

# Effect of Hygiene Guidelines on Knowledge, Attitudes, and Practices of Food Handlers at University Cafeterias

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## ABSTRACT

**Context:** Safe food is a critical issue in the prevention of foodborne diseases. Food handlers play an essential role in preventing foodborne diseases and food poisoning at all stages of food preparation, storage, and handling.

**Aim:** The study aimed to evaluate the effect of hygiene guidelines on the knowledge, attitudes, and practices of food handlers at University cafeterias.

**Methods:** A quasi-experimental design was used to carry out the study. Setting: The study was conducted at the Faculties Cafeteria at Benha University. A convenient sample of (60) food handlers worked at Cafeterias of Benha University. Three tools were used for collecting data: A Structured interview questionnaire included two parts. First is concerned with the assessment of the food handlers' demographic characteristics. The second part is concerned with assessing knowledge, and the third part included an assessment of food handlers' practices of the food handlers about food hygiene. The second tool is the food handlers' attitude assessment scale. The third tool is an environmental observational checklist that assessed the cafeteria's environmental condition.

**Results:** 73.3% of the studied food handlers were male and single, 50.0% of them aged 20 - <30 years with mean± SD (32.63±4.71). Additionally, 76.7% of food handlers had a secondary education level, and they had health certificates. Only 18.3% of the food handlers had good knowledge regarding food hygiene before the guideline sessions compared to 85.0% after the guideline sessions. On the other hand, 65.0% of food handlers negatively affected food hygiene before the guideline sessions decreased to 15.0% after the guideline sessions. Moreover, 68.3% of food handlers had unsatisfactory practices regarding food hygiene before the guideline sessions compared to 76.7% after the guideline sessions.

**Conclusion:** A considerable improvement was noticed among the studied food handlers after the guideline sessions related to the knowledge, attitude, and food hygiene practices. Recommendations: Further research should be geared towards regularly implementing health education programs for food handlers about food safety and hygiene at all faculties of Egyptian universities.

**Keywords:** Hygiene, guidelines, knowledge, attitudes, practices, food handlers, university cafeteria

## 1. Introduction

Foodborne diseases represent major health problems in developing and developed countries. World Health Organization (WHO) reported that more than thirty percent of the population experience foodborne diseases yearly in developed countries. More than two million deaths are estimated per year, and 1.9 million are children in developing countries. Every day, people can be exposed to unhealthy food from eating food all over the world (Tessema, Gelaye, & Chercos, 2014).

Food safety and hygiene are significant issues in preventing foodborne diseases because food contamination can occur at any stage of food preparation (Ismail & Abdullahi 2013). Food handlers play a vital role in the passive transmission of microorganisms from contaminated sources, such as transmitting pathogens from raw meat to ready-to-eat food. Also, human pathogens of foodborne as typhoid salmonella, staphylococcus aureus, hepatitis A, Shigella species, and noroviruses can be present in food

handlers' hands, mouths, sores, or cuts, hair, and skin (Adams & Moss, 2008).

Food handlers are essential persons responsible for the strict application of food safety principles throughout the food chain process, especially the production and storage stage of food processing. Food handlers need to follow good personal hygiene, especially washing hands, well, clean work attire, perform food hygiene practices, and continuous and regular training to provide safe food in handling and preparation (Jeinie, Saad, Sharif, & Nor, 2016).

A study by Adesokan, Akinseye, and Adesokan (2015) revealed that food safety training was associated with improved knowledge and behaviors among foodservice establishments' workers and noted a significant change in knowledge and practice of safe food handling but with a repeated short term of training. Community health nurse (CHN) has many responsibilities and vital roles in foodborne diseases prevention and control. These roles generally fall into the categories of monitoring, education, immunization, early detection, referral, and treatment. CHN

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also provides supportive care for food handlers, including educating food handlers about measures to reduce or prevent foodborne diseases (Mohamed, 2011).

## 2. Significance of the study

Globally, one person from ten may fall ill after consuming contaminated food, with the high rate of burden in Africa, average in Southeast Asia, and the low burden of foodborne diseases reported in Europe (WHO, 2015). Ministry of Health and Population (MOHP) In Egypt reported three outbreaks of food poisoning in 2013 from May to March among university students *Ahram Online* (2013). Causative agents of enteric viruses cause most foodborne illnesses and outbreaks. According to WHO, Egypt included within the region of moderate or high endemicity of various enteric viruses. Different enteric virus infections detected. Human rotaviruses, noroviruses, astroviruses, adenovirus, hepatitis A, and E were found with a high prevalence rate among the Egyptian population (Aboubakr & Goyal 2019).

Harmful pathogens as bacteria, chemicals, viruses, and parasites may be included in contaminated food and cause more than 200 diseases ranging from diarrhea to cancer. The university community is an essential segment of the community. Students, teaching staff, and other workers from the university spend many hours of their days at university, and that requires eating meals and sandwiches from the university cafeterias. So, cleaning cafeterias, handling, preparing, and providing safe food, and maintaining food handlers' hygiene are very important. Researches to assess food hygiene among the food handlers and cafeterias cleaning condition are fundamental to establish baseline data and construct programs to improve their knowledge and practices.

## 3. Aim of the study

The current study aimed to evaluate the effect of hygiene guidelines on knowledge, attitudes, and practices of food handlers at University cafeterias.

