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Educational Program to Prevent Foodborne Diseases at Restaurants of Suez Canal University

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Abstract: **Food Safety refers to handling, preparing and storing food in a way to best reduce the risk of individuals becoming sick from foodborne illnesses. High standards of hygiene minimizes food spoilage and help to ensure that when food is eaten, it is as wholesome and free from pathogenic bacteria as much as possible. Food safety is a global concern that covers a variety of different areas of everyday life. Aim: to evaluate the effects of educational program on preventing food borne diseases at restaurants of Suez Canal University. Design: A quasi-experimental design was used in this study. 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. The results revealed that, statistically significant ($p<0.001$) differences between the studied group's mean scores of knowledge, practices and attitude regarding food safety before and after program implementation. 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 handle.**

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**, (Abd el-Rasoul et al, 2017).**

Food safety is a discipline entails food handling, preparation and storage. Safety of food involves monitoring the safety of food where it is initially created until it reaches the market and the customer. This also includes all problems related to labeling, food additives and preservatives, allowed pesticides, hygiene, biotechnology and instructions for import and export **(king et al.,2017)**

It was not until 1993 before food safety became a standard system of food regulation, when the common outbreak " Jack-in-the-Box " in the United States which caused by E coli O157:H7. At the same time, `another outbreak by Bovine Spongiform Encephalopathy challenged the existing food safety systems in the United Kingdom. Ever since, strict guidelines and legislations were commenced to apply effective food safety measures. Therefore, it was a wake-up call to employ the Hazard Analysis Critical Control Point (HACCP). After a global implementation of principles of HACCP, foodborne illnesses started to decrease **(Weinbroth et al., 2018)**. Food industries worldwide have to conform to microbial standards associated with the safety and the quality of their products. Safety aspects are of major importance, thus are determined clearly and unambiguously. Usually, strict limits up to no tolerance are implemented for pathogenic microorganisms that could cause severe health problems to consumers, **(Sofy et al, 2017).**

There is a tremendous efforts exerted by nurses to stand for foodborne diseases starting from primary prevention up to managing complications. Previous studies conducted many surveys to assess nurses' knowledge and practice about food safety; moreover, they investigated their role in epidemics and outbreaks. Regarding the roles a public health nurse has towards prevention of foodborne illness, they can be classified into ten roles: prevention, health education, coordination, protection, leadership, promotion, advocacy, caregiving, integration, research **(Harris 2019).**

Significance of the study

The food service industry is a big part of the Egyptian economy. It includes people working in the many different parts of food service, like restaurants and grocery stores, and factories that process, package and ship food to those restaurants and stores, **(Said & Mamdouh, 2018).**

According to **Azab et al, 2016** who studied Epidemiology of acute poisoning in children presenting to the poisoning treatment center at Ain Shams University in Cairo during 5-year study period between 1 January 2009 and 31 December 2013, found that 38 470 patients were treated by the Ain Shams University's Poisoning Treatment Center (ASU-PTC) in Cairo. 19 987 (52%) were younger than 6 years of age; 4196 (11%) were 6–12 years; and 14 287 (37%) were >12 years .

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 consumption of unsafe food, **(Todd 2017).** According to the World Health Organization (WHO), the Middle East and North Africa have the 3rd highest burden of foodborne illnesses, **(WHO 2019).**

The community health nurse play 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 implementation prevention program regarding prevention of food borne diseases for food handlers to evaluate the effect on their knowledge, practices and attitude to prevent them, **(Gould et al, 2019).**

The restaurants of Suez Canal University, as part of the food chain, are required to give a detailed attention to food hygiene so as to minimize food hazards. There are a 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.

2. SUBJECTS AND METHODS

I. Study Design: A quasi-experimental 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: Evaluate the effect of educational program on preventing foodborne diseases at restaurants of Suez Canal university through :

1. Assessing the knowledge, attitude and practices of food handlers regarding food safety in restaurants of Suez Canal University to detect their needs.
2. Assessing the hygiene measures, facilities and environmental sanitation in restaurants kitchens.
3. Developing educational program according to food handlers and environmental sanitation needs.
4. Evaluating the effect of the educational program on knowledge, attitude and practices of food handlers in restaurants.

