. The highest level was relevant to food borne diseases and prevention of food contamination respectively **(Fig.2)**. This finding was congruent with the study by ***Lee et al., (2017)*** "Assessment of food safety knowledge, attitude, self-reported practices, and microbiological hand hygiene of food handlers. " (n=85) who found that more than half of participated food handlers demonstrated moderate knowledge regarding food safety and was similar to the study by ***Guennouni et al., (2022)"*** Knowledge and Practices of Food Safety among Health Care Professionals and Handlers Working in the Kitchen of a Moroccan University Hospital" (n=72) who found that more than half of participant knew the correct answer of the total knowledge regarding food safety. The highest food safety knowledge score was for cross contamination and food storage. However, disagree with him as the lowest mean score was for food poisoning knowledge.

The present study finding was lower than the study by ***Fekadu et al., (2024)*** "Knowledge, Attitude, and Practices on Food Safety among Food Handlers Working in Public Food Service Establishments in Lemi Kura Subcity, Addis Ababa, Ethiopia." (n=400) Who found that two third of food handlers had good knowledge regarding food safety**.** While, lower than the study by ***Bojuwoye et al., (2022)*** "The Impact of Knowledge on Food Hygiene Practices among Food Handlers in a Tertiary Hospital in Nigeria" (n=81) who showed that the majority of the participants had satisfactory level of knowledge, although only minority had deficient food safety knowledge.

However, the current study finding was higher than the study done by ***Awad Allah et al., (2017)*** who studied "knowledge, attitude and practice of female teachers regarding safe food handling; is it sufficient? An intervention study, Zagazig, Egypt"(n=42) who showed that more than two third of the sample had an unsatisfactory knowledge about safe food handling. And at the same line with the study by ***Hassan et al., (2022)*** "Development and assessment of health education program regarding food safety among food handlers at Ain Shams university hospitals", Cairo, Egypt, **(N=75)** who revealed that half of respondents had poor knowledge regarding food safety.

The current study was disagreed with the study by ***Sharif et al., (2013)*** **"**Food hygiene knowledge, attitudes and practices of the food handlers in the military hospitals" (n=200) who found that the majority of food handlers had good total level of knowledge. And inconsistent with study done in Ethiopia by ***Tessema et al., (2014)*** "Factors affecting food handling practices among food handlers of Dangila town food and drink establishments, North West Ethiopia". (n=41) who reported that the majority of food handlers had poor knowledge on food handling practices.

From the view of the researcher poor knowledge level may be because the training may not cover the important topics like proper handwashing, safe food storage and preparation, cleaning and sanitizing, and recognizing signs of food contamination or may be because the public internet websites is the main source of data which may provide incorrect or invalid information. Also, high staff turnover may lead to hiring inexperienced workers or because they may not receive sufficient training before starting their jobs.

Regarding food safety practices:

The current study showed that two third of food handlers had adequate total level of practice regarding food safety standards **(Fig.7)**. This finding was lower than the study by ***Abdalfatah & Osman (2020)*** "Evaluation of an Educational Program concerning Food Safety for Food Services Employees in Assiut University Restaurants- Assiut Governorate" (n=202) who revealed that around half of the studied food handlers had adequate practices. However, it was higher than the study by ***Al-Banna et al., (2022)*** Assessment of Food Safety Knowledge, Attitudes and Practices of Food Service Staff in Bangladeshi Hospitals: A Cross-Sectional Study" (n=191) who revealed that the majority of food handler had adequate practices regarding food safety. On the other hand current study was inconsistent with the study by ***Ahmed & Sayed, (2021) "***Effect of

Educational Guidelines Regarding Safety Food Measures on Food Handlers Practices at Fayoum University Restaurants" (n=80) who revealed that the majority of food handlers had unsatisfactory practices level regarding safety food measures.

The current study finding was in **agreement** with the study by ***Guennouni et al., (2022)*** "knowledge and practices of food safety among health care professionals and handlers working in the kitchen of a Moroccan University hospital" (n=72) who found that there was no significant correlation was found between food safety knowledge and food safety practices.