### 3.1. Research Hypotheses

- Food handlers exposed to the hygiene guidelines will exhibit improved knowledge and practices compared to their pre-intervention level.
- Food handlers exposed to the hygiene guidelines will exhibit a more positive attitude toward food hygiene than their pre-intervention level.

## 4. Subjects & Methods

### 4.1. Research design

A quasi-experimental with pre and post-test design used to conduct this study.

### 4.2. Research Setting

The study was conducted at 12 Cafeterias of Benha University Faculties named (Faculty of Medicine, Arts, Commerce, Nursing, Faculty of Education, Engineering,

Computing and Information, Applied Arts, and Education Quality, Law, Physical Education, and Science).

### 4.3. Subjects

A convenient sample of all food handlers worked in previous selected Cafeterias of Benha University Faculties. The total number was 60 food handlers (after excluding the pilot sample, six food handlers) distributed as follows. Faculty of Medicine (4), Faculty of Arts and Commerce (20), Faculty of Nursing (5), Faculty of Education (4), Faculty of Engineering (3), Faculty of Computing and Information (3), Faculty of Applied Arts (3), Faculty of Education Quality (4), Faculty of Law (5), Faculty of Physical Education (4) and Faculty of Science (5).

### 4.4. Tools of data collection

Data collected through the utilization of the following tools:

#### 4.4.1. Structured Interview Questionnaire

It developed by the researchers and composed of two parts:

Part I included questions that assessed the demographic characteristics of food handlers as age, gender, residence, educational status, marital status, work in another job, years of experience, monthly income, and health certificate.

Part II was adapted from *Sharif and Al-Malki (2010)* and modified by the researchers to meet the study purpose. The original questionnaire was 15 questions after modification; another two questions added include adding two questions related to foodborne diseases that can be transmitted by foods (Cholera, Hepatitis A, and Typhoid are an example of diseases that can be transmitted by food). The questions were classified into seven questions about food poisoning, five questions about food sanitation, and five questions about food storage or preservation.

#### Scoring system

The scoring system of food handler knowledge is calculated as follows (2) scores for a correct and complete answer, while (1) score for the correct and incomplete answer, and (zero) for incorrect or do not know the answer. The total knowledge scores were (34 points) considered good if the score of the total knowledge  $\geq 75\%$  equal and more ( $\geq 26$  points) while considered average if it equals 50-75 % (17-26 points) and considered poor if it equals or less than 50% ( $\leq 17$  points).

Part III is concerned with practice-related questions. It originally consisted of 20 questions that became 26 after the addition of 6 questions. The added questions include inquiry about the regularity of medical examination, the absence from work in case of illness, and drying the utensils after washing. In addition to questions related to food protective coverage, checking the expiry date before purchasing food items, and reading the instruction for use and preservation of food). The questionnaire divided into three main parts as follows: 5 questions assessed practices of personal hygiene, 8 for protective measures, and 13 for food handling, safety, and storage, and cleaning of utensils.

### Scoring system

The scoring system for food handler practices calculated as follows (2) score for regular done, while (1) score for irregular and (zero) for not done the practice. The total reported practice score was (54 points) considered satisfactory if the score of the total practices  $\geq 60\%$  equal ( $\geq 32$  points), while considered unsatisfactory if it is  $<60\%$  equal (32 points).

#### 4.4.2. Food Handlers Attitudes Assessment Scale

It is a 3-points Likert scale adapted from *Sharif and Al-Malki (2010)* to assess the food handlers' attitude regarding food safety and handling. It included 15 questions; nine questions asked about food handlers' attitudes toward food safety, and six asked about food handling, storage, and cleaning of utensils.

The respondents were asked to put their responses as one of the following (agree, sometimes, and disagree). The scoring system for the food handler attitude is calculated as follows (2) score for a positive response, while (1) score for neutral response, and (zero) score for a negative response. The total attitude scores were (30 points) considered positive if the score of the total attitude  $\geq 75\%$  equal and more ( $\geq 23$  points) while considered negative if it less than 75 %.

#### 4.4.3. Environmental Observation Checklists

It consisted of 20 items guided by the SC5 hygiene inspection checklist published by *Food Standard Agency, (2013)*. The checklist assessed the cafeterias' environmental condition and composed of 7 items covered clean tools, place, and ventilation, seven items for storage and handling of foods, and six items for pest control and waste disposal.

#### 4.5. Procedures

The validity of data collection tools and booklets' content examined by three experts, one professor from the Community Health Nursing, Faculty of Nursing, Zagazig University, one professor from the Community Health Nursing, Faculty of Nursing, Alexandria University, and one professor from the Community Health Nursing, Faculty of Nursing, Benha University to assess clarity, applicability, and understanding of the tools. All recommended change on the tools was done.

The internal consistency reliability of all items of the tools assessed using Cronbach's alpha coefficient. It was 0.89 for the first tool (a structured questionnaire included: demographic data, questions of knowledge, practices about food hygiene, and attitude), and 0.83 for the second tool (observation checklist assessed the cafeterias environmental condition).

Fieldwork: Data collection took three months, from April to the end of June 2019. The researchers initiate the data collection two days per week (Sunday and Thursday) during the three months. The study was accomplished through four phases: assessment, planning, implementation, and evaluation.

Assessment phase: This phase included the pre-guideline session for baseline assessment. The researchers first introduced themselves and explained the purpose of the research to the dean of faculty responsible for the cafeteria and the cafeteria food handlers.