RESEARCH HYPOTHESIS: Implementing of educational program will improve knowledge and practices regarding food safety and food hygiene among restaurant food handlers of Suez Canal University.

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 **WHO(2015)** 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).

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.

Operational design

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. 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..

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.

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.

5. Fieldwork :

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.

Program construction

1. Assessment phase:

- The assessment phase (pre-test) was done on 86 food handlers and took two weeks to be fulfilled, one visit for each restaurant, including two sessions, each session took 45 minutes were allocated for data collection, around 5 food handlers were assessed per visit.

- The pre-test format to assess the baseline data for food handlers' knowledge, attitude and practices, and to detect the needs through collecting data from them.
- The aim of the study was explained to the food handlers and make interview with them, the average time needed to fill the questionnaire was 30-45 minutes.

2. Planning phase:

The program was designed by the researcher based on the food handlers' needs obtained from the study tools; also, after reviewing the relevant literature in various aspects related to the study. This program content was revised and validated by the supervisors.

The program content included the following:

1. Food safety: Definition**,** Importance and sources of food poising(microorganisms, chemicals and physical hazards).

2. WHO 'Five Keys to Safer Food': Keep clean, Avoid contamination**,** Destroy hazards when possible**,** Minimize growth of microorganisms in food and Use safe water and raw materials

- **Program:**

A power point presentation and the pamphlet included all contents of the program, were designed and given to the supervisors of the restaurants and the food handlers and brochures were hanged at clear place on each restaurant as an educational reference during program implementation.

3. Implementing phase:-

The implementation phase was taken 6 sessions (5 theoretical & 1 practical), each session was toke about 45 minutes with a break for 10 minutes, to cover all program content. Every week take two restaurants because the food handlers' alternate day by day, each restaurant have one sessions/day and each one take about five weeks to complete the implementation phase. The teaching methods were carried out through lecture, discussion, role play, simulation, while the media was included pamphlet, lab top, brochure, video and presentation. By the end of each session a summary was made and time allocated for questions and answers & plan for next session was made. Except for the last session a termination of sessions through feedback was done.

4. Evaluation phase:-

This phase aimed to evaluate the level of improvement in knowledge, attitudes and practices among food handlers about prevention of food borne diseases, through post-test after the program. The evaluation phase (post-test) it was done through two weeks after approximately three months from the program beginning.

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.

The used tests were

1. **Paired t-test:** For normally distributed quantitative variables, to compare between two periods
2. **McNemar and Marginal Homogeneity Test:** Used to analyze the significance between the different stages
3. **Chi-square test:** For categorical variables, to compare between different groups
4. **Monte Carlo correction:** Correction for chi-square when more than 20% of the cells have expected count less than 5
5. **F-test (ANOVA):**For normally distributed quantitative variables, to compare between more than two groups
6. **Cronbach's Alpha:** Reliability Statistics was assessed using Cronbach's Alpha and test retest tests.

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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.

Figure(1) Shows that all the studied group's knowledge regarding Cross contamination prevention / disinfection procedures, Separate raw food and cooked food, Cook the food well cooked, Keep food at a safe temperature and Use safe water and safe soft materials has been improved after implementation of the educational program, they were in the following percentages 91.9%, 93%, 87.2%, 77.9% and 87.2% respectively. The Overall knowledge also had improved from 5.8% to 89.5%.

Table (2) illustrates that there were highly statistically significant ($p<0.001$) differences between the studied group's mean scores of attitudes toward food safety as reported by them before and after program implementation.

Table(3): Shows that there were highly statistically significant ($p<0.001$) differences between the studied group's mean scores of practices as reported by them regarding food safety (pre/post) implementation of the program about Personal hygiene and preventive measures, Food preparation and separation and Food cooking and reheating. It also revealed statistically significant improvement in studied students' mean scores of Keep food at a safe temperature and Use safe water and safe soft materials.

Figure (2) shows that, the two restaurants' kitchens had insufficient Supplies (<50%)**.**

Table (4) shows that, there are statistically significant ($p<0.001$) relations between Knowledge VS attitude, Knowledge VS practice and Attitude VS practice throughout the program.

Table (5) clarify that, there were statistically significant ($p<0.001$) relation between educational level and overall food handler's knowledge before implementation the program, but no significant relation between them after implementation the program this refers to that all food handlers represent improvement in their knowledge after implementation the program regardless their educational level.

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., (2019) 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 (Figure 1), more than half of the studied group knew the correct answers about cross contamination prevention. These finding in the line with the study by ***Sani & Siow, (2014)*** who studied " Knowledge, attitudes and practices of food handlers on food safety in food service operations at the University 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. , (2013)*** who studied "Determinants of safe food handling behaviors among middle school youth in the USA" who reported that the most consumers not be aware about importance of hand washing, they are not washing their hands thoroughly. Also, ***Elsherbiny et al., (2019)*** who studied "Knowledge, attitude and practices of food safety among food handlers in Ismailia city hospitals, Egypt" who mentioned that majority of the study participants, more than three quarter 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 quarter of food handlers had good knowledge regarding separation of raw food from cooked food. These finding was disagreed with ***Elsherbiny et al., (2019)*** 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 Keep food at a safe temperature and Use safe water and safe soft materials. Moreover, this was in agreement with the study 0f **Sani and Siow, (2014)** 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 majority of respondents more than two-third did not know the correct temperature danger zones for RTE foods is 5-60 °C. This result was supported by ***Bas et al., (2006)*** who studied " The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in food businesses in Turkey" founded that many of their respondents had lack of knowledge about critical temperatures for RTE foods, acceptable refrigerator temperature ranges and cross-contamination.

Similar findings was founded by ***Buccheri et al., (2010)*** who studied " Knowledge, attitudes and self-reported practices of food service staff in nursing homes and long-term care facilities for the elderly in Sicily, Italy" 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 score of the present study illustrated that more than one half of food handler's over all knowledge score was poor regarding prevention of food borne diseases (food safety). Similarly, the study done by **Gorman et al., (2002**) who studied " A study of cross-contamination of foodborne pathogens in the domestic kitchen in the Republic of Ireland" . their result showed that more than three quarter of the sample had lack of food safety knowledge. Also, in agreement with our results **Awad Allah et al., (2017**) who studied "knowledge, attitude and practice of female teachers regarding safe food handling; is it sufficient? An intervention study, Zagazig, Egypt". Their research showed that more than two third of the sample had an unsatisfactory knowledge about safe food handling.

The finding in the present study revealed that knowledge scores increased significantly between 25.74 ± 12.33 before the intervention and 44.88 ± 8.13 with p value (<0.001) denoting significant difference in the level of food safety knowledge between pre and post intervention scores.

In the same line, the study by **Park et al., (2010)** whose study was "Evaluation of the food safety training for food handlers in restaurant operations in Korea" reported that Employee knowledge of the intervention group also showed a significant improvement in their score, increasing from 49.3 before training to 66.6 after training. Also, **Awad Allah et al., (2017**) reported that Knowledge about safe food handling had highly significant improvement ($p<0.01$) after intervention especially in the item of purchasing and storage in comparison to the item of personal hygiene which had the highest knowledge score before intervention.

It could be, deficient of health educational program and training courses in restaurants about food safety and low educational level as most of food handlers are read and write only lead to lack of knowledge among food handlers. So educational programs are very important to improve the food handlers' knowledge, practices and attitude, all of them lead to reduction of any food borne diseases.

The result of the present study showed that , attitude scores increased significantly between 49.90 ± 8.66 before the intervention and 54.51 ± 3.48 after the intervention. In total it appeared that there was improved food safety attitude by 12.15% between the pre-test and the post-test with a statistically significant difference ($p<0.01$). Our findings were consistent with **Al-Mohaithef, (2014)** who studied " Food hygiene in hospitals: evaluating food safety knowledge, attitudes and practices of foodservice staff and prerequisite programs in Riyadh's hospitals, Saudi Arabia", he found that, intervention group of food services staff had a significant improvement in attitude scores as the mean score increased significantly from 19.8(79.2%) before training to 21.1(84.4%) after training with ($p<0.01$).

Also, in the same line ***Elsherbiny et al., (2019)*** found that attitude scores had a significant increase between 14 ± 3.3 before the intervention and 17.9 ± 1.5 after intervention. In total it appeared that there was improved food safety attitude by 12.15% between the pre-test and the post-test with a statistically significant difference ($p<0.05$).

On the other hand, these results are disagreeing with the study of **Ehiri et al., (1997)** who studied " Evaluation of a food hygiene training course in Scotland" reported that, they didn't detect any improvement in the control group's knowledge, attitudes and opinions in the pre and post-tests.

According to the practices of food handlers, the results of this study manifested improvement in values of total mean scores relating to the food handlers' over all practices between 91.47 ± 3.45 before the intervention and 101.51 ± 6.85 after the intervention. In total it appeared there was a statistically difference ($p<0.01$) improvement in food safety practices between the pre-test and the post-test.

Similarly, the study by ***Wahdan et al., (2019)*** who studied the "Effect of an Educational Program on Food Safety Practices in Food Preparation and Handling Procedures in Governmental Hospitals of an Egyptian Governorate". Their result illustrated that there were significant improvement of all food hygiene practices between pre and post-intervention scores of food handlers concerning the mean score of all food hygiene practices, the food handler's post-intervention had better and fair levels of food hygiene practices compared with food handler's pre-intervention. There were significant differences between both pre and post intervention practice scores ($p= 0.000$).

Similarly, observations were reported in a study conducted by ***Ngivu (2016)*** who studied " Impact of food handlers' food safety training in a pediatric hospital in East Africa " her study revealed that there was a 35% increase in food safety compliance audit score especially hand hygiene compliance which improved from 50% before the intervention to 100% after the intervention.

In contrast with the current study, the study by **Awad Allah et al., (2017**) mentioned that, no significant change in Practice level. While **Adesokan et al (2015)** who studied " Food Safety Training Is Associated with Improved Knowledge and Behaviors among Foodservice Establishments' Workers." reported significant change in knowledge and practice of safe food handling but with repeated short term training.

In the present study there were positive correlations between knowledge with practices ($p<0.001$), knowledge with attitudes ($p<0.001$) and attitudes with practices ($p<0.001$) which were statistically significant. These findings indicated that level of food handlers' knowledge about food safety will affect their practices and attitudes in safe handling of food and also their attitudes influence their practices.

In the same direction, the study by ***Sani & Siow, (2014)*** who studied " Knowledge, attitudes and practices of food handlers on food safety in food service operations at the University Kebangsaan Malaysia " who observed that, there was a significant positive correlation between knowledge with practices ($p<0.05$), knowledge with attitudes ($p<0.05$) and attitudes with practices ($p<0.05$).

In the same line with the current study the study by ***Elsherbiny et al., (2019)*** found that there were positive correlations between knowledge with practices ($p<0.05$) and knowledge with attitudes, which were statistically significant, ($p<0.05$).

5. CONCLUSION

Based on the aim of the study and research hypothesis of the present study, it was concluded that: The knowledge , attitudes and practices related to food safety and prevention of food borne diseases among food handlers were improved after implementing of the program. Statistically significant ($p<0.001$) relation between educational level and overall food handler's knowledge before implementation the program, but no significant relation between them after implementation the program this refers to that all food handlers represent improvement in their knowledge after implementation the program regardless their educational level. Although both restaurants' kitchens had safe environment, but they hadn't sufficient supplies.

6. RECOMMENDATIONS

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.

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APPENDICES

Table I: 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
40 –	36	42
50 – 60	20	23
Gender		
Male	65	76
Female	21	24
Marital status		
Single	4	4.7
Married	78	91
Widow	3	3.5
Divorced	1	1.2
Educational level		
Illiterate	1	1.2
Reads and writes	30	35
Technical	42	49
High	13	15
Type of work		
Cooker	9	11
Assistant Cooker	9	11
Other	68	79
Years of Experience		
1-	5	5
5 – 10	5	5.8
10 – 15	14	16
15 – 20	37	43
>20	25	29

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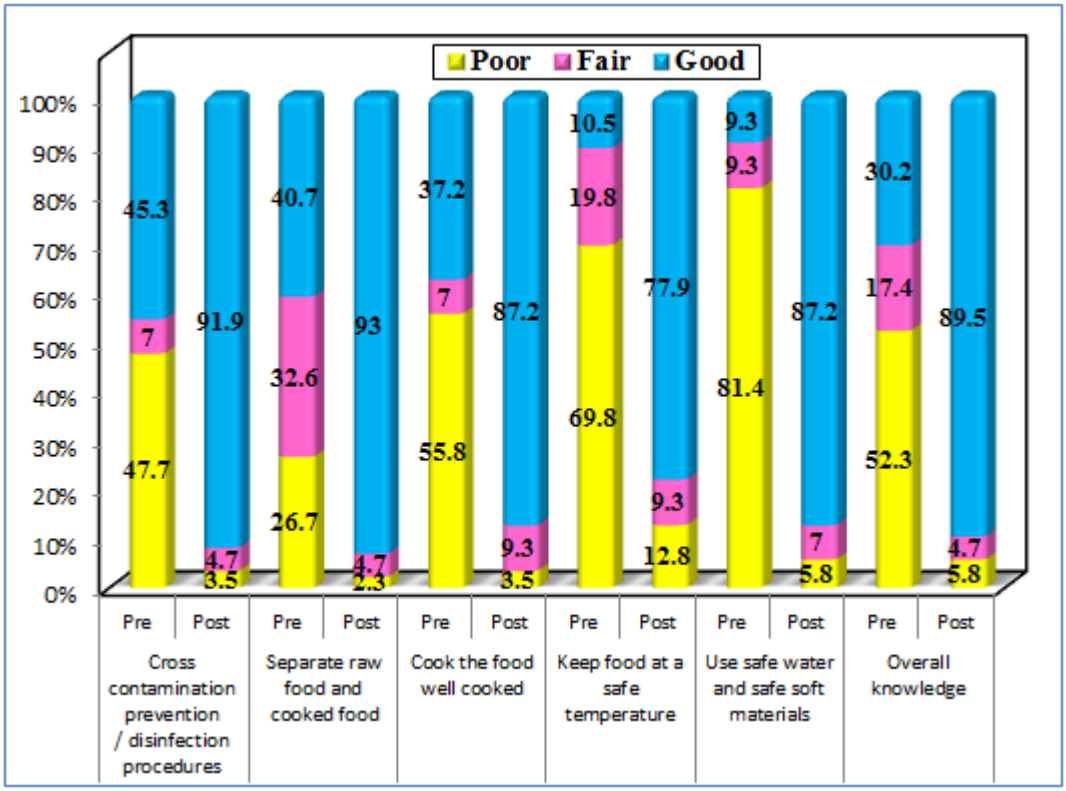

Figure I: Distribution of correct knowledge of the Food handlers on Cross-contamination prevention/disinfection procedures (n=86)

Table II: The mean and SD of the Food handlers on food safety attitudes subscales (n = 86)

Food handler's altitude	Pre Mean ± SD.	Post Mean ± SD.	t	p
Personal hygiene/ keep cleanliness Total score Percent score	 25.85 ± 5.11 79.24 ± 25.54	 28.64 ± 2.29 93.20 ± 11.43	 8.301*	 <0.001*
Cross contamination prevention / disinfection procedures Total score Percent score	 8.12 ± 1.19 85.27 ± 19.87	 8.87 ± .48 97.87 ± 8.0	 6.670*	 <0.001*
Cook the food well Total score Percent score	 5.19 ± 1.02 79.65 ± 25.58	 5.47 ± 0.89 86.63 ± 22.26	 1.569	 0.12
Keep food at a safe temperature Total score Percent score	 4.80 ± 1.45 70.06 ± 36.14	 5.53 ± 1.09 88.37 ± 27.30	 8.457*	 <0.001*
Use safe water and safe soft materials Total score Percent score	 5.94 ± 0.24 98.55 ± 5.88	 6.0 ± 0.0 100.0 ± 0.0	 2.291*	 0.024*
Overall attitude Total score Percent score	 49.90 ± 8.66 81.30 ± 22.80	 54.51 ± 3.48 93.45 ± 9.17	 7.023*	 <0.001*

t: Paired t-test

p: p value for comparing between the pre and post

*: Statistically significant at $p \leq 0.05$

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Table III: The mean and SD of the Food handlers on food safety correct practices subscales (n = 86)

Food handlers' practices	Pre Mean ± SD.	Post Mean ± SD.	t	p
Personal hygiene and preventive measures				
Total score	55.05 ± 3.61	62.73 ± 5.86	22.775*	<0.001*
Percent score	61.01 ± 5.64	73.02 ± 9.15		
Food preparation and separation				
Total score	13.26 ± 2.21	14.88 ± 0.47	5.974*	<0.001*
Percent score	85.47 ± 18.40	99.03 ± 3.92		
Food cooking and reheating				
Total score	9.30 ± 0.96	9.87 ± 0.34	6.338*	<0.001*
Percent score	91.28 ± 11.98	98.40 ± 4.20		
Keep food at a safe temperature				
Total score	3.86 ± 1.62	4.02 ± 1.53	0.821	0.414
Percent score	23.26 ± 20.22	25.29 ± 19.08		
Use safe water and safe soft materials				
Total score	10.0 ± 0.0	10.0 ± 0.0	–	–
Percent score	100.0 ± 0.0	100.0 ± 0.0		
Overall practices				
Total score	91.47 ± 3.45	101.51 ± 6.85	15.880*	<0.001*
Percent score	66.47 ± 3.45	76.51 ± 6.85		

t: Paired t-test

*: Statistically significant at $p \leq 0.05$

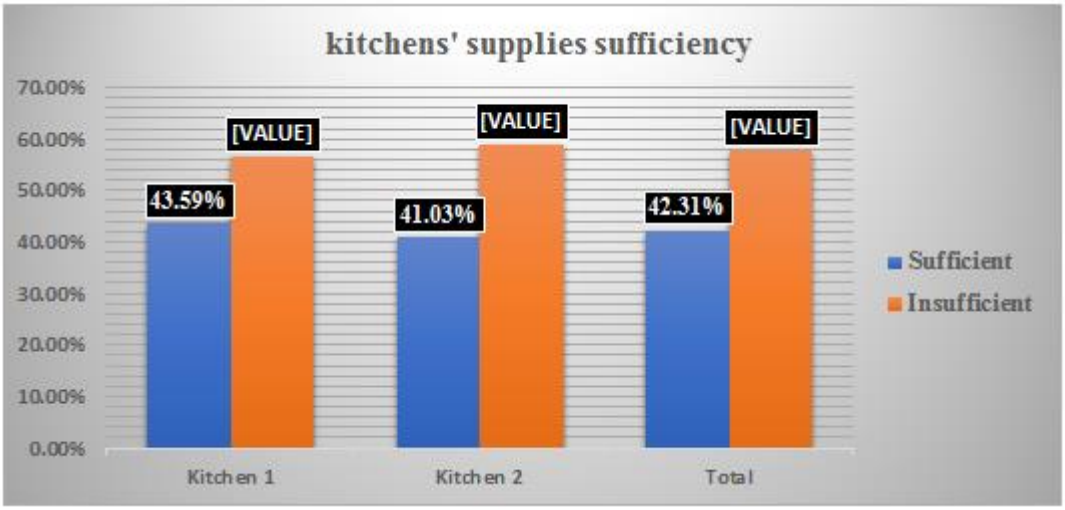

Figure I: Distribution of the restaurants' kitchens to Supplies (n = 2)

Table IV: Correlation between knowledge, practice and attitude (n = 86)

	Pre		Post	
	r	P	r	P
Knowledge VS altitude	0.803*	<0.001*	0.919*	<0.001*
Knowledge VS practice	-0.125	0.252	0.926*	<0.001*
Altitude VS practice	0.371*	<0.001*	0.935*	<0.001*

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

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Table V: Relation between educational level and overall food handler's knowledge (n = 86)

Educational level	Overall food handlers knowledge															
	Pre								Post							
	Poor (n=45)		Fair (n=9)		Good (n=20)		Excellent (n=12)		Poor (n=5)		Fair (n=3)		Good (n=4)		Excellent (n=74)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Illiterate	1	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.4
Technical	15	33.3	2	22.2	1	5.0	12	100	0	0.0	0	0.0	0	0.0	30	40.5
Reads and writes	19	42.2	4	44.4	19	95.0	0	0.0	5	100	3	100	3	75.0	31	41.9
High	10	22.2	3	33.3	0	0.0	0	0.0	0	0.0	0	0.0	1	25.0	12	16.2
χ^2(p)	43.357* (<0.001*)								14.002(0.132)							

χ^2: Chi square test

MC: Monte Carlo

p: p value for associated between different categories

*: Statistically significant at $p \leq 0.05$