Concerning the level of food hygiene, the current study illustrated that less than half of food handlers had inadequate practice regarding food hygiene **(Fig.6)**. The current study finding was higher than the study by ***Abbas et al., (2023)*** "The food hygiene practices among workers in restaurants of Wasit Governorate, Iraq" (n=330) who found that more than two third of food handlers had poor food hygiene practices.

Concerning wear work clothes, the current study revealed that more than two third of the studied food handlers had adequate level of practices **(Fig.4)**.

This finding was in agreement with the study by ***Meleko et al., (2015)*** Assessment of the sanitary conditions of catering establishments and food safety knowledge and practices of food handlers in Addis Ababa University Students' Cafeteria" (n=302) who showed that the two third of food handlers wear gown during work time. However, this finding was disagreed with the study by ***Salam et al., (2021)*** "The effect of training of food handlers in hospitals kitchen in Khartoum State, Sudan, Magna Scientia Advanced Biology and Pharmacy" (n=56), who presented that minority of food handlers wear uniform. Also, was disagreed with the study by ***Elsersy et al., (2018)*** "Assessment of Food Safety in Hospital Kitchens in Tanta City Gharbia Governorate, Egypt" (n=175) who revealed that about three quarters in governmental kitchens were applied safety measures regarding working clothes with insufficient level.

From the view of researcher inadequate practices may be explained because lake of education and awareness, unsafe infrastructure, insufficient resources, insufficient monitoring and oversight, lack of a food safety culture, complex food service operations which can increase the risk of breakdowns in communication and coordination and lead to lapses in food safety practices.

Concerning hand washing the current study revealed that around two third of food handlers had inadequate practice regarding hand washing.

The current finding was lower than the observations were reported in a study conducted by ***Ngivu, (2016)*** **who** studied " Impact of food handlers' food safety training in a pediatric hospital in East Africa " who revealed that half of the studied food handlers had adequate practices. However, the current finding was in the same line with the study by ***Elsersy et al., (2018)*** "Assessment of Food Safety in Hospital Kitchens in Tanta City Gharbia Governorate, Egypt" (n=175) who found that the majority of food handlers were insufficient in washing hands in both university and governmental kitchens.

Concerning the prevention of food contamination, the current study revealed that more than half of food handlers had adequate score practice **(Fig.4)**. This finding was in agreement with the study by ***Elsersy et al., (2018)*** "Assessment of Food Safety in Hospital Kitchens in Tanta City Gharbia Governorate, Egypt" (n=175) who found that about one half in governmental kitchens were sufficient practice regarding prevent food contamination.

Concerning the course of work; more than two third of food dandlers had adequate practices **(Fig.6)**. This finding was in agreement with the study by ***Elsersy et at., (2018)*** "Assessment of Food Safety in Hospital Kitchens in Tanta City Gharbia Governorate, Egypt" (n=175) who reported that the majority of governmental kitchens followed food safety measures regarding course of work in the

kitchen. On the other hand, the current result disagreed with him whereas none of university kitchens followed food safety measures regarding course of work in the kitchen.

Concerning receiving and preparation of food, the current study revealed that more than half of the studied food handlers had inadequate practices regarding receiving and preparation. **(Fig.5)**. This finding was in agreement with the study by ***Elsersy et al., (2018)*** "Assessment of Food Safety in Hospital Kitchens in Tanta City Gharbia Governorate, Egypt" (n=175) who found that approximately half of the studied food handlers had inadequate practice regarding receiving, preparation and cooking food.

Relation between food handlers' knowledge and their socio-demographic characteristics:

The current study revealed that there was a significant relation between food handlers' knowledge and their age & job. **(Table 2)**. This result was in agreement with the study by ***Abdel Hakeem, (2021)*** **"**Food Safety Knowledge among Food Handlers in Hospitals of Jordan" (n=245) who showed that there was a statistically significant relationship between age and food safety knowledge score. And disagree with the study by ***Abdalfatah & Osman (2020)*** **"**Evaluation of an Educational Program concerning Food Safety for Food Services Employees in Assiut University Restaurants- Assiut Governorate" (n=202) who reported that there was no relationship between food services employees' age and their knowledge regarding food handling measures (p value= 0.219).

The current study demonstrated that that there was no significant relation between food handlers' knowledge level and their education, gender and working experience **(Table 2)**. This finding was in the same line with the study by ***Abdul-Mutalib et al., (2012)*** **"**Knowledge, attitude and practices regarding food hygiene and sanitation of food handlers in Kuala Pilah, Malaysia" (n=64) who reported that there was no significant relationship between the respondents' knowledge level and their working experience. And also, with the study by ***Abdalfatah & Osman, (2020)*** **"**Evaluation of an Educational Program concerning Food Safety for Food Services Employees in Assiut University Restaurants- Assiut Governorate" (n=202) who observed that there was no significant relationship between the respondents' knowledge level and their gender and educational level. However, disagreed with the study by ***Siow and Sani, (2011)*** "Assessment of Knowledge, Attitudes and Practices (KAP) Among Food Handlers at Residential Colleges and Canteen Regarding Food Safety" (n=65) who found out that there was a significant relationship between the respondents' knowledge level and their working experience. Also, disagreed with the study by ***Lee et al., (2017)*** "Assessment of food safety knowledge, attitude, self-reported practices, and microbiological hand hygiene of food handlers" (n=85) who showed that there was association between gender and food handlers' knowledge.

Relation between food handlers' practices and their socio-demographic characteristics:

The current study revealed that there was a significant relation between food handlers' practices and their working experience. However, there was no significant relation between food handlers' practices and their (age, gender, educational qualification and working activity) **(Table 3)**. This finding was in agreement with the study by ***Abdalfatah & Osman, (2020)*** **"**Evaluation of an Educational Program concerning Food Safety for Food Services Employees in Assiut University Restaurants- Assiut Governorate" (n=202) who reported that there was no relationship between the participants' gender and educational level with their attitude and practice regarding food safety measures. However, was disagreed with the study by ***Flores et al., (2024)*** "Assessment of Knowledge, Attitude, and Practices of Food Handlers on Food Safety in Selected Tertiary Hospitals in Metro Manila, Philippines" (n=50) who found that there was no significant association was demonstrated between their years of experiences and practices of food handlers regarding food safety standards. Also, was disagreed with the study by ***Elsersy et al., (2018)*** "Assessment of Food Safety in Hospital Kitchens in Tanta City Gharbia Governorate, Egypt" (n=175) who revealed that there were statistically significant differences, between the total practice of university food handlers and their age and gender.

Correlation between knowledge and practices:

The current study revealed that there was no significant correlation between total score of food handlers' knowledge, and total level of practices about food safety standards **(Table.4)**. This finding was disagreed with the study by ***Mohamed et al., (2020)*** Educational program to prevent food borne diseases at restaurants of suez Canal University (n=86) who showed that there were statistically significant (p <0.001) positive correlations between food handlers' knowledge and practices. However, was in the same direction, with the study by ***Hassan et al., (2022)*** "Development and assessment of health education program regarding food safety among food handlers at Ain Shams university hospitals", Cairo, Egypt, (N=75) who found that there was no correlation between knowledge and practices among food handlers.

Conclusion

The results reported a statistically significant relation between food handlers' knowledge and their age and job. Statistically significant relation between food handlers' practices and their experience. No correlation between food handlers' total level of knowledge, and their total practices.

Recommendations

The study recommended that orientation program in addition to on job training, more continuous implementation of the food safety training and integration of employee appraisal program with the outcome of food safety training were needed, provide comprehensive training and ongoing support and resources**.** Further researches are needed to upgrade the food handlers' knowledge about food safety.

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