All the food handlers working in the cafeteria of Benha University Faculties were met. The pre-test knowledge, practices, and attitudes questionnaires were distributed. Then the same questionnaires were used after the guideline sessions' implementation (one month later) as a post-test for comparison. The time consumed for answering questionnaires ranged from 25-30 minutes for each. The data were primarily tested to provide the basis for designing the guideline sessions.

Planning phase: Based on a review of the literature, sample features, and the results obtained from the assessment phase, the researchers designed the content of guidelines. The researchers prepared an illustrated booklet, and after its content validation, it gave for food handlers to be used as a guide for self-learning.

General objective: The general objectives of the food handlers' guideline sessions were to improve their knowledge, practices, and change negative, and support positive attitudes toward food hygiene.

Specific objectives: By the end of the guideline sessions, the food handlers supposed to be able to:

- Identify the importance of food safety.
- Recognize the sources of food safety hazards.
- Perform standardized hand washing.
- Identify the importance of personal hygiene.
- Apply the procedure of wearing protective clothing correctly.
- Explain the methods of pest control.
- Identify the cross-contamination.
- Use of cleaning fabrics appropriately.
- Demonstrate the cleaning and sterilization technique.
- Differentiate between the methods of cooking liquid foods, chicken, red meat, and mixed foods.
- Enumerate the methods of keeping hot food and reheating.
- Identify the correct methods of freezing and preservation of food.
- Identify the proper method of cooling hot food.

Implementation phase: The researchers visited the previous setting two days per week from 9.00 a.m. to 1.00 p.m. and met 5-7 food handlers each day. The guidelines were implemented in five sessions (three theoretical and two practical); the time of each session was 60 minutes. Group discussions and lecture used as teaching methods for theoretical sessions (first, second, and third) while demonstration and re-demonstration teaching methods used for practical sessions (fourth and fifth), and a variety of teaching materials supported the sessions as the data show, booklet, brochure, posters, and images. The objectives of the sessions were as follows:

- The first session: The main objective covered the knowledge about the importance of food safety, personal hygiene, and sources of food safety hazards.

- The second session: The main objective covered the knowledge about the methods of pest control and cross-contamination.
- The third session: The main objective covered the methods of cooking liquid foods, chicken, red meat, and mixed foods, as well as the methods of keeping hot food, reheating, cryopreservation, and freezing, followed by cooling hot food.
- The fourth and fifth sessions: These sessions covered the practice of handwashing (time and methods), wearing protective clothing, use of cleaning fabrics followed by cleaning and sterilization.

The evaluation phase includes evaluating the guideline sessions about food hygiene was done one month later after the application of the sessions; through the same tools.

A pilot study was conducted to identify the needed time to complete the tools and assess the study process's applicability, clarity, and feasibility. A pilot study was carried out on six food handlers representing 10% of the study sample and excluded later from the study.

Administrative and ethical considerations: Approval to conduct the study was obtained from the dean of the Faculty of Nursing, Benha University, directed to the dean of the selected cafeteria faculties to implement the present study. The researchers also took informed oral consent from each food handler who agreed to participate in the study. They were also assured about the confidentiality of the information given to carry out the study that will be used only for the study.

#### 4.6. Data analysis

Data entry and statistical analysis made using the Statistical Package for Social Sciences (SPSS), version 20.0. The data collected, organized, coded, computerized, and analyzed by using appropriate statistical methods. Mean and standard deviation for quantitative data,  $X^2$  for qualitative data, and correlation tests were used. Data presented in suitable tables and figures using appropriate statistical techniques & tests of significance detected at  $p$ -value  $< 0.05$ .

### 5. Results

Table 1 reveals the frequency and percentage distribution of studied food handlers according to their socio-demographic characteristics. This table indicates that the age of 50.0% of the food handlers was 20 to less than 30 years and 43.3% from 30 to less than 40 years with Mean $\pm$ SD of 32.63 $\pm$ 4.71 and 73.3% of them were males and single. Additionally, 58.3% of the participants were from urban areas, and 76.7% had a secondary education level. Moreover, 78.3% of participants worked in another job, and 35.0% had five to less than ten years of working experience as food handlers.

Figure 1 illustrates that 76.7% of the studied food handlers had health certificates, while 23.3% did not have health certificates.

Table 2 shows the comparison of food handlers' knowledge about food hygiene pre and post-intervention

guidelines. In this table, the knowledge of 21.7 % of food handlers was poor, average among 60.0%, and good among 18.3 %. A statistically significant improvement in their knowledge level post-intervention compared to their pre-intervention level regarding food poisoning, food sanitation, and food storage or preservation ( $p < 0.000$ ). The percentage of good knowledge increased to 85.0%, and poor knowledge decreased to 5.0%.

Table 3 shows the comparison of food handlers' attitudes toward the food hygiene pre and post-intervention guidelines. This table displays a statistically significant improvement in their attitude responses post-intervention compared to their pre-intervention level regarding the attitudes toward food safety, handling and storage of food, and cleaning tools. ( $p < 0.000$ ).

Figure 2 illustrates that 65.0% of the studied food handlers had a negative attitude toward food hygiene before the guideline sessions decreased to 15.0 % after the guideline sessions.

Table 4 indicates the comparison of food handlers' practice regarding food hygiene pre and post-intervention guidelines. This table shows statistically significant improvement in their practices post-intervention compared to the level of their practice pre-intervention regarding personal hygiene, protective measures, food storage & safety, and cleaning of tools ( $P=0.000$ ).

Figure 3 illustrates that 31.7% of the studied food handlers had satisfactory practices regarding food hygiene before the guideline intervention increased to 76.7% after the intervention.

Table 5 reveals correlations between the socio-demographic characteristics of food handlers and their knowledge about food hygiene pre-post guidelines intervention. This table shows significant correlations between food handlers' knowledge about food hygiene with age ( $r = 0.34$ ,  $p = 0.007$ ) pre-intervention and educational level ( $r = 0.72$ ,  $p = 0.03$  &  $r = 0.52$ ,  $p = 0.04$ ) pre and post-intervention. Additionally, there were significant correlations between their knowledge and work experience ( $r = 0.30$ ,  $p = 0.01$ ) post guideline intervention.

Table 6 reveals correlations between socio-demographic characteristics of food handlers and their attitudes toward food hygiene pre-post guidelines intervention. This table Indicates significant correlations between food handlers' attitudes toward food hygiene with gender ( $r = 0.27$ ,  $p = 0.03$ ) post guideline intervention. As well, there were highly statistically significant correlations between their attitudes with residence, educational level, and work experience ( $r = 0.45$ ,  $r = 0.60$  &  $r = 0.45$ ,  $p = 0.000$ ) post guideline intervention.

Table 7 shows correlations between the socio-demographic characteristics of food handlers and their practices related to food hygiene pre-post guidelines intervention. This table displays significant correlations between food handlers' practices related to food hygiene and educational level ( $r = 0.27$ ,  $p = 0.03$ ).

Table 8 reveals the frequency and percentage distribution of environmental conditions of 12 cafeterias at faculties of Benha University. This table indicates that all

cafeterias (100%) were clean, in good condition, and in proper ventilation places. Also, 91.7% of the tools and utensils used in food preparation were clean and well kept. Suitable chemicals for cleaning were available and appropriately stored at 83.3% of the university cafeterias.

Whereas separate towels to dry the utensils were unavailable at 83.3% of the university cafeterias, 58.3% of hand wash basins were unclean. Also, 75.0% of workers' toilets and facilities were clean. For storage and handling of foods, dried foods and food stored adequately at all cafeterias 100%, and chillers and freezers worked fine. On the other hand, in all cafeterias, food in the

refrigerator/freezer was not covered or wrapped in transparent bags, but 91.7% of the food outside the refrigerator covered and protected insects and dust.

The date of production and validity for food stock was not checked regularly at 75.0% of the cafeterias, and preparation of food in a separate clean place was not found in 41.7% of the cafeterias. Regarding pest control and waste disposal, all cafeterias 100% were free from insects (e.g., flies, cockroaches), the windows covered with an insect protection net, insecticides were available and kept in suitable places and used correctly. Also, the waste disposed of properly at 83.3% of the cafeterias.

**Table (1): Frequency and percentage distribution of studied food handlers according to their socio-demographic characteristics (n=60)**

Socio-demographic characteristics	No	%
<b>Age in years</b>		
20- < 30 Y	30	50.0
30- < 40 Y	26	43.3
40+	4	6.7
<b>Mean <math>\pm</math>SD</b>	32.63 $\pm$ 4.71	
<b>Gender</b>		
Male	44	73.3
Female	16	26.7
<b>Residence</b>		
Urban	35	58.3
Rural	25	41.7
<b>Educational level</b>		
Cannot or only can read and write	4	6.7
Basic education	10	16.7
Secondary	46	76.7
<b>Marital status</b>		
Single	44	73.3
Married	16	26.7
<b>Work in another job (extra work)</b>		
Yes	47	78.3
No	13	21.7
<b>Work experience</b>		
Less 5 years	19	31.7
5 to <10 years	21	35.0
$\geq$ 10 years	20	33.3
<b>Monthly income:</b>		
Enough	35	58.3
Enough and saving	25	41.7
<b>Training course</b>		
Yes	0	0.0
No	60	100

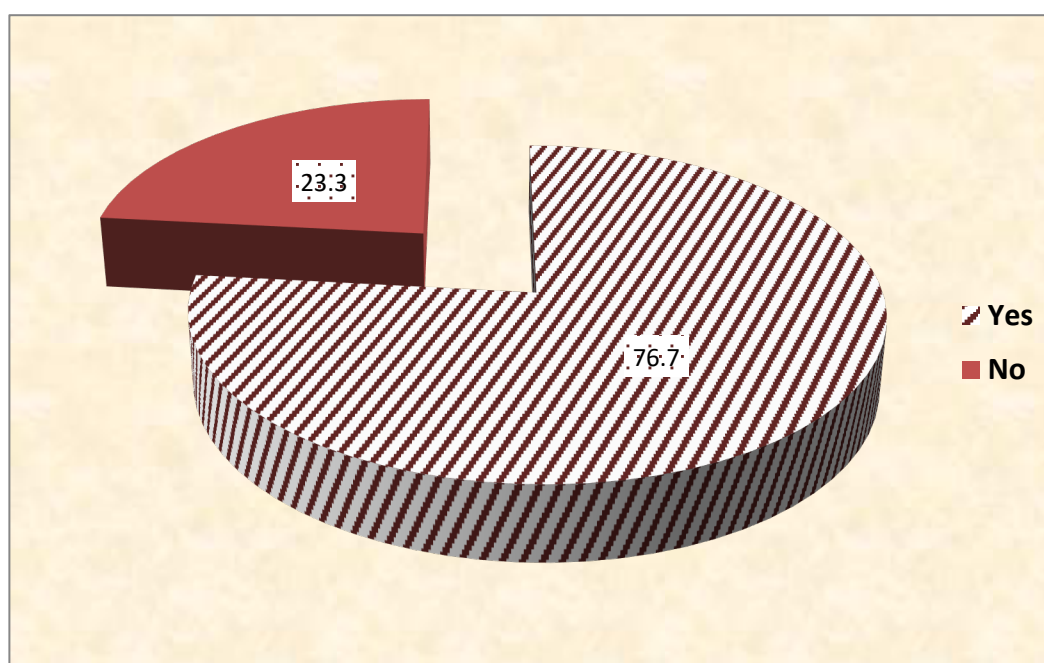


Figure (1): Percentage distribution of studied food handlers according to a health certificate for working (N=60).

Table (2): Comparison of food handlers' knowledge regarding food hygiene pre and post-intervention guidelines.

Knowledge	Pre (N=60)						Post (N=60)						X <sup>2</sup>	P-value
	Good		Average		Poor		Good		Average		Poor			
	No	%	No	%	No	%	No	%	No	%	No	%		
The total score of knowledge about food poisoning	10	16.7	13	21.7	37	61.7	51	85.0	6	10.0	3	5.0	59.0	0.000
The total score of knowledge about food sanitation	16	26.7	25	41.7	19	31.7	53	88.3	6	10.0	1	1.7	47.6	0.000
The total score of knowledge about food storage or preservation	18	30.0	13	21.7	29	48.3	57	95.0	1	1.7	2	3.3	54.0	0.000
The total score of knowledge about all items	11	18.3	36	60.0	13	21.7	51	85.0	6	10.0	3	5.0	53.4	0.000

Table (3): Comparison of food handlers' attitude regarding food hygiene pre and post-intervention guidelines.

Attitude	Pre (N=60)						Post (N=60)						X <sup>2</sup>	P-value
	Positive		Neutral		Negative		Positive		Neutral		Negative			
	No	%	No	%	No	%	No	%	No	%	No	%		
Attitude towards food safety	10	16.7	13	21.7	37	61.7	51	85.0	6	10.0	3	5.0	59.0	0.000
Attitude towards handling food, cleaning tools, and storage of food	16	26.7	25	41.7	19	31.7	53	88.3	6	10.0	1	1.7	47.6	0.000
The total score of attitudes toward food hygiene	11	18.3	36	60.0	13	21.7	51	85.0	6	10.0	3	5.0	53.4	0.000

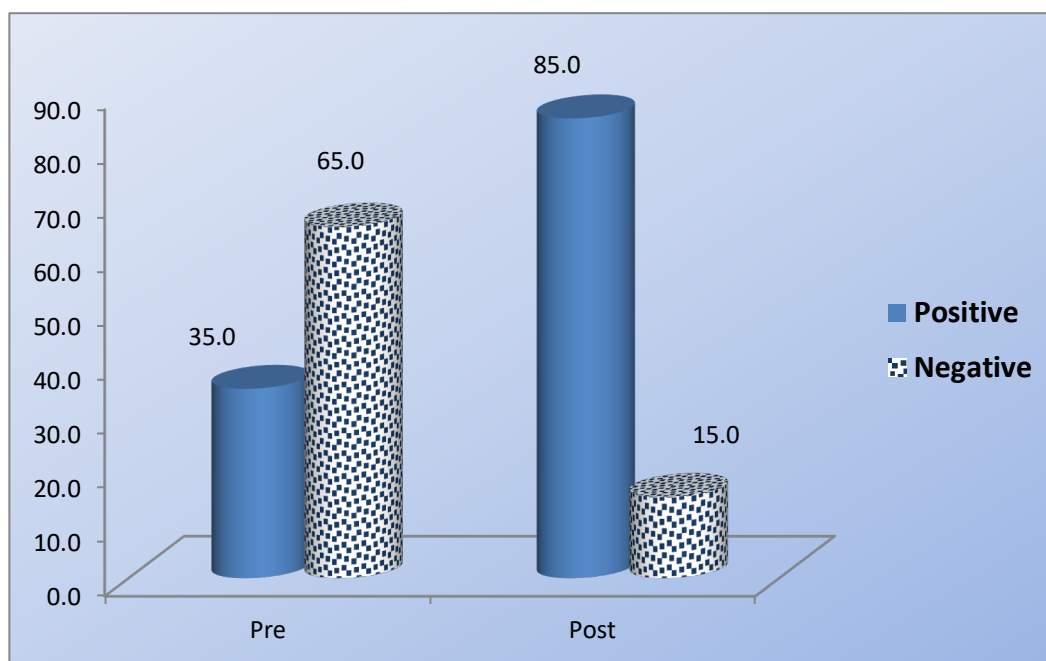


Figure (2): Percentage distribution of studied food handlers' total attitude score towards food hygiene pre- post-intervention guidelines (n=60).

Table (4): Comparison of food handlers' practice regarding food hygiene pre and post-intervention guidelines.

Practices	Pre (N=60)						Post (N=60)						X <sup>2</sup>	p-value
	Regular done		Irregular done		Don't done		Regular done		Irregular done		Don't done			
	No	%	No	%	No	%	No	%	No	%	No	%		
practices related to personal hygiene	25	41.7	16	26.7	19	31.7	43	71.7	6	10.0	11	18.3	11.44	0.0003
practices related to protective measures	8	13.3	16	26.7	36	60.0	38	63.3	5	8.3	17	28.3	32.1	0.000
practices related to clean tools, safety food, and storage	7	11.7	10	16.7	43	71.7	52	86.7	2	3.3	6	10.0	67.5	0.000

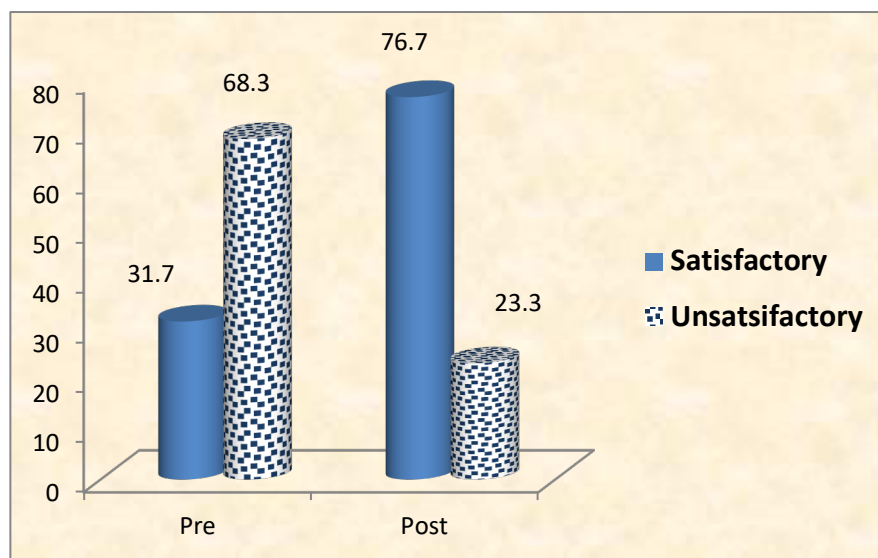


Figure (3): Percentage distribution of the total scores of practices related to food hygiene among the studied food handlers pre-post guideline sessions (no=60).

**Table (5): Correlations between the socio-demographic characteristics of food handlers and their knowledge about food hygiene pre-post intervention guidelines.**

Socio-demographic characteristics	Total knowledge			
	Pre		Post	
	r	p-value	r	p-value
Age	0.34	0.007	0.53	0.05
Gender	0.42	0.85	0.51	0.69
Residence	0.41	0.27	0.82	0.08
Educational level	0.72	0.03	0.52	0.04
Work experience	0.32	0.06	0.30	0.01

**Table (6): Correlations between socio-demographic characteristics of food handlers and their attitudes toward food hygiene pre-post intervention guidelines.**

Socio-demographic characteristics	Total attitude			
	Pre		Post	
	r	p-value	r	p-value
Age	0.56	0.67	0.73	0.58
Gender	0.44	0.73	0.27	0.03
Residence	0.38	0.58	0.45	0.000
Educational level	0.31	0.43	0.60	0.000
Work experience	0.61	0.32	0.45	0.000

**Table (7): Correlations between the socio-demographic characteristics of food handlers and their practices related to food hygiene pre-post intervention guidelines.**

Socio-demographic characteristics	Total practices			
	Pre		Post	
	r	p-value	r	p-value
Age	0.24	0.059	0.34	0.18
Gender	0.065	0.72	0.11	0.38
Residence	0.16	0.33	0.12	0.91
Educational level	0.34	0.13	0.27	0.03
Work experience	0.26	0.44	0.52	0.82



**Table (8): Frequency and percentage distribution of environmental conditions at 12 cafeterias at faculties of Benha University.**

Cafeterias environmental condition	Yes		No	
	No	%	No	%
<b>Clean tools, place, and ventilation</b>				
The place is clean and in good condition	12	100.0	0	0.0
Food preparation tools and utensils are clean and well kept	11	91.7	1	8.3
Suitable chemicals for cleaning are available and stored properly	10	83.3	2	16.7
Separate towels are used to dry the utensils once	2	16.7	10	83.3
Clean hand washbasins	5	41.7	7	58.3
Workers' toilets and facilities are clean	9	75.0	3	25.0
The ventilation is good in place	12	100.0	0	0.0
<b>Storage and handling of foods</b>				
Dried foods and food are stored properly	12	100.0	0	0.0
Food in refrigerator/freezer covered or wrapped in transparent bags	0	0.0	12	100.0
The food outside the refrigerator is covered and protected from insects and dust	11	91.7	1	8.3
The date of production and validity is regularly checked for food and stock	3	8.3	9	75.0
Chillers and freezers work fine	12	100.0	0	0.0
Prepared foods are prepared in a separate clean place	7	58.3	5	41.7
There are separate tools and utensils used for ready-to-eat foods	6	50.0	6	50.0
<b>Pest Control and Waste Disposal</b>				
The place is free of insects (e.g., flies, cockroaches)	12	100.0	0	0.0
The windows are covered with an insect protection net	12	100.0	0	0.0
There are pesticides to fight insects	12	100.0	0	0.0
Insecticides are kept in a suitable place and used properly	12	100.0	0	0.0
There are a wastebasket and a basket of other foods	7	58.3	5	41.7
The waste in the cafeteria is disposed of properly	10	83.3	2	16.7

## 6. Discussion

Food handlers across the food chain play critical roles in ensuring food safety. Deficit knowledge about food safety among food handlers and poor food handling practices can reduce food-keeping quality and increase the incidence of foodborne disease (*Sharif, Obaidat & Al-Dalalah, 2013; Aluko, Ojeremi, Olaleke, & Ajidagba, 2014*).

This study aimed to evaluate the effect of hygiene guidelines on food handlers at Benha university cafeterias. The age of the highest percentage of food handlers who participated in the current study was 20-40 years with Mean  $\pm$ SD (32.63 $\pm$ 4.71), more than half of them were from urban areas, and three-quarters of them were males. The current finding agreed with the study conducted by *Lee, Abdul Halim, Thong, & Chai (2017)* in Malaysia, who assessed hand hygiene of food handlers, food safety knowledge, attitude, and self-reported practices and found the food handlers aged from 21- 41years old represented 64.2%. Also, in the same line with a study on food safety knowledge, attitude, and practices of orange-fleshed, sweet-potato-puree handlers implemented by *Malavi, Abong, and Muzhingi (2017)* in Kenya. The study founded that (77.1%) food handlers were males, while more than half (57.1%) of all food handlers were within the age group 26-35 years. However, these results disagreed with the study of *Akabanda, Hlorts, and Owusu-Kwarteng, (2017)*. They conducted a study on food safety knowledge, attitudes, and practices of institutional food-handlers in Ghana, who reported that most food-handlers were between the age of 41-50 years, and more than three-quarters of them were

females. This difference may be referred to as the cultural difference between Egypt and other African countries.

Educational levels of the food handlers in the current study revealed that more than three-quarters of the food handlers had secondary education. It may be due to the lack of suitable employment chances for this level of education. This finding was in line with *Afolaranmi, Hassan, Bello, and Misari (2015)*, who conducted a study in primary schools in Nigeria on food safety knowledge, practice, and hygiene among food vendors. The study found that more than fifty percent of them had a secondary educational level. Also, the current study was in agreement with a study conducted by *Mashuba, Bopape, and Kekana (2016)*. The study knowledge and practices of food service staff regarding food safety and food hygiene in the Capricorn district hospitals in the Limpopo province, South Africa. They reported that the majority of foodservice staff had secondary school education.

Before the guideline sessions, knowledge about food hygiene of the food handlers in the current study was poor among 21.7 %, average among 60.0%, and good among 18.3%, which reflects the unsatisfactory level of knowledge about food hygiene among them. It may be because most of them had a moderate level of education and did not receive any training course about food hygiene. This result is consistent with a study in Malaysia conducted by *Lee et al. (2017)*, who noticed an average level of knowledge about food safety among (61.7%) of the food handlers. However, the finding is contrary to *Akabanda et al. (2017)*, who found good knowledge among the participated food handlers about food safety, cleaning and sanitation, and

personal hygiene in a study implemented in Ghana on food safety knowledge, attitudes, and practices.

After the guideline sessions, the percentage of good knowledge increased to 85.0%, and poor knowledge decreased to 5.0%, with a statistically significant difference between pre and post guidelines intervention, which reflects a satisfactory level of knowledge resulting from the effect of guideline sessions. These results were in line with a study carried out by *Adesokan et al. (2015)*, who revealed that food safety training was associated with improved knowledge and behaviors among food service establishments' workers. Also, noted a significant change in knowledge and practice of safe food handling but with repeated short-term training. It supports the first research hypothesis.

The current study results showed that about two-thirds of the food handlers had negative attitudes toward food hygiene before the guideline sessions. It may be due to the unsatisfactory knowledge among them about food poisoning, food sanitation, food storage and preservation, and lack of training courses about food hygiene. So they can not appreciate their role in transmitting microorganisms and food poisoning. After the guideline intervention, the negative attitudes among food handlers decreased. There were significant correlations between food handlers' attitudes toward food hygiene with gender, residence, educational level, and work experience. These modifications of food handlers' attitudes may be due to the improvement of their knowledge that occurred after the guideline sessions.

This finding agrees with *Bas, Ersun, and Kivanç (2006)*. They found poor attitude scores among the food handlers toward the prevention and control of foodborne diseases and noticed that attitude is a significant factor that ensures a reduction trend of foodborne diseases. At the same line with studies of *Tan, Bakar, Karim, Lee, and Mahyudin (2013)*; *Sani and Sion (2014)*. They found negative attitudes toward hand hygiene, the practice of safe storage of food, and the control of cross-contamination were observed among food handlers of their studies. The current result was in contrast with *Mustaffa, Rahman, Hassim, and Ngadi (2017)*, who found a positive attitude among most food handlers in their study. Also, the study of *Ituma, Onwasigwe, Nwonwu, Azuogu, and Ezel (2018)* found that 52.9% of the studied food handlers had a positive attitude toward food hygiene, and this result in contrast with the result of the current study. This finding supports the second research hypothesis.

Food handlers of the current study had unsatisfactory practices regarding food hygiene. It represented in the practices related to personal hygiene (one third), protective measures, food safety, storage, and cleaning utensils (two thirds), which reflected poor practice before the guideline sessions. This deficient practice may be due to unsatisfactory knowledge and lack of training courses about food handling and hygiene. However, the practices improved among about three-quarters of them after the guideline sessions. The current finding is in line with *Afolaranmi et al. (2015)*, who found that 15.5% of the food

vendors were cleaning and sanitizing the cutting surfaces, reflecting poor practice among them. This result agrees with a study in South Africa by *Mashuba et al. (2016)*, who revealed several inadequate food hygienes and poor practices among food handlers staff about food safety. This finding was in line with *Ituma et al. (2018)*, who found that only 27.6% of food handlers had a good practice. Only 33.5% of them wore an apron, and 27.1% covered their heads. Besides, 14.7% of the food handlers of the study of *Pagotto, Espindula, da Vitória, Machado, and Brilhante (2018)* went to work even if they are suffering from diarrhea or had wounds and cuts of hands and other diseases. This result may indicate that food handlers are unaware of the risks of handling food when they are sick, besides indicating the fear of work loss.

In contrast to the current study result, good practices were reported among the respondents of *Malavi, et al. (2017)* study. They reported good practice in the form (85.7%) washed their hands with soap every time after visiting the toilet; 74.3% used gloves to handle food; 54.3% washed their hands before wearing gloves, and 68.6% did not wipe their hands with their aprons. This finding is supporting the first research hypothesis.

In the current study, there were significant correlations between educational level and work experience of food handlers with their knowledge and significant correlations between their practices related to food hygiene with their educational level about food hygiene pre-post guidelines intervention. This result in agreement with a study conducted in South Africa by *Mashuba et al. (2016)*. The study indicated that knowledge was significantly associated with an education level of food service staff, indicating a need to consider education level when employing staff to work in public food service and provide them with continuous training about food hygiene. The current study, also in line with a study in South Africa by *Mashuba et al. (2016)*, found that knowledge scores were significantly higher in trained food handlers than those who were not trained. The finding in agreement with a study in Sri Lanka by *Galgamuwa, Iddawela, and Dharmaratne (2016)*, revealed a significant correlation between the educational levels of subjects and their food hygiene practices. Also, the result in consistent with a study implemented in Kenya by *Malavi et al. (2017)* and found food safety practices increased with age, level of education, years of employment, and food safety training.

About the cafeterias' environmental condition, food preparation in a separate clean place was not found in less than half of the university cafeterias. It may be due to the university cafeterias rented from specialized companies, and a separate clean place for food preparation will be an economic load. This finding was in disagreement with the guidelines published by the *Food and Agriculture Organization of the United Nations and Pan American Health Organization / World Health Organization (2017)*. They recommended that the location of the food preparation area and surroundings should be distant from garbage, sewage, places where toxic products are produced, and other contamination sources. Also, the reception and

storage areas of food should be separated from the other areas and be in good order, clean, and disinfected at all times.

However, the current results revealed that all cafeterias were clean, good ventilated, and in good condition. Also, most of the tools and utensils used in food preparation were clean and well kept. Also, suitable chemicals for cleaning were available and appropriately stored at most university cafeterias. For storage and handling of foods, dried foods and food appropriately stored at all cafeterias and chillers and freezers worked fine. Also, three-quarters of workers' toilets and facilities were clean. Most of the food outside the refrigerator is covered and protected from insects and dust.

Regarding pest control and waste disposal, all cafeterias were free from insects (e.g., flies, cockroaches), the windows covered with an insect protection net, insecticides were available and kept in suitable places and used correctly. Also, the waste is disposed of properly at the majority of the cafeterias. It may be due to the university cafeterias are rented by private companies, so the infrastructure and resources are available to achieve success. Also, because they serve oriented categories of people represented in university students, staff, and employees, it requires quality in the service to get their satisfaction.

These results were in line with *Alimentarius* (2009), who stated that to minimize the risk of foodborne illnesses in the production and processing of foods, it is important to reduce the contamination risk in the placement. This risk minimization could be done through well preparation and arrangement of the kitchen utensils, preparing the area properly, cleaning, and disinfecting surfaces and materials of the kitchen. Ensure that the kitchen has a control mechanism for humidity and temperature and protective measures against pests.

The current findings also agreed with the study of *Odiye et al.* (2019), who revealed that facilities necessary for safe storage of cooked food were available in 75% of the cafeterias of their study. Also, all cafeterias had access to both potable water and an adequate refuse disposal system. Besides, 31.3% were adequately ventilated, 46% had access to means of adequate sewage disposal, and flies and rodents were absent in 75% of the visited cafeterias.

## 7. Conclusion

In light of the present study results, it can be concluded that the educational guideline intervention was effective and resulted in an increase in the knowledge level of food handlers, change their negative attitudes, and improve their practices about food hygiene. This supported the research hypotheses. Also, the level of education and years of experience can influence the knowledge and practices of food handlers about food hygiene.

## 8. Recommendations

Based on the present study findings, the following recommendations are suggested:

- Continuous health education interventions about food hygiene improve food handlers' knowledge, attitudes, and practices at all cafeterias of Benha University.
- Illustrated booklets and handouts based on standardized knowledge and practices of food hygiene and safe food should be available for food handlers at all cafeterias of Benha University to be used as a reference.
- Further research should be geared towards implementing health education programs to improve food handlers' knowledge, attitudes, and practices about food safety and hygiene at all cafeterias of Egypt Universities.

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