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Assessment of Food Safety Among Food Handlers at Restaurants of Suez Canal University

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Abstract

Background:- Food safety has become a major issue of public concern, Institutional foodborne illness outbreaks continue to hit the headlines in the country, indicating the failure of food handlers to adhere to safe practices during food preparation. Aim: to assess food safety among food handlers. Design: descriptive research design. Setting: Two restaurants at Suez Canal University. Sample: All food handlers in the two restaurants of Suez Canal University constituted the study population. Their total number were 86 workers. Tools: Two tools were used in the present study, the first tool was a questionnaire which included four parts: socio-demographic data, knowledge, attitude and practices related to food safety, the second tool was an observational checklist to assess safety kitchen environment and supplies. Results: The mean age of the participants was 43.2±9.7. Regarding their knowledge 52.3% of the studied group had poor knowledge regarding food safety while only 17.4% of them had fair knowledge. Regarding their practices 65.1% of the studied group had poor practice related to Keeping food at a safe temperature. Regarding their attitude only 39.5% of them think keeping the food cooked outside the fridge for more than two hours is not safe. The kitchens of the two restaurants were safe and had insufficient supplies by 41.03%. Conclusion: The food handlers had poor overall knowledge, good overall practices and positive overall attitude related to food safety and prevention of foodborne diseases. The kitchens of the two restaurants were safe and insufficient supplies. Recommendation: It is recommended therefore to conduct regular training courses for all food handlers as part of their continuous education.

Keywords: Food safety, Prevention of foodborne diseases, Restaurant and Food handlers.

1. Introduction

A food handler is anyone who handles packaged or unpackaged food directly as well as the equipment and utensils used to prepare or serve food and/or surfaces that come into contact with food. Food handlers are expected to meet food hygiene requirements, [1].

Food can be a source of infection if it became contaminated with various organisms such as viruses, bacteria, or parasites. However, these infections are preventable if adequate precautions were taken and food safety measures were followed. Human beings are dependant on food for nutrition however, this food could be contaminated with various organisms that cause foodborne illness. More efforts are needed to detect causes and pathogens of foodborne illnesses, [2].

When something is eaten or drank makes you sick, it's called 'foodborne illness.' Foodborne illness used to be called 'food poisoning,' but because more foodborne illnesses are caused by infection than poison, this has been changed. When food is contaminated by bacteria, viruses, parasites or chemicals, it can make you sick. Any of these things in food can be called a 'contaminant' [3].

There are four causes of foodborne illness: Chemical contamination, physical Contamination, allergens and microbiological contamination. A foodborne illness from food contaminated by bacteria, viruses or parasites is microbiological, [4].

1.1. Significance of the Study

Over 100 million people in the Eastern Mediterranean region are anticipated to be affected by foodborne illnesses per year. Of those 100 million, 32 million are below the age of five. Approximately 3000 people die annually due to the consumption of unsafe food [5]. According to the World Health Organization (WHO), the Middle East and North Africa have the 3rd highest burden of foodborne illnesses [6].

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Everybody is at danger for foodborne illness, but some sure individuals are in more severe danger than others. Children, pregnant women, elderly, and those with compromised immune systems are at an expanded danger to illnesses connected with food. Additionally included are food-insecure individuals and those living in undesirable conditions as a result of poverty [7]. The community health nurse plays a vital role in organizing and delivering educational sessions that help in the prevention of foodborne diseases and promoting awareness about food safety by using structure and systematic planning process and ongoing support for implementation, a core of educational sessions must take into account local circumstances and should be disseminated through an active educational and training programs. This must be an implementation prevention program regarding the prevention of foodborne diseases for food handlers to evaluate the effect on their knowledge, practices and attitude to prevent them [8]. The restaurants of Suez Canal University, as part of the food chain, are required to give detailed attention to food hygiene to minimize food hazards. There are limited data available concerning the attitudes and practices used for food safety; the same is for foodborne diseases and the use of HACCP either among food handlers or among consumers. There have been no studies on restaurant food-services staff available.

1.2. Subjects and Methods

I. **Study Design:** A descriptive study design.
II. **Study Setting:** This study was conducted at two restaurants in Suez Canal University (Boys housing compound and Girls housing compound) for inclusion in the study.
III. **Subjects**: All food handlers in the two restaurants of Suez Canal University (Boys housing compound and Girls housing compound) constituted the study population

The total number of workers in food catering services in the two restaurants was 86 workers distributed as 39 in Boys housing compound and 47 in Girls housing compound. All of them were be included in this study.

Aim: to assess food safety among food handlers through:

Assessing the knowledge, attitude and practices of food handlers with regard to food safety in restaurants of Suez Canal University to detect their needs and assessing the hygiene measures, facilities and environmental sanitation in restaurants kitchens. **Research questions:** 1- Is there deficient in knowledge regarding food safety among food handlers at restaurants of Suez Canal University? 2- Are they have bad practices regarding food safety? 3- Are they have negative attitudes toward food safety? 4- Is there relation between educational level and overall food handler's knowledge? 5- Are there insufficient supplies and food safety measures in restaurants kitchens**?**

1.3. Tools for Data Collection

In order to fulfill the aim of this study: two tools were developed and used:

Tool (1): A structured interview questionnaire:

A questionnaire sheet was prepared by the researcher for the purpose to assess food handlers' knowledge, practice and attitude regarding food safety. Preparing and developing of the questionnaire was guided by World Health Organization (WHO) [9], and reviewing of recent literature, which includes four parts to gather the following data:

Part I: The questionnaire addressed to the participants focused on their socio-demographic characteristics, years of experience and nature of work Part II: Food handlers ' knowledge regarding food safety.

It included questionnaires to assess knowledge of the food handlers regarding the prevention of foodborne diseases, it consisted of the following items-:

- Cross-contamination prevention/disinfection procedures:- It included 18 questions as; time and technique of hand washing, protective clothes, diseases affecting food safety, effective method of cleaning and disinfecting contact surfaces for food and causes food-borne diseases.
- Separate raw food and cooked food:- It included 8 questions as; using different instruments between raw and cooked food, best methods for cleaning instruments used in preparing food and how to separate raw food and cooked food during cooking and storing .
- Cook the food well cooked:- it included 4 questions as; Proper cooking temperature, proper reheating technique and signs of well done.
- Keep food at a safe temperature:- it included 9 questions as; how to keep cooked food at a safe temperature, the temperature at which bacteria multiply and best methods for dissolving frozen food.
- Use safe water and safe soft materials:- it included 3 questions as; how to identify safe water, how to wash fruits and vegetables and guidelines for choosing safe soft materials.

Scoring for food handlers' knowledge:- The food handlers' questionnaire sheet for assessment knowledge regarding food safety and prevention of foodborne disease consisted of 42 questions, as true or false questions and the total scores were 42 degrees .

The result categorized as the following :

Zero = incorrect answer 1= correct answer

Summation of all and calculate the mean and standard deviation were computed.

The total score was categorized as the following:

Poor knowledge = 1 - 20 (<50%)

Fair knowledge = 21-29 (50% - 70%)

Good knowledge = 30- 42 (>70%)

Part III: Food handlers ' attitude toward food safety precautions:

It was included questionnaires about the attitude of the food handlers toward food safety precautions, it consisted of the following items -:

- Cook the food well:- it included 2 questions as; the importance of using thermometer during cooking and importance of boiling soup
- Keep food at a safe temperature:- it included 2 questions as; the importance of de-frozen food in a cool place and limited time for keeping cooked food outside the fridge .
- Use safe water and safe soft materials:- it included 2 questions as; the importance of checking the quality and safety of food and throwing of expired foods .

Scoring for food handlers' attitude: The food handlers' questionnaire sheet for assessment attitudes toward food safety and prevention of foodborne disease consisted of 19 Q., total scores were 38 degrees and every question answered by: Agree (2), Not sure (1) and Disagree (0). Summation of all and calculate the mean and standard deviation were computed.

Part IV: Food handlers ' practices related to food safety:

It was included questionnaires about the practice of food handlers regarding food safety precautions, it consisted of the following items-:

- Personal hygiene and preventive measures:- it included 16 questions as: hand washing, wearing protective clothes and personal hygiene.
- Food preparation and separation:- it included 3 questions as using a separate instrument for food preparation, changing gloves between raw and ready- to- eat food and separation of raw and cooked food during storage .
- Food cooking and reheating:- it included 2 questions as: methods for cooking and reheating food well
- Keep food at a safe temperature:- it included 2 questions as: methods for de-frozen and storing food safely.
- Use safe water and safe soft materials:- it included 2 questions as: methods for choosing safe food and methods of washing fruits and vegetables properly.

Tool II : An Observational Checklist:

This tool was developed by the Lebanese Ministry of Public Health, Preventive Medicine Department (2015), and used after modification.

- It was used to assess safety kitchen environment and supplies and consisted of six parts:

Part I: Food preparation settings: it included 18 questions as: (floors, walls, ceilings, lighting, ventilation, kitchen equipment, doors and windows.

Part II: Food handlers: it included 11 questions as: (Personal hygiene, medical examination and training courses(

Part III: Receiving and preparing food: it included 22 questions as: (receiving and storage of raw materials, Freezing and cooling facilities and prevention of cross-contamination).

Part IV: Cleaning and disinfection: it included 3 questions.

Part V: Sanitary facilities and changing room: it included 13 questions as (Bathrooms, Washbasins and Washing machines).

Part VI: Basic sanitation: it included 17 questions as (water supply, waste management and insect protection).

Those parts were divided into two categories: Safety measures (which consisted of 46 points) and Supplies (which consisted of 39 points).

1.4. Scoring System

A. The checklist to assess safety measures consisted of 46 items, each item was given two points to make the total scores 92 degrees and the safety measure divided into as follows:- Unsafe = (<50%), Safe = (≥50%).
B. The checklist to assess supplies consisted of 39 items, each item was given two points to make the total scores 78 degrees and the supplies with divided into as follows:-Insufficient = (<50%), Sufficient = (≥50%)

The summation of all and calculate the number and percentage were computed.

2. Operational Design

2.1. Validity of the Tool

After developing tools and before data collection, the tools were ascertained by a jury of five expertise (four from community health nursing staff faculties and one from occupational medicine). Modifications of the tools were done accordingly.

2.2. Reliability

The reliability of the modified scale, this was done using the internal consistency method. The reliability proved to be high with a Cronbach alpha coefficient test which was high for all questionnaires, and suitable for scientific purposes.

2.3. Pilot Study

The pilot study was carried out after the development of tools and using the Arabic version of the questionnaire before starting the data collection, it was carried out on 9 workers in restaurants. The subjects included in the pilot study were excluded from the study subjects.

2.4. Design Phase

During this period, the preliminary design of the questionnaire to be used for data collection was accomplished, tested and accordingly the final structure of the questionnaire had been done for data collection.

2.5. Fieldwork:

A. **A. Approvals:** An official letter from the Vice Dean of Suez Canal University for Education and Student Affairs was sent to the Supervisor of Nutrition in the Suez Canal university administration to facilitate research implementation. Then meetings were held with the directors of restaurants to clarify the purpose of the study and to gain their cooperation during data collection. Then meetings were held with the Supervisor of Nutrition in the Suez Canal university administration and the supervisors and workers of each restaurant having the responsibility of food preparation at the restaurant to clarify the purpose of the study. Last an oral consent was obtained from each one to participate in the study, to set data for data collection and to gain their cooperation during the data collection.

B. **Data collection:** Data were collected from the beginning of January 2019 to the beginning of July 2019; the actual duration was three months & a half, at the period of examination and holidays". This was implemented through four phases as namely: - Assessment phase, Planning phase, Implementation phase and Evaluation phase.

C. The researcher met the food handlers (males and females) at the rest period of the working. The purpose of the study was explained to each food handlers to gain their consent and cooperation before their participation. Then worker's oral consent was obtained before their participation, they were informed about their rights to withdraw from the study at any time and that their answers will not be taken against them, it will be kept confidentially, and will be used just for the purpose of the study.

2.6. Statistical Methods

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0**.** **(**Armonk, NY: IBM Corp**)** Qualitative data were described using numbers and percentages. Quantitative data were described using range (minimum and maximum), mean, standard deviation. The significance of the obtained results was judged at the 5% level.

3. Results

Table (1) Showed that 41.9% of the studied sample ranged in age from 40-50 years and 75.6% of them were males. Concerning marital status, it was found that 90.7% of the studied group were married and the lowest percentages1.2% were divorced. Regarding the level of education, it was observed that 48.8% of the studied group were read and write, while 1.2% of them were illiterate. Concerning years of experience,43% of the studied group reported having experience from 15-20 years, while only 11.6% of the studied group reported having experience less than or equal ten years.

Table (2) Showed that only 14% of studied group had correct knowledge regarding Cross-contamination prevention/disinfection procedures as washing hands after touching the money and body, 7% of them were Using the mouth cover while handling food and 20.9% of them knew the effective method of cleaning and disinfecting contact surfaces for food.

Table (3) Showed that only 10.5% of the studied group had good knowledge about Keep food at a safe temperature, only 9.3% of them had good knowledge about Use safe water and safe soft materials and regarding overall knowledge, 30.2% of them had good knowledge.

Table (4) Regarding attitudes of the studied participants towards different food safety issues with mean score 49.90 ± 8.66, all of the study participants 100% were agree with the issue that it's important to throw out expired foods time while only 39.5% of them were agree that keeping the food cooked outside the fridge for more than two hours is not safe.

Table (5) Showed that no one 0%of studied group exercised proper handwashing procedures, washed their hand when you return to work after a break, toke a vacation if you are suffering from foodborne diseases or Put the lid of mouth and nose before starting work. on the other hand, 75.6% of them always wore a clean and appropriate work uniform before starting work and 88.4% wore gloves when touching ready foods.

Table (6) Clarified that, there were statistically significant ($p<0.001$) relation between educational level and overall food handler's knowledge.

Figure (1) **S**hows that, the two restaurants' kitchens had insufficient Supplies (<50%)**.**

4. Discussion

The results of the present study showed that, Those aged less than 40 years constituted more than one third while those aged 40 years and more constituted about two thirds. More than three-quarters of the food handlers were males. More than three-quarters of them had below university education.

On the other hand, the study by Wahdan, *et al.* [10] in Egypt founded that those aged less than 40 years constituted about two-third while those aged 40 years and more constituted more than one third. More than half of the food handlers were females.

The results of the present study showed that, more than half of the studied group knew the correct answers about cross-contamination prevention. These findings in the line with the study by Sani and Siow [11] in Kebangsaan Malaysia who reported that, only half of the respondents knew the answer for questions about cross-contamination.

On the other hand, these results are disagreeing with the study by Quick, *et al.* [12] in the USA who reported that most consumers were not aware about the importance of handwashing, they are not washing their hands thoroughly. Also, Elsherbiny, *et al.* [13] in Egypt who mentioned that majority of the study participants, more than three-quarters of them didn't know the correct answer regarding the duration they should rub their hands during hand washing and only one-third of them were aware of the importance of washing hands after handling raw meat.

The current study showed that, about three-quarters of food handlers had good knowledge regarding the separation of raw food from cooked food. These findings disagreed with [13] in Egypt who found more than half of the study participants were ignore why raw foods have to be kept separate from cooked foods. The results of the present study showed that, lack of food handlers' knowledge about food safety especially about Keeping food at a safe temperature and using safe water and safe soft materials. Moreover, this was in agreement with the study 0f Sani and Siow [11] in Kebangsaan Malaysia who found that more than three-quarter of respondents thought that hot Ready-To-Eat (RTE) foods are safe to be kept at temperatures below 60 °C, while two-third stated that cold RTE foods can be kept in temperatures above 5 °C for long periods of time.

This finding shows that the majority of respondents (more than two-thirds) did not know the correct temperature danger zones for RTE foods is 5-60 °C. This result was supported by Baş, *et al.* [14] in Turkey who founded that many of their respondents had a lack of knowledge about critical temperatures for RTE foods, acceptable refrigerator temperature ranges and cross-contamination.

Similar findings by Buccheri, *et al.* [15] in Italy who reported that food handler' proportions as high as more than three-quarter and one quarter did not know the critical temperature of storing hot and cold RTE foods respectively.

The result of the present study illustrated that, the score of more than one half of the food handler's overall knowledge was poor regarding the prevention of foodborne diseases (food safety). Similarly, the study by Gorman, *et al.* [16] in Ireland who mentioned that more than three-quarters of the sample had a lack of food safety knowledge. Also, in agreement with the results of the present study [17] who studied "knowledge, attitude and practice of female teachers regarding safe food handling; is it sufficient? An intervention study, Zagazig, Egypt". clarified that more than two-thirds of the sample had an unsatisfactory knowledge about safe food handling.

It could be, the food handlers need to improve their knowledge and awareness about food safety as cross-contamination prevention/disinfection procedures, Separate raw food and cooked food, keep food at a safe temperature and Use safe water and safe raw materials.

In the current study almost all of the study participants 94.2% agreed that It is important to check the quality and safety of foods, all of them agreed that it's important to throw out expired foods. Studies from other countries showed less strict procedures than in the present study. Almeida, *et al.* [18] in Brazil found that food temperature receipt, or expiry date and package integrity were not checked in 37.2% of the observations. Meleko, *et al.* [19] in Ethiopia found that ingredients, food expiry dates were not checked before use in half of their observations. The findings of the current study revealed that there was strict supervision of sources of food and its storage by qualified personnel.

No one 0% of the studied group put the lid of mouth and nose before starting work. A study conducted by Anuradha and Dandekar [20] in India found that masks were used in 66.7% of the observations. Differences in the use of personal protective equipment are partly due to the availability of this equipment in the various setting and rules and regulations concerning them in different countries.

5. Conclusion and Recommendations

Based on the aim of the study and research questions of the present study, it was concluded that: the food handlers had poor overall knowledge, good overall practices and positive overall attitude related to food safety and prevention of foodborne diseases. The kitchens of the two restaurants were safe and insufficient supplies. It is recommended therefore to conduct regular training courses to all food handlers as part of their continuous education. It is also recommended to ensure the regular supply of required equipment to ensure the ability to perform the required duties for food safety. There is also a need to ensure effective supervision of food handlers.

Acknowledgment

The authors are thankful to all female teachers for their participation in the study.

Table-1. Distribution of the food handlers according to socio-demographic characteristics (n=86)

Socio-demographic characteristics	**No.**	**%**
Age (years)		
20 –	5	5.8
30 –	25	29.1
40 –	36	41.9
50 – 60	20	23.3
Gender		
Male	65	75.6
Female	21	24.4
Marital status		
Single	4	4.7
Married	78	90.7
Widow	3	3.5
Divorced	1	1.2
Educational level		
Illiterate	1	1.2
Technical	30	34.9
Reads and writes	42	48.8
High	13	15.1
Type of work		
Cooker	9	10.5
Assistant Cooker	9	10.5
Other	68	79.1
Years of Experience		
1- 5	5	5.8
5 – 10	5	5.8
10 – 15	14	16.3
15 – 20	37	43.0
>20	25	29.1

Table-2. Distribution of correct knowledge of the Food handlers on Cross-contamination prevention/disinfection procedures (n=86)

		No.	**%**
1	**When preparing food, wash your hands:**		
	Before handling food	67	77.9
	After touching the money	12	14.0
	After using toilets	70	81.4
	After dealing with meat or raw poultry	41	47.7
	After touching the body	16	18.6
	After cleaning the nose	53	61.6
	After dealing with garbage	56	65.1
	After smoking	55	64.0
2	Wash hands by moistening with run water, apply soap, rub hands together for 20 second	68	79.1
3	Using a clean towel to wipe hands is important to prevent food contamination	54	62.8
4	Cutting the nails prevent food contamination	76	88.4
5	Washing nails constantly is important with washing hands	19	22.1
6	Wearing a clean uniform while preparing food help in promoting food safety	61	70.9
7	Wearing overhead while preparing food help in promoting food safety	17	19.8
8	Using a clean apron is important when serving food	53	61.6
9	Using the mouth cover while handling food prevent food contamination with mouth droplets	6	7.0
10	Wearing gloves when touching the ready-made food is important to keep food safe	60	69.8
	Individuals shouldn't prepare food for other people		
11	If have Sneezing	56	65.1
12	If have Coughing	56	65.1
13	If have a Fever	56	65.1
14	If have Vomiting	39	45.3
15	If have Diarrhea	40	46.5
16	Using of soap, water and disinfectant is the most effective method of cleaning and disinfecting contact surfaces for food	18	20.9
17	Wipes can contribute to the spread of germs	59	68.6
18	Ignoring hygiene rules when preparing food causes food-borne diseases	65	75.6

Table-3. The total Food handlers' correct knowledge on food safety pre/ post (n = 86)

	No.	**%**
Cross contamination prevention / disinfection procedures		
Poor knowledge <50%	41	47.7
Fair knowledge 50-70	6	7.0
Good knowledge>70	39	45.3
Separate raw food and cooked food		
Poor knowledge <50%	23	26.7
Fair knowledge 50-70	28	32.6
Good knowledge>70	35	40.7
Cook the food well cooked		
Poor knowledge <50%	48	55.8
Fair knowledge 50-70	6	7.0
Good knowledge>70	32	37.2
Keep food at a safe temperature		
Poor knowledge <50%	60	69.8
Fair knowledge 50-70	17	19.8
Good knowledge>70	9	10.5
Use safe water and safe soft materials		
Poor knowledge <50%	70	81.4
Fair knowledge 50-70	8	9.3
Good knowledge>70	8	9.3
Overall knowledge		
Poor knowledge <50%	45	52.3
Fair knowledge 50-70	15	17.4
Good knowledge>70	26	30.2

Table-4. Distribution of the food handlers related to their attitudes toward cooking the food well, keeping food at a safe temperature and using safe water and safe raw materials (n=86)

	Items	**agree**		**Not sure**		**Disagree**	
		No.	**%**	**No.**	**%**	**No.**	**%**
Cooking the food well							
1	Thermometers are useful to make sure the food is cooked well	45	52.3	21	24.4	20	23.3
2	Always cook soup and drink to boil to ensure food safety	77	89.5	9	10.5	0	0.0
Keeping food at a safe temperature							
3	Thawing frozen food in a cool place is guaranteed for its safety	70	81.4	0	0.0	16	18.6
4	I think keeping the food cooked outside the fridge for more than two hours is not safe	34	39.5	33	38.4	19	22.1
Using safe water and safe raw materials							
5	It is important to check the quality and safety of foods	81	94.2	5	5.8	0	0.0
6	I think it's important to throw out expired foods	86	100	0	0.0	0	0.0
Overall attitude							
Total score*		49.90 ± 8.66					
Percent score		81.30 ± 22.80					

*(Mean ± SD)

Table-5. Distribution of the food handlers according to their correct practices related to personal hygiene and preventive measures (n=86)

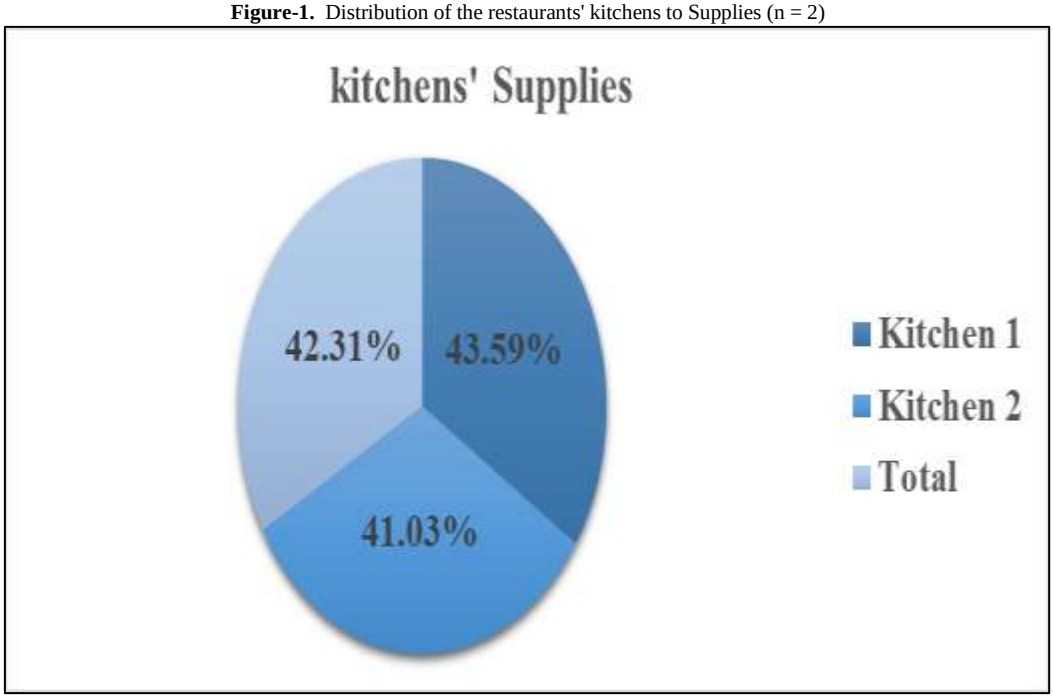
	Always		Often		Sometimes		Rarely		Never	
	No.	%	No.	%	No.	%	No.	%	No.	%
Wash my hands before and during food preparation	68	79.1	0	0.0	18	20.9	0	0.0	0	0.0
Exercise proper hand washing procedures	0	0.0	0	0.0	19	22.1	11	12.8	56	65.1
Wash your hands when you return from the toilet	65	75.6	21	24.4	0	0.0	0	0.0	0	0.0
Wash your hands after rubbing your nose or scratching your body	29	33.7	0	0.0	0	0.0	31	36.0	26	30.2
Wash your hand when you return to work after a break	0	0.0	63	73.3	23	26.7	0	0.0	0	0.0
Wash your hands after handling food or garbage	54	62.8	29	33.7	3	3.5	0	0.0	0	0.0
Make sure your hands are dry and clean when handling food	75	87.2	0	0.0	11	12.8	0	0.0	0	0.0
Wear a clean and appropriate work uniform before starting work	65	75.6	21	24.4	0	0.0	0	0.0	0	0.0
Wear appropriate shoes before starting work	33	38.4	0	0.0	36	41.9	0	0.0	17	19.8
Wear an apron before starting work	73	84.9	0	0.0	13	15.1	0	0.0	0	0.0
Put a hood before starting work	39	45.3	0	0.0	21	24.4	0	0.0	26	30.2
Wear gloves when touching ready foods	76	88.4	0	0.0	10	11.6	0	0.0	0	0.0
Take a vacation if you are suffering from foodborne diseases	0	0.0	0	0.0	16	18.6	51	59.3	19	22.1
Put the lid of mouth and nose before starting work	0	0.0	0	0.0	0	0.0	0	0.0	86	100

Table-6. Relation between educational level and overall food handler's knowledge (n = 86)

Educational level	**Overall food handler's knowledge**		
	Poor (n=45)	**Fair (n=15)**	**Good (n=26)**
	%	**%**	**%**
Illiterate	2.2	0.0	0.0
Technical	33.3	13.3	50.0
Reads and writes	42.2	66.7	50.0
High	22.2	20.0	0.0
χ^2(^{MC}p)	13.226*(0.019*)		

χ^2: **Chi square test** MC: **Monte Carlo**
p: p value for associated between different categories
*: Statistically significant at $p \leq 0.05$.

Figure-1. Distribution of the restaurants' kitchens to Supplies (n = 2)



References

[1] Abdelrasoul, S. E. and Kouzmal, H. A., 2017. "Assessment of storage conditions of food items and their relation with food safety in sharm el sheikh resorts." *International Journal of Heritage, Tourism, and Hospitality*, vol. 10.

[2] Logue, C. M., Barbieri, N. L., and Nielsen, D. W., 2017. "Pathogens of food animals: Sources, characteristics, human risk, and methods of detection." *In Advances in Food and Nutrition Research*, vol. 82, pp. 277-365.

[3] Cliver, D. O., 2010. "Early days of food and environmental virology." *Food and Environmental Virology*, vol. 2, pp. 1-23.

[4] Public Health Ontario, 2015. "Foodborne illness what we don't know can harm us." Available: http://www.publichealthontario.ca/en/DataAndAnalytics/OntarioHealthProfile/Pages/OHP-IWR-FoodborneIllness.aspx

[5] Todd, E., 2017. *Foodborne disease in the middle east. (eds) in: Water, energy and food sustainability in the middle east*. Springer International Publishing.

[6] Available: www.who.int/foodsafety/publications/foodborne_disease/fergreport

[7] Alaimo, K., Olson, C. M., and Frongillo, E., 2001. "Food insufficiency and American school-aged children's cognitive, academic and psychosocial development." *Pediatrics*, vol. 108, pp. 44-53.

[8] Gould, V. J., Evans, E. W., Redmond, E. C., Marklinder, I. M., Quinlan, J. J., and Ilic, S., 2019. "Exploring the role of dietitians in the delivery of food safety information." *Food Protection Trends*, vol. 39, pp. 277-282.

[9] World Health Organization (WHO), 2015. "Five-keys to safer food manual. WHO Press, Geneva, Switzerland." Available: http://www.who.int/foodsafety/publications/consumer/manual_keys.pdf

[10] Wahdan, I. H., Gad, Z. M., Habib, I. M., and Elshazly, O. A., 2019. "Effect of an educational program on food safety practices in food preparation and handling procedures in governmental hospitals of an egyptian governorate." *Journal of High Institute of Public Health*, vol. 49, pp. 90-96.

[11] Sani, N. A. and Siow, O. N., 2014. "Knowledge, attitudes and practices of food handlers on food safety in food service operations at the Universiti Kebangsaan Malaysia." *Food Control*, vol. 37, pp. 210-217.

[12] Quick, V., Byrd-Bredbenner, C., and Corda, K., 2013. "Determinants of safe food handling behaviors among middle school youth." *Nutrition and Food Science*, vol. 43, pp. 543-553.

[13] Elsherbiny, N. M., Sobhy, S. A., Fiala, L. A., and Abbas, M., 2019. "Knowledge, attitude and practices of food safety among food handlers in Ismailia city hospitals, Egypt." *International Journal of Advanced Community Medicine*, vol. 2, pp. 96-102.

[14] Baş, M., Ersun, A. Ş., and Kıvanç, G., 2006. "The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in food businesses in Turkey." *Food Control*, vol. 17, pp. 317-322.

[15] Buccheri, C., Mammina, C., Giammanco, S., Giammanco, M., Guardia, M., and Casuccio, A., 2010. "Knowledge, attitudes and self-reported practices of food service staff in nursing homes and long-term care facilities." *Food Control*, vol. 21, pp. 1367-1373.

[16] Gorman, R., Bloomfield, S., and Adley, C. C., 2002. "A study of cross-contamination of food-borne pathogens in the domestic kitchen in the Republic of Ireland." *International Journal of Food Microbiology*, vol. 76, pp. 143-150.

[17] Awad, A. M., El-Shafei, D., Sheta, S., and Abdelsalam, A., 2017. "Knowledge, attitude and practice of female teachers regarding safe food handling; is it sufficient? An intervention study, zagazig, Egypt." *Egyptian Journal of Occupational Medicine*, vol. 41, pp. 271-287.

[18] Almeida, K. M., André, M. C., Campos, M. R., and Díaz, M. E., 2014. "Hygienic, sanitary, physical, and functional conditions of Brazilian public school food services." *Review of Nutrition*, vol. 27, pp. 343-56.

[19] Meleko, A., Henok, A., Tefera, W., and Lamaro, T., 2015. "Assessment of the sanitary conditions of catering establishments and food safety knowledge and practices of food handlers in Addis Ababa University Students' Cafeteria." *Science Journal of Public Health*, vol. 3, pp. 733-43.

[20] Anuradha, M. and Dandekar, R. H., 2014. "Knowledge, Attitude and Practice among food handlers on foodborne diseases: A hospital-based study in tertiary care hospital." *International Journal of Biomedical and Advance Research*, vol. 5, pp. 196-198.