

FOOD SAFETY DURING COVID-19 PANDEMIC: KNOWLEDGE, ATTITUDE AND PRACTICE AMONG FOOD HANDLERS – AN INTERVENTIONAL STUDY

By

Elshamy RA and Mahmoud NA

Department of Public Health and Community Medicine, Faculty of Medicine, Zagazig University, Zagazig, Egypt

Corresponding author : Elshamy RA. **E mail:** RAALY@medicine.Zu.edu.eg

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Abstract

Introduction: Food may serve as an important channel for COVID-19 virus to spread between persons. Food handlers can transfer the virus by several methods

Aim of Work: To assess the effectiveness of health education on knowledge, attitude, and practice (KAP) of food handlers at Zagazig University (ZU) cafeterias' during

COVID -19 pandemic. **Materials and Methods:** Sixty-four food handlers at ZU cafeterias participated in an interventional study. Using an observational checklist, the

workplace condition was evaluated. Using a pre-posttest method, KAP of food handlers about COVID-19 transmission, clinical picture, and prevention were evaluated. KAP

of food handlers about five items of food safety were evaluated. **Results:** KAP of the participants on COVID-19 transmission, clinical picture, and prevention significantly

improved after intervention. KAP of the participants on five items of food safety; personal hygiene, food preparation, food hygiene, cross-contamination and the thawing

of food significantly improved after intervention. **Conclusion and Recommendations:** Food handlers have a significant risk of transmitting infections to persons so there

is an increased requirement for further health educational programs for food safety guidelines and regulations during COVID-19 pandemic

Keywords: Knowledge, Attitude, Practice, Food handlers and COVID-19 Pandemic

Introduction

According to WHO, food-related diseases are more common in developing countries because of unhygienic food handling, bad understanding, insufficient food safety regulations, lax regulatory systems, and lack of funding (Azanaw et al., 2019).

By the end of December 2019, COVID-19 has rapidly spread over the world after it had been first identified in Wuhan City, Hupei Province in China (WHO, 2020). COVID-19 has been linked to changes in eating and cooking patterns, consumer food safety awareness, attitudes toward food and hygiene and food purchasing behavior (Osaili et al., 2021). According to the WHO, COVID-19 spreads by direct contact between people or through coughing and sneezing droplets (WHO, 2021).

Food may serve as a channel for COVID-19 virus to spread. The food container, utensils, tabletops, money, equipment, or even a simple handshake could all become sources of infection after coming into contact with an infected person (WHO, 2020). Food handlers can transfer the virus by coughing, speaking, breathing, or sneezing because saliva has been found

to contain COVID-19. All of those have the potential to produce an infectious aerosol that spreads microorganisms into the surrounding air (Mohammadi-Nasrabadi et al., 2021).

Aim of Work

To assess the effectiveness of health education on knowledge, attitude, and practice (KAP) of food handlers at Zagazig University (ZU) cafeterias during COVID -19 pandemic.

Materials and Methods

Study Design: It is an interventional study.

Place and duration of the study: The study was conducted at Zagazig University (ZU) cafeterias. Data were collected during December 2021 till June 2022.

Study sample: The study populations were food handlers who were currently working at ZU cafeterias in preparation, delivering, cleaning and service areas at the time of the study.

Sample Size and Sampling technique

Using Epi Info version 6 statistical software, the sample size was calculated assuming that, total number of food handlers at ZU cafeterias was 75, food

handlers' knowledge regards food safety had changed by 25% according to a pilot study. The predicted sample size was 60 plus 10% non-response, based on a 95% confidence range and an 80% degree of precision. So, our final study sample size was 66 food handlers, 64 of them completed the training program. A pilot study was done on 6 food handlers (10% of the sample) to determine simplicity, language comprehensibility, and the average completion time for the questionnaire. The questionnaire was reevaluated based on the findings, and minor changes were made. All KAP questions were internally consistent and reliable according to the reliability test (Cronbach's alpha were 0.75, 0.82, and 0.74, respectively). All participants of the pilot were not included in the results of the study.

Data Collection

Data were collected in 3 phases

Phase one: Assessment of workplace by observational checklist consisted of items guided by the hygiene inspection checklist published by Elserly et al. (2018) and Ramadan et al. (2019).

Phase two: Food handlers were interviewed at the work sites and given

feedback regarding the evaluations of the cafeterias. In this phase, a structured pre-test questionnaire guided by relevant literature and previous studies was distributed among food handlers. The researchers explained the necessity for a training program for food safety during COVID-19 pandemic, the purpose of the study, the nature of the questions and privacy was assured to all participants. All subjects were asked questions covering the following sections:

Section I: Socio-demographic and occupational history of the studied food handlers.

Section II: Food safety and COVID-19 pandemic adopted from Omar (2020) and Osaili et al. (2021). It included questions about KAP regarding COVID-19.

The block related to food safety knowledge during Covid-19 evaluation comprised 7 questions related to COVID-19 transmission, clinical picture, and prevention. The total score of participants' knowledge was calculated by the summation of correct answers from each aspect. Each correct answer was given "1" point while incorrect and not sure answers were given a score of "0". The block related

to food safety attitude during Covid-19 evaluation comprised 7 questions related to COVID-19 transmission and prevention. The total score of participants' attitude was calculated by the summation of correct answers from each aspect. Each correct answer was given "1" point while incorrect and do not know answers were given a score of "0". The block related to food safety practices during Covid-19 evaluation comprised 16 questions about behavioral changes during the COVID-19 pandemic where the answer choices were "Less than before," "About the same" and "More than before".

Section III: Food safety KAP evaluation was organized into three blocks following WHO (2006) and Vitória et al. (2021).

The block related to **knowledge** evaluation comprised 18 objective questions related to personal hygiene, food preparation, food hygiene, cross-contamination and the thawing of food. The three answer options were "Yes", "No" and "I do not know"; "1" point was given for every correct answer and "0" points for incorrect answers or do not know answers. Then, the responses to these questions were added together to generate total knowledge score

(Azanaw et al., 2019). The **attitude** assessment block included 17 questions related to personal hygiene, food preparation, food hygiene, cross-contamination and the thawing of food. In this block, attitude was considered a way of thinking that is reflected by a person's behavior. The food handlers indicated their level of agreement on a 3-point scale that reflected the following response options: "I agree" "Disagree" and "Not sure". "1" point was given for every correct answer and "0" points for incorrect answers or not sure answers. Then, we added all scores together and divided by the number of scores to obtain the mean. The last block of the questionnaire referred to the evaluation of self-reported **practices** and comprised 14 questions about daily practices that were related to food safety. A 5-point rating scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often and 5 = Always) except for negatively worded question number 7 and number 13 we reversed the score. Then, we added all scores together and divided by the number of scores to obtain the mean.

Phase three: This phase included a health education on food safety, according to WHO (2006); CDC (2020) and Ghaffari et al. (2020). The

five-key guidelines to safe and healthy food were developed in two parts. The context and goal of the recommendation were presented in the first section, and the five keys to gaining access to food safety were discussed in the second section. Several training techniques, including posters, and video files, were used, and at the end, flyers including all the information required to assure message delivery were distributed to the participants. The participants were given the same questionnaire as a post-test four weeks following the end of training intervention in order to assess the training program's effectiveness. The workplace was also reevaluated using the observational checklist.

Consent

All participants provided informed consent before being enrolled in the interventional study. The research goal

was clearly stated to all participants, and they had all the right to approve or decline participation. They were assured that the data would be used only for research purposes.

Ethical Approval

The Institutional Review Board (IRB) of the Faculty of Medicine, ZU approved the study protocol (ZU-IRB # 9085). Confidentiality and ethical concerns were granted.

Data Management

The collected data were computerized and statistically analyzed using SPSS program version 26.0. Qualitative data were presented as frequencies and percentages. Quantitative data were displayed as mean and standard deviation and compared using paired t test. The test results were considered significant when p values were < 0.05 .

Results

Results showed that the mean age of food handlers was 30.5 ± 9.5 . The majority of them (89.1%) were males. More than half of them were married, lived in rural areas and with university or technical diploma education. Concerning occupational history, the mean duration of work was 12.5 ± 10.2 . Regarding work hours per week, the mean was 54.0 ± 8.82 (Non tabulated results).

Table (1): Participants' Knowledge and Attitude scores about Food Safety during COVID- 19 (pre/ post Intervention):

Food safety during 19-COVID	Pre-test	Post-test	Paired t-test	p value
	Mean \pm SD	Mean \pm SD		
Knowledge				
Transmission	48.44 \pm 8.77	92.88 \pm 10.20	26.4	<0.0001*
Clinical picture	56.77 \pm 15.35	93.88 \pm 9.78	16.3	<0.0001*
Prevention	51.56 \pm 9.96	94.92 \pm 10.14	24.4	<0.0001*
Total score	52.26 \pm 8.68	93.89 \pm 10.08	25	<0.0001*
Attitude				
Transmission	39.6 \pm 13.10	87.2 \pm 10.2	22	<0.0001*
Prevention	41.40 \pm 12.77	84.92 \pm 7.61	23.4	<0.0001*
Total score	40.5 \pm 11.9	86.06 \pm 8.9	24.5	<0.0001*

*: Statistically significant.

Table 1 showed that there was a statistically significant improvement in the participants' knowledge and attitude about transmission, clinical picture, and prevention during COVID-19 pandemic (pre/post intervention) ($p < 0.0001$).

Table (2): Participants' practices about Food Safety during COVID- 19 (pre/post Intervention):

Practices about Food Safety during COVID- 19	No. (%)		
	(No =64)		
	Less than before No %	About the same No %	More than before No %
1.Eating meals with friends	54 (84.4)	8 (12.5)	2 (3.1)
2. Changing the intake of certain foods due to your concern about their safety.	12 (18.8)	30 (46.8)	22 (34.4)
3. Buying groceries and food through delivery or takeaway.	9 (14.1)	15 (23.4)	40 (62.5)
4. The number of times and duration of shopping differ.	48 (75)	12 (18.8)	4 (6.2)
5. Hand hygiene (when you get home, before eating, and after touching the outer bags and covers).	1 (1.6)	13 (20.3)	50 (78.1)

Table 2 showed that, there were changes after health education, most of them showed less eating meals with friends and number of times and duration of shopping. More than 60% changed their practice regarding buying food through delivery and hand hygiene. As regarding changing the intake of certain foods due to concern about their safety, 46.8 % of participants showed no change.

Table (3): Participants' Knowledge and Attitude scores about Food Safety during COVID- 19 (pre/ post Intervention):

Food Safety	Pre-test	Post-test	Paired t-test	p value
	Mean ± SD	Mean ± SD		
Knowledge				
Personal hygiene	72.85 ± 12.71	94.53 ± 8.3	11.4	<0.0001*
Food hygiene	67.21 ± 8.40	95.24 ± 12.83	25.3	<0.0001*
Food preparation	57.63 ± 18.32	94.07 ± 7.98	14.6	<0.0001*
Cross contamination	66.88 ± 12.20	95.28 ± 11.35	13.6	<0.0001*
Thawing	73.44 ± 14.52	94.88 ± 17.54	7.5	<0.0001*
Total score	67.61 ± 13.23	94.80 ± 11.60	12.4	<0.0001*
Attitude				
Personal hygiene	58.78 ± 16.65	86.88 ± 12.20	10.9	<0.0001*
Food hygiene	57.66 ± 14.60	87.19 ± 11.70	12.6	<0.0001*
Food preparation	49.02 ± 12.66	85.70 ± 9.92	18.2	<0.0001*
Cross contamination	59.82 ± 14.53	85.94 ± 12.31	11	<0.0001*
Thawing	51.13 ± 16.75	89.65 ± 14.58	13.9	<0.0001*
Total score	55.31 ± 14.82	87.1 ± 12.14	13.3	<0.0001*

*: Statistically significant.

Table 3 showed that there was a statistically significant improvement in knowledge and attitude of food handlers regarding the 5 items of food safety (pre/post-intervention) ($p < 0.0001$).

Table (4): Participants' Practice score about Food Safety during COVID- 19 (pre/ post Intervention):

Food Safety	Pre-test	Post-test	Paired t-test	p value
	Mean ± SD	Mean ± SD		
Practice				
Personal hygiene	49.21 ± 9.8	82.53 ± 8.83	20.8	<0.0001*
Food hygiene	48.20 ± 8.4	79.24 ± 2.83	28	<0.0001*
Food preparation	43.37 ± 6.44	80.48 ± 4.02	39.2	<0.0001*
Cross contamination	52.42 ± 7.87	79.32 ± 7.47	19.8	<0.0001*
Thawing	58.75 ± 12.6	81.19 ± 11.68	10.4	<0.0001*
Total score	50.42 ± 9.01	80.55 ± 6.91	21.3	<0.0001*

*: Statistically significant.

Table 4 showed that there was a statistically significant improvement in practice of food handlers regarding the 5 items of food safety (pre/post-intervention) ($p < 0.0001$).

Table (5): Food safety checklist:

Checklist items	Pre-test	Post-test	Paired t-test	p value
	Mean ± SD	Mean ± SD		
1.Personal hygiene	55.82 ± 11.44	84.32 ± 9.41	6.1	<0.0001*
2.Food preparation	50.81 ± 9.80	81.24 ± 7.90	7.65	<0.0001*
3.Hot and cold holding	49.63 ± 8.41	52.72 ± 8.92	0.798	0.435
4.Food storage and dry storage	46.82 ± 10.27	50.37 ± 11.63	0.727	0.477
5.Refrigerator and cooler	59.81 ± 13.23	82.61 ± 12.42	3.98	0.0009*
6.Cleaning and sanitizing	40.32 ± 8.54	45.82 ± 8.81	1.42	0.172
7.Utensils and equipment	57.34 ± 12.22	81.29 ± 10.13	4.78	<0.0001*
8.Waste storage and disposal	57.82 ± 8.34	78.73 ± 7.63	5.88	<0.0001*
9.Pest control	44.81 ± 6.62	49.32 ± 7.91	1.38	0.182

*: Statistically significant.

Table 5 showed statistically significant improvement as regards all items of food safety check list ($p < 0.0001$), except items of hot and cold holding, food and dry storage, cleaning and sterilization and pest control ($p > 0.05$).

Discussion

In university cafeterias, food preparation is a responsibility of food handlers, including employees from all sectors of the food service industry (Souza et al., 2018). Food handlers should actively participate in effective training, which is essential in increasing knowledge and perceptions (Ko, 2013). According to studies from Saudi Arabia, Ethiopia, and Ghana; training programs on food safety are advised to help turn this knowledge into good hygiene habits (Ayaz et al., 2018; Lema et al., 2019; Odonkor et al., 2020). In Egypt, El Derea et al., (2008) found that following training session, food safety procedures improved significantly. Accordingly, the aim of this study was to assess the effectiveness of a health education intervention on food handlers' KAP regarding food safety at ZU cafeterias during COVID -19 pandemic.

A total number of 64 food handlers working in ZU cafeterias were included in the study. The mean age of food handlers was 30.5 ± 9.5 years. The majority of them (89.1%) were males. More than half of them were married, lived in rural areas and with university or technical diploma education (Non tabulated data), that agreed with

Ramadan et al. (2019) who reported that the age of food handlers in their study at Benha University cafeterias; was 20-<40 years with a mean of 32.63 ± 4.71 , and three-quarters of them were males with high education. This was documented in studies by Lee et al. (2017) in Malaysia and Malavi et al. (2017) in Kenya. This may be explained by lack of various job opportunities for this level of education. On the other hand, studies by Cunha et al. (2014) and Vitória et al. (2021) from Brazil and Sibanyoni et al. (2016) from South Africa, found that women predominated in the food services industry.

Regarding knowledge of food handlers during COVID-19 pandemic following the intervention program, there was a statically significant improvement in the participants' knowledge about all items related to COVID-19 transmission, clinical picture, and prevention, with mean of 93.89 ± 10.08 ($p < 0.0001$) (Table 1), that was inconsistent with Omar (2020) who reported that knowledge of food handlers during COVID-19 pandemic in Jordan was high. Moreover, according to a study conducted in Saudi Arabia, almost all of participants (94.8%) were aware that COVID-19 may spread

through the respiratory droplets (Al-Hanawi et al., 2020). This finding can be attributed to cultural similarities in Egypt, Jordan, and Saudi Arabia.

Regarding attitude of food handlers during COVID-19 pandemic, results of the current study reported that attitude about transmission and prevention was significantly changed after intervention to be 86.06 ± 8.9 ($p < 0.0001$) (Table 1). That agreed with Omar (2020) with mean of $91.3 \% \pm 12.7$. This similarity might be due to the same study methods and training session.

As regards participants practice during covid-19 pandemic, there was reduced frequency of eating meals with friends and less shopping time and duration (Table 2). This agreed with a study done in Qatar, as people reported eating more with family members at home during COVID-19 (Ben Hassen et al., 2020). Current study revealed that more than 60% of participants changed their practice regarding hand hygiene and buying food through delivery (Table 2). This was in accordance with a study of Mohammadi-Nasrabadi et al. (2021) in Iran, who revealed that 73.6% of participants changed their desirable practice after intervention. The participants in the current study

were trained to use gloves while handling raw foods, in contrast to Limon (2021) who claimed that during the COVID-19 pandemic, 98.4% of Filipino food handlers didn't use gloves when handling raw food. As regards changing the intake of certain foods due to concern about their safety, 46.8 % of participants showed no change (Table 2). This might be explained by no evidence that certain food can cause nor prevent COVID-19.

Regarding food handