Knowledge, attitudes and practices of food handlers about food safety at Fayoum restaurants

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Abstract

Background: All food handlers are required to possess adequate food safety knowledge and food handling skills to handle food hygienically during preparation and to ensure that food is safe by the time it reaches the consumer especially during a corona pandemic. **The aim** of this study was to assess the level of knowledge, attitudes, and practices regarding food safety among food handlers at local and international restaurants in Fayoum. To determine the correlation between the knowledge, attitudes and practices of food handlers about food safety during the corona virus pandemic. **Study design:** a comparative quantitative cross-sectional study. **Subjects and Method**: a descriptive cross-sectional research design was conducted with a convenient **sample** of 100 food handlers from Fayoum. The data is collected using structured questionnaires arranged by interviews. There are four **tools**: first; Food handler's personal and socio-demographic data, second; Food handlers' knowledge Questionnaire, third; Food handlers' practices and fourth; Food handlers' attitude toward food safety scale. **Results**: More than one quarter of the food handlers had poor knowledge about food safety and less than one fifth of them had good knowledge level. The majority (98.0%) of the food handlers had a positive attitude toward food safety and controlling food temperature. Around two thirds (66.0%) of the food handlers had poor practice level about food safety and controlling food temperature. More than one quarter (30.0%) of the food handlers had fair practices. **Conclusion**: Lack of knowledge and practices of food handlers are important a potential risk. Therefore, it is **recommended** that there is an urgent need to train programmers for food handlers and repeat the training at specific time intervals to ensure that the learned data is applied in daily life practice and reduce the occurrence of epidemics.

Key words: Knowledge, Attitude, Practice, Food handlers, Temperature control, Local cuisine restaurants, International restaurants.

Introduction

The corona virus pandemic has affected every country in the world, restraining people's exposure and encouraging them to stay at home more [1]. Staying at home and limiting going to the markets has led to an increase in the demand for food delivery service from restaurants. There is currently no evidence that COVID-19 can be contracted through food. Restaurants should spotlight on protecting food workers, consumers and diners from human-to-human transmission [2].

Food borne disease outbreaks in food preparation and service facilities are attributed to cook and storage of food at incorrect temperatures, as well as cross-contamination of food due to unsanitary handling practices [3]. Poor personal hygiene and the procurement of food from unreliable sources have also been found to contribute to food borne disease outbreaks in food preparation and service facilities [4]. Food handlers can spread the virus by coughing, speaking, breathing, sneezing, or singing. When viruses are propelled into the surrounding air, all of these actions can produce an infectious aerosol [5].

In food preparation and service facilities such as restaurants, food handlers with insufficient food safety knowledge pose a severe hazard to food safety [6]. As a result, all food handlers must have sufficient food safety knowledge and abilities in order to handle food hygienically throughout preparation and ensure that food is safe by the time it reaches the customer [7, 8]. Food handlers must maintain high levels of food hygiene and sanitation to avoid microbial contamination of food [9].

Food borne disease outbreaks can cause morbidity and mortality in the public leading to increased hospitalization cost for the public health department [10]. When a food borne disease outbreak occurs, the government incurs expenses by paying health institutions to address the problem [11, 12]. Inadequate food handling procedures have been linked to low levels of food safety knowledge among food handlers[13].According to the European Food Safety Authority, food services in food premises are responsible for roughly 48.7% of food-borne illnesses in 2019 [13]. Disease Control and Prevention (CDC) estimates that there are around 48 million cases of food borne illness every year, resulting in the loss of 33 million healthy life years [14].

Food handlers play a major role in food contamination [15]. In Egypt, Ministry of Health pointed out that many outbreaks food borne diseases have been occurred in last decade caused by a large proportion of people is 'eating out' [16]. In 2021, approximately 1647 food borne illness were reported and consumption of food from commercial sources comprised about 62 per cent (1029) of those who fell ill [17]. In 2021 alone, the 255 incidences of food borne diseases were reported to cause illness in 2066 people [18].

Significance of study:

WHO reported that one out of every ten individuals falls ill by eating unsafe food each year [19]. While food safety is a shared responsibility, individual consumers and food handlers play a crucial role in preventing food borne diseases. PAHO/WHO recommends five keys to safer food: Keep everything clean, keep raw and cooked foods separate, cook fully, keep food at safe temperatures, and use safe water and raw materials [20].

In Egypt, The initiation of COVID-19 has been reported to impact people's food preparation/ eating habits, consumer food safety awareness, food and hygiene related attitude and food purchasing behavior [12].

A safe and hygienic workplace helps to create a productive workforce, therefore creating a food safety and hygiene policy will ensure all employees know how to contribute to appropriate work practices [13]. As a result, the main purpose of this study was to (i) assess the level of knowledge, attitudes, and practices regarding food safety among food handlers at local and international restaurants in Fayoum. (ii) Determine the correlation between the knowledge, attitudes and practices of food handlers about food safety during the corona virus pandemic.

Operational definitions

Knowledge, attitude, and practice **(KAP)** surveys are the most commonly used methods in health-seeking behavior research, and they are typical of a certain community to collect information on what is **known**, **believed**, and **done** in regard to a specific topic [23].

A food handler is anyone who works in a food industry and handles food or surfaces that are likely to come into contact with food such as cutlery and plates. A food handler may do tasks such as chopping, cooking, cooling, packing, transporting, food service, or cleaning the premises and equipment [25].

The aim of this study was to: - assess the level of knowledge, attitudes, and practices regarding food safety among food handlers at local and international restaurants in Fayoum. To determine the correlation between the knowledge, attitudes and practices of food handlers about food safety during the corona virus pandemic

Research question

-What are the levels of food handler's knowledge, attitudes, and practices regarding food safety and temperature?

- Are there any differences between the KAP of food handlers by the types of restaurants?

- Is the Correlation between knowledge, attitude and practice levels regarding food safety temperature?

- What are the Predictors of good knowledge, attitude and practice regarding food safety temperature?

Subjects and Method

Study design: - A descriptive cross-sectional descriptive design was used in this study.

Study settings: - This study was conducted at local and international restaurants in Fayoum city. Fayoum is a governorate in Egypt in the middle of the country. Its capital is the city of Fayoum, located about 81 mi (130 km) south west of Cairo. It has a population of 3,848,708 (2020). There are 30 restaurants in Fayoum, including 6 international restaurants (American - European - seafood) and 24 local food restaurants. [25].

Study subjects: - A convenience sample of (100) food handlers. The total number of food handlers in all restaurants in 2020–2021 was announced to be 250. Ten restaurants were randomly selected from the existing data (N = 30). The inclusion criteria were all restaurant food handlers working as chefs, kitchens assistants, delivery or waiters, aged 20 years or above, having access to smartphone and Whatsapp messenger, and agreeing to participate actively in the study. The exclusion criterion was a volunteer's unwillingness to continue with the research for any reason.

Study tools: Four tools used in this study. A self-administered questionnaire for this study was prepared based on previous research [26, -28]. The questionnaire was translated from English to Arabic. It was tested by four bilingual academics specializing in food safety, for its understandability. The final questionnaire consisted of 30 items. The questionnaire was composed of four sections; demographic information (5 items), Food handlers' knowledge (8 items), practices (10 items) and attitudes (7 items). The

questionnaire also included an introductory part that explained the study's purpose, the voluntarism of participants, and the time needed to complete the study

Tool (I): Sociodemographic characteristics such as, age, educational level**,** duration of work in the restaurant, previous training on food safety and sources of information about food safety.

Tool (II): Food handlers' knowledge regarding food temperature structured interview schedule: It included **8** questions (yes/no format) to explore the food handlers' knowledge regarding food safety, proper temperature for storage of different food items and proper time for storage in refrigerators or freezers. The total score on the knowledge scale was calculated and converted into a percentage score classified as follows, poor practice ((≥ 50 % score), fair practice (50- < 75% score) and good practice (≤ 75% score).

Tool (III): Food handlers reported practices regarding food temperature scale:

The researchers developed it after reviewing the recent literatures. The scale comprised **10** questions with three responses [always = (2), sometimes= (1) and never= (0)].The total score on the practice scale was calculated and converted into a percentage score classified as follows, poor practice ((≥ 50 % score), fair practice (50- < 75% score) and good practice (≤ 75% score).

Tool (IV): Food handlers' attitude toward food safety and food temperature scale: It was developed by the researchers after reviewing of recent literatures. The scale comprised **7** statements with five-response choices from "strongly disagree" to "strongly agree" were used to ask these concerns. Questions in derogatory sentences reversed the order of the ratings. The total score was calculated and converted into percent score classified as follow, The responses were categorized into three levels, such as ≥ 75 % is positive attitude, (50- <75% score) is neutral attitude, and > 50 % score is negative in food safety attitude.

2- Methods:

The study was accomplished through the following steps**:**

Administrative process

1 – An official restaurants permission and written approval to carry out the study was obtained from the Dean of faculty of nursing to mangers of restaurants before conducting this study through official letters explaining the aim of the study.

2- **Ethical considerations:**

The study protocol was reviewed and approved by the Institutional Review Board of Faculty of Nursing, Fayoum University. Informed oral consents were obtained from the food handlers after brief explanation of the purpose and nature of the research. The anonymity and confidentiality of responses, voluntary participation and right to refuse to participate in the study were emphasized to food handlers. The researchers explained the objectives of the study to the participants.

3-Tool development:

The study tools were adopted by the researcher based on literatures review modified to suit the level of understanding of all subjects and was tested for translation by experts in English language

4- Validity of tools.

It was validated by juries of (5) experts in the field. Their suggestions and recommendations were taken into consideration.

5-Reliability of tools:

Cronbach Alpha Coefficient test was used to ascertain the reliability of tools after translation into Arabic language, (r = 0.83 for tool II, r = 0.75 for tool III and 0.87 for tool IV).

6- Pilot study

It was carried out on 10 food handlers who were randomly chosen froma restaurant not included in the sample in order to ascertain the relevance, clarity and applicability of the tools, test wording of the questions and estimate the time required for the interview. Based on the obtained results, the necessary modifications were done.

7- .Data collection

Approval of responsible authorities was obtained through official letters from the Deanship of Scientific Research (DSR), El fayoum University. Meetings were held with the directors of the selected settings to clarify the purpose of the study and to gain their cooperation and support during data collection. The researchers collected data during the period from January 2021 to May 2021.

8- Data analysis:

After data were collected, they were coded and transferred into specially designed formats so as to be suitable for computer feeding. Following data entry, checking and verification processes were carried out to avoid any errors during data entry, frequency analysis, cross tabulation and manual revision were all used to detect any errors. The statistical package for social sciences (SPSS version 20) was utilized for both data

presentation and statistical analysis of the results. The level of significance selected for this study was P equal to or less than 0.05.

3. Results:

Demographic characteristics of the study population

Table (1) shows that more than tenth (11.0%) of the food handlers aged 40 years old and more, while only 4.0% of them aged less than 25 years old. About two thirds (60.0%) of the food handlers had university education and 7.0% of them had basic education. Additionally, more than one third (37.0%) of the food handlers were working for less than five years and 17.0% of them were working for ten to 15 years. The majority (96.0%) of the food handlers had no previous training courses and programs about food safety. Furthermore, the main sources of their knowledge about food safety and food temperature control were public internet sites (98.0%), followed by food inspectors (55.0%), friends (36.0%), and training courses (30.0%).

Knowledge level of the studied food handlers

Figure (1) illustrates that more than one quarter (26.0%) of the food handlers had low level of knowledge compared to 16.0% of had high knowledge level. While, more than half (58.0%) of them had moderate knowledge level**.**

Reported practice level of the studied food handlers

Figure (2) shows that around two thirds (66.0%) of the food handlers poor practice level regarding food safety and only 4.0% had good practice. On the other hand, more than one quarter (30.0%) of the food handlers had fair practices**.**

Attitude level of the studied food handlers:

Figure (3) shows that vast majority (98.0%) of the food handlers had positive attitude towards food safety (2.0%) had neutral attitude.

Comparison between knowledge, attitude and practice levels of food handlers by type of restaurants regarding food safety.

Table (2) reveals that more than one quarter (28.6%) of food handlers working in international restaurants compared to 3.9% of those working in local restaurants had good knowledge regarding food safety, with a statistically significant difference between them (X2= 28.690, P= 0.000). Additionally, more than one third (34.7%) of the food handlers in international restaurants compared to the vast majority (96.1%) of those working in local restaurants had poor food safety, with a statistically significant

difference between them (X2= 42.025, P= 0.000).

Moreover, the same table portrays that all (100.0%) food handlers working in international restaurants compared to 96.1% of those working in local restaurants had positive attitude towards food safety.

Table (3): illustrated the relation between the sociodemographic characteristics of food handlers and their mean & SD for knowledge, practices and attitude levels.

Concerning food handlers' knowledge, it was noticed that higher knowledge mean scores was observed among food handlers aged 40 years and more compared to those aged less than 25 years (4.65 ± 1.663, and 3.50 ± 0.577 respectively), with a statistically significant relation between food safety knowledge and age of the food handlers (F= 2.489, P= 0.037). Moreover, the food handlers with university education showed higher knowledge mean score in comparison to those with basic education (4.57 ± 1.155, and 3.14 ± 1.574 respectively), with a statistically significant relation between food safety knowledge and level of education of the food handlers (F= 3.875, P= 0.024). The same table reveals a statistically significant relation between the food handlers' knowledge regarding food safety and temperature control and duration of work in the restaurants (F= 7.692 P = 0.001) where, food handlers working in newly opening restaurants (less than 5 years) had higher knowledge mean score than those working in old restaurants (10 -15 years) (4.68 ± 1.226, and 3.24 ± 1.602 respectively). Furthermore, trained food handlers had higher knowledge mean score than non-trained ones (4.37 ± 1.189, and 4.33 ± 1.462 respectively).

Regarding food handlers' practice, it was found that the younger the age of the food handlers the lesser practice mean score where food handlers aged 20 to less than 25 years had practice mean score 2.50 ± 5.000 compared to 6.55 ± 3.479 of those age 40 years and more. Additionally, a statistically significant relation was found between food handlers' food safety practices and their level of education (F= 7.377, P= 0.001), where the food handlers with university education had the highest practice mean score (5.62 ± 5.374). Moreover, food handlers working in new restaurants had better food safety practice mean score than those working in old restaurants (5.49 ± 5.388, and 1.35 ± 3.823 respectively) with a statistically significant relation between the food handlers' practices regarding food safety and temperature control and duration of work in

the restaurants (F= 3.922, P = 0.023). The same table reveals that food handlers who received training about food safety and food temperature control had higher practice mean score than those who did not receive any training (5.50 ± 5.361, and 3.59 ± 5.038 respectively).

With respect to attitude towards food safety and food temperature control, it was noticed that food handlers aged 20 to less than 25 years old had lower attitude mean score compared to those aged 40 years and more (28.0 ± 1.882, and 30.0 ± 3.559 respectively). The same was found in level of education, where food handlers with basic education had lower attitude mean score than those with university education (28.5 ± 2.079, and 29.0 ± 2.944 respectively). Furthermore, higher attitude mean score was noticed among food handlers working in newly opened restaurants (<5 years) in comparison to those working in older restaurants (10-15 years) (28.8 ± 2.243, and 28.3 ± 1.921 respectively). Lastly, food handlers who reported previous training on food safety and food temperature control had slightly higher attitude mean score than those who did not have such training (28.8 ± 1.937, and 28.5 ± 2.251 respectively).

Table (4): shows the relationship between the food handlers' knowledge mean scores and their practice and attitude level regarding food safety. The table reveals a significant relation between the food handlers' knowledge mean score and their food safety practices (F= 109.40, P= 0.000) where food handlers with good practices had higher knowledge mean score (6.00 ± 0.816) compared to those with poor practice (3.94 ± 1.424).

Moreover, higher knowledge mean score was noticed among food handlers with positive attitude toward food safety compared to those with neutral attitude (4.37 ± 1.373, and 3.00 ± 1.414 respectively).

Table (5): shows a statistically significant correlation between the food handlers' knowledge mean scores and their practice (r= 0.407, P = 0.000), while, no correlation was found between the food handlers' attitude and their knowledge or practice regarding food safety.

Table (6): shows the association between knowledge regarding food safety and characteristics of the study sample. It was explored using logistic regression analysis (Enter method) with good knowledge as the dependent variable. The R2 value is 0.341 which means that only 34.1% of the

variability in the outcome is explained by the studied characteristic. It was noticed that only one variable was found to be predictors of good knowledge namely type of restaurants (P= 0.001).

Table (7): shows the association between practice regarding food safety and control of food temperature and characteristics of the study sample using logistic regression analysis (Enter method) with good practice as the dependent variable. The R2 value is 0.553 which means that only 55.3% of the variability in the outcome is explained by the studied characteristic in the model. It was noticed that two variables were significantly predicting good practices namely type of restaurants (P= 0.000) and level of education of food handlers (P= 0.013).

Table (8): shows the association between attitude towards food safety and control of food temperature and characteristics of the study sample using logistic regression analysis (Enter method) with positive attitude as the dependent variable. The R2 value is 0.065 which means that only 6.5% of the variability in the outcome is explained by the studied characteristic in the model. It was noticed that no variables were predicting positive attitude towards food safety and control of food temperature

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Table (1): Comparison between the studied food handlers by type of restaurants according to their basic data:

Items	Food handlers at				Total (n=100)		Test of significance
	International restaurants (n=49)		Local restaurants (n=51)				
	No	%	No	%	No	%	
Age							
- 20	1	2.0	3	5.9	4	4.0	X^2 = 10.088
- 25-	8	16.3	15	29.4	23	23.0	P= 0.073
- 30-	22	44.9	14	27.5	36	36.0	
- 35-	15	30.6	11	21.6	26	26.0	
- ≥ 40	3	6.1	8	15.7	11	11.0	
Educational level							
- Basic education	2	4.1	5	9.8	7	7.0	X^2 = 7.315
- Secondary education	11	22.4	22	43.1	33	33.0	P= 0.026*
- University education	36	73.5	24	47.1	60	60.0	
Duration of work in the restaurant (years)							
- <5	23	46.9	14	27.5	37	37.0	X^2 = 7.004
- 5-	22	44.9	24	47.1	46	46.0	P= 0.030*
- 10-15	8	8.2	13	25.5	17	17.0	
Have previous training on food safety							
- No	45	91.8	51	100.0	96	96.0	X^2 = 4.337
- Yes	4	8.2	0	0.0	4	4.0	P= 0.037*
Sources of information about food safety#							
- Government websites	4	8.2	0	0.0	4	4.0	X^2 = 13.446
- TV	2	4.1	0	0.0	2	2.0	P= 0.097
- Public internet sites	48	98.0	50	98.0	98	98.0	
- Friends	20	40.8	16	31.4	36	36.0	
- Family	2	4.1	1	2.0	3	3.0	
- Food inspectors	31	63.3	24	47.1	55	55.0	
- Training course	21	42.9	9	17.6	30	30.0	
- Scientific websites	4	8.2	1	2.0	5	5.0	
- Social media	7	14.3	1	2.0	8	8.0	

X^2Chi square test * Significant p at ≤0.0

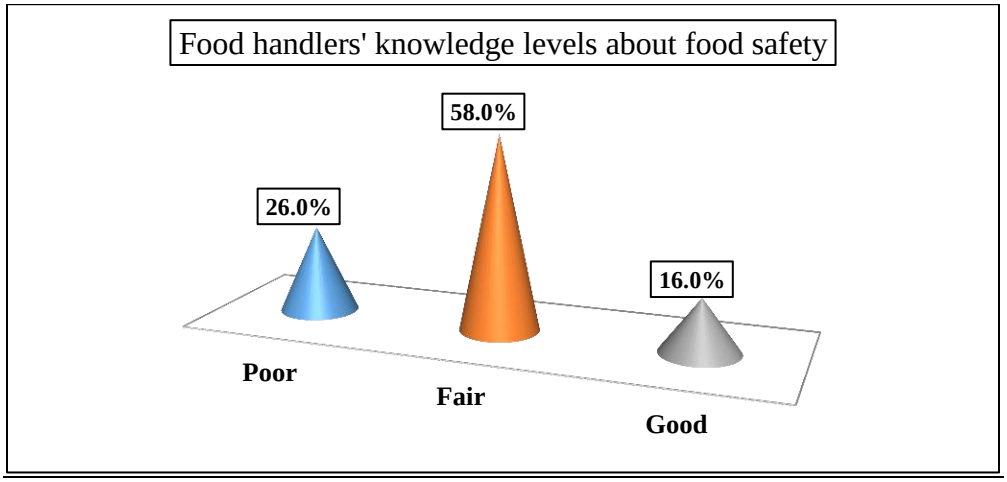

Figure 1: Distribution of the studied food handlers according to their knowledge level

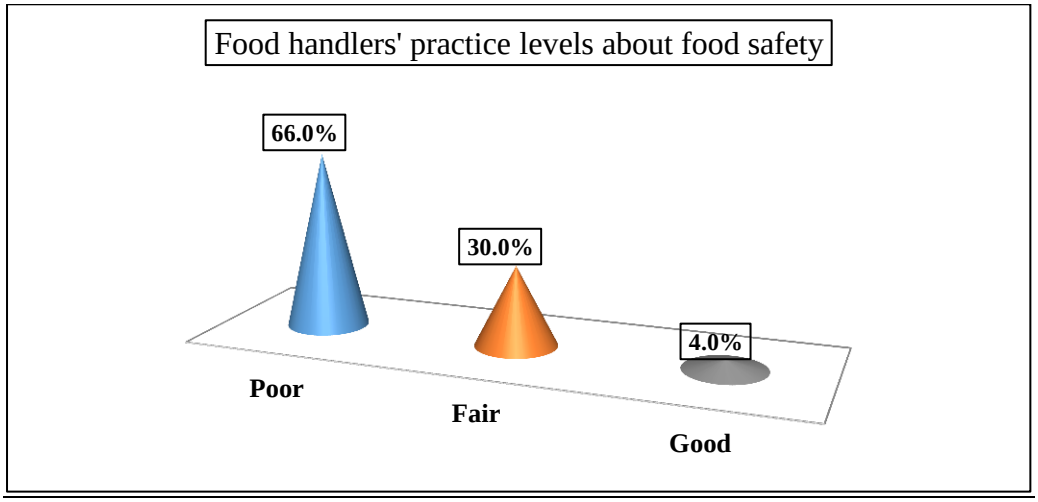

Figure 2: Distribution of the studied food handlers according to their practice level

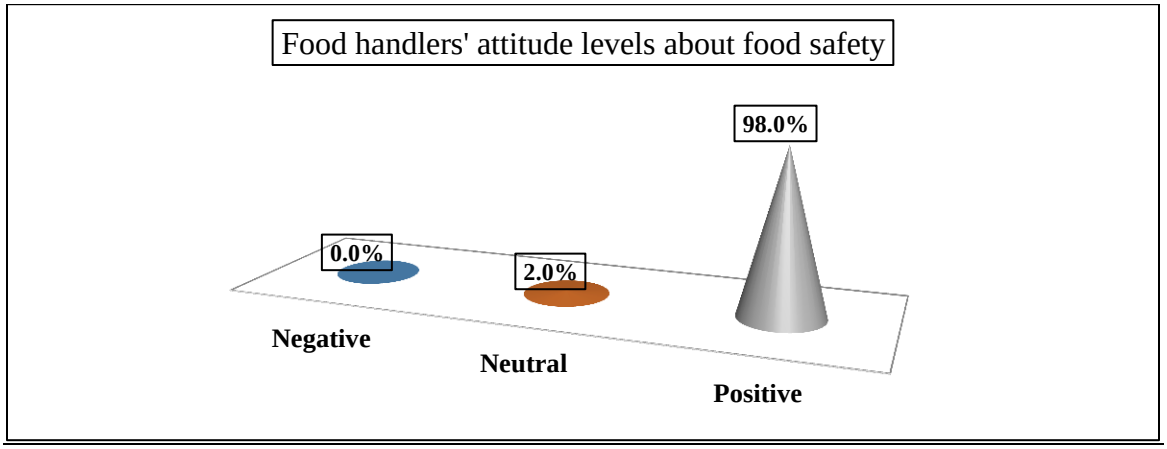

Figure 3: Distribution of the studied food handlers according to their attitude level

Table (2): Comparison between the studied food handlers by type of restaurants according to their knowledge, attitude and practice levels regarding food safety:

Items	Type of restaurants				Test of significance
	International (n=49)		Local (n=51)		
	No	%	No	%	
Knowledge level					
- Poor	2	4.1	24	47.1	X^2 = 28.690 P= 0.000*
- Fair	33	67.3	25	49.0	
- Good	14	28.6	2	3.9	
Mean ±SD	5.06± 0.827		3.65±1.454		t = 35.372 P= 0.000*
Practice level					
- Poor	17	34.7	49	96.1	X^2 = 42.025 P= 0.000*
- Fair	28	57.1	2	3.9	
- Good	4	8.2	0	0.0	
Mean ±SD	7.92± 4.690		1.55±2.230		t = 8.728 P= 0.000*
Attitude level					
- Negative	0	0.0	0	0.0	X^2 = 1.961 P= 0.161
- Neutral	0	0.0	2	3.9	
- Positive	49	100.0	49	96.1	
Mean ±SD	28.84± 2.135		28.33±2.169		t = 1.367 P= 0.245

X^2Chi square test **t** = Student t test * Significant p at ≤0.05

Table (3): Relation between the sociodemographic characteristics of food handlers and their mean & SD for knowledge, practices and attitude as regard food safety:

Items	Knowledge Mean Score	Practice Mean Score	Attitude Mean Score
	Mean ± SD	Mean ± SD	Mean ± SD
Age			
- 20 - 25- - 30- - 35- - ≥ 40	3.50± 0.577 4.43± 1.409 4.47± 1.341 4.50± 1.164 4.65± 1.663	2.50± 5.000 3.48± 5.607 4.58± 5.139 5.11± 5.103 6.55± 3.479	28.0± 1.882 28.2± 1.874 28.8± 2.466 29.2± 1.946 30.0± 3.559
Test of significance	F= 2.489 P= 0.037*	F= 1.643 P= 0.156	F= 1.377 P= 0.240
Educational level			
- Basic education - Secondary education - University education	3.14± 1.574 4.18± 1.590 4.57± 1.155	0.00± 0.000 2.39± 4.351 5.62± 5.374	28.5± 2.079 28.6± 2.180 29.0± 2.944
Test of significance	F= 3.875 P= 0.024*	F= 7.377 P= 0.001*	F= 0.144 P= 0.866
Duration of work in the restaurant (years)			
- <5 - 5- - 10-15	4.68± 1.226 4.48± 1.225 3.24± 1.602	5.49± 5.388 4.13± 5.128 1.35± 3.823	28.8 ± 2.243 28.7± 2.405 28.3± 1.921
Test of significance	F= 7.692 P= 0.001*	F= 3.922 P= 0.023*	F= 0.588 P= 0.558
Previous training programs about food safety			
- No - Yes	4.33± 1.462 4.37± 1.189	3.59± 5.038 5.50± 5.361	28.5± 2.251 28.8± 1.937
Test of significance	t= 0.016 P= 0.900	t= 2.918 P= 0.091	t= 0.444 P= 0.507

F = ANOVA test **t** = Student t test * Significant p at ≤0.05

Table (4): Relation between knowledge mean scores and practice and attitude levels regarding food safety:

Items	Knowledge Mean Scores
	M ± SD
Practice level	
- Poor	3.94± 1.424
- Fair	5.00± 0.830
- Good	6.00± 0.816
Test of significance	F= 10940 P= 0.000*
Attitude level	
- Neutral	3.00± 1.414
- Positive	4.37± 1.373
Test of significance	F= 1.944 P= 0.166

F = ANOVA test **t** = Student t test * Significant p at ≤0.05

Table (5): Correlation Matrix between knowledge and practice and attitude regarding food safety:

		Knowledge of food safety	Practices of food safety	Attitude toward food safety
Knowledge of food safety	r			
	P			
Practices of food safety	r	0.407		
	P	0.000*		
Attitude toward food safety	r	0.072	0.174	
	P	0.475	0.083	

r = Pearson correlation* Significant p at ≤0.05

r≥0.9 very high correlation r 0.7-<0.9 high correlation r 0.5-<0.7 moderate correlation r < 0.5 low correlation

Table (6): Predictors of good knowledge regarding food safety (regression analysis):

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.998	1.891		2.644	0.010
Type of restaurant	1.132	0.328	0.412	3.452	**0.001***
Age	0.003	0.154	0.002	0.020	0.984
Level of education	1.256	0.213	0.216	2.199	0.023
Duration of restaurant activity	-0.289	0.245	-0.149	-1.180	0.241
Previous training courses about food safety	0.420	0.284	0.140	1.478	0.431

R = 0.584 R^2 0.341

Table (7): Predictors of good practice regarding food safety (regression analysis):

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	10.647	5.927		1.796	0.076
Type of restaurant	6.731	0.938	0.652	7.176	**0.000***
Age	0.131	0.475	0.027	0.276	0.783
Level of education	1.637	0.647	0.198	2.529	**0.013***
Duration of restaurant activity	-0.107	0.762	-0.015	-0.140	0.889
Previous training courses about food safety	0.727	0.878	0.065	0.829	0.409

R = 0.743 R^2 0.55

Table (8): Predictors of positive attitude toward food safety (regression analysis):

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	30.543	1.718		17.782	0.000
Type of restaurant	0.479	0.643	0.112	0.744	0.459
Age	0.456	0.284	0.223	1.601	0.113
Level of education	0.276	0.398	0.080	0.692	0.490
Duration of restaurant activity	0.439	0.453	0.145	0.968	0.336
Previous training courses about food safety	0.225	0.533	0.048	0.421	0.675

R = 0.254 R^2 0.065

Discussion

When food is cooked on a large scale, it may be handled by many individuals and thus increasing the chances of contamination of the final food. Unintended contamination of food during large-scale cooking, leading to food-borne disease outbreaks can pose danger to the health of consumers and economic consequence for nations [29].

Hence, it becomes a necessity to provide food handlers with at least the basic knowledge of proper food safety methods. In other words, food service employees should be trained to have the knowledge needed in undertaking their tasks and to attain skills improving their practices of food handling. So, knowledge, attitude and practice of food handlers, play dominant role in food safety with regards to food service safety [30]

Concerning the food handlers' knowledge regarding food safety and proper food temperature control, the results of the present study showed that more than one quarter of the food handlers had poor knowledge regarding food safety and less than one fifth of them had good knowledge level. This could be explained by the educational level of the food handlers where more than half of them were from basic and secondary education, which may affect them knowledge level. Moreover, this low knowledge level may because the studied food handlers stated that their main source of data were public internet websites which may project incorrect or invalid information. This finding shed the light on the role of media in the dissemination of information and in promotion of services, thus, more attention and supervision should be placed on social media and public websites. This result was consistent with those of **Insfran-Rivarola, et al., 2020** who found that food handlers with higher educational levels were more knowledgeable, thiswas reflected in the current study findings, which found a statistically significant relation between the food handlers' knowledge and their level of education [31]. These results were supported by those of **Cunha et al., 2015** &**Kunadu et al., 2016** who found a positive correlation between the food handlers' knowledge level and their level of education [32, 33].

Food safety practices are extremely important to ensure that the food produced is safe for the consumer. The current study findings showed that around two thirds of the food handlers had poor food safety practices. These findings may be explained in the light of lower educational level of the studied food handlers as the current study found a statistically significant relation

between the level of practice and level of education of the food handlers. Another factor may contribute to this low practice level is the food handlers' lower knowledge level regarding food safety and food temperature control. These findings were contradicting those of **LING et al., (2021)** & **Ahmed et al., (**2021**)** and **Kwol et al., (2020)** who found a high practice levels among respondents.[34. 35, 36]

Food safety attitudesis also a crucial factor that may influence food safety behavior and practice, thus decrease the occurrence of foodborne diseases and other health hazards **(Younes et al., 2021**& **Yusof et al., 2018)** **[37, 38]**. The current study found that the vast majority of the studied food handlers had positive attitude towards food safety and temperature control. This positive attitude toward food safety may motive the food handlers to enhance their knowledge level which in turn will reflect on their practices, and thus contribute to the prevention of food borne diseases. This finding is consistent with those of **Zanin** et al., (2017) & **Aquino** et al., (2021) [39, 40].

Knowledge accumulates through learning processes and these may be formal or informal instruction, personal experience e and experiential sharing. Knowledge is automatically translated into behavior and shaped attitudes. Knowledge is vital in the cognitive processing of information in the attitude-behavior relationship **Kwol et al., (2020)**.[36] This was portrayed in the current study findings where food handlers with good food safety practices or those with positive attitude toward food safety and food temperature control had higher knowledge levels. Similar findings were reported by **Ali et al., 2018; Al Kandari et al., 2019** &**Akabanda et al., 2017).**who found significant relations between knowledge, attitudes and behavior of food handlers [41-43].

Furthermore, evidence drawn from the current study indicated that the higher the age of the food handlers, the higher the level of their knowledge and practices. Plausible explanation for such relation may be attributed to many reasons; older food handlers might have had better education, have good cognitive capacity and rich life experiences reflected in their higher knowledge and practice level. Similar findings were reported by **ZANIN et al., 2017)** **[44]**.These findings suggest that younger food handlers and that lower level of education may require particular attention to enhance their knowledge and practices.

Training and education may be an effective tool to increase food safety knowledge among food handlers and thus improve food safety practices. The same picture was portrayed in the current study findings where food handlers who reported previous training about food safety had higher levels of food safety related knowledge and practices and these were reflected on their attitude. Similar findings were reported by **Al Kandari et al., 2019) [42].**who found significant relationship between training of the studied subjects and their knowledge and practice level regarding food hygiene and sanitation.

Moreover, the current study findings reveal that the type of restaurants is among the factor that affects the food handlers' knowledge and practice levels regarding food safety and food temperature control. In addition, it was found that food handlers working in had higher knowledge and practice level. A possible explanation is the difference in the level of education between those working in international restaurants in comparison to those working in local restaurants, which would be reflected in their knowledge and practice level. Similar results were reported by **Ahmed et al., (**2021**)** and **Kwol et al., (2020) [35.36].**

Conclusion:

Based upon the findings of the current study it could be concluded that lack of knowledge and attitude regarding food handler was being served as potential risk. Inadequate food safety knowledge by food handlers poses a serious threat to food safety in food preparation and service establishments such as restaurants. More than one quarter of the food handlers had poor knowledge regarding food safety and less than one fifth of them had good knowledge level. Around two thirds of the food handlers' poor practice level regarding food safety and controlling food temperature. More than one third of the food handlers in international restaurants compared to food handler working in local restaurants had poor food safety and food temperature control practice, with a statistically significant difference between them. All food handlers working in international restaurants had positive attitude towards food safety and controlling food temperature. Two variables were significantly predicting good practices namely type of restaurants and level of education of food handlers.

Recommendation: There is an urgent need of training program for food handlers and repeated at particular intervals to guarantee that learnt data is put into the day by day life

practices. Increasing awareness about safe food handling requires more attention and researches especially in developing countries.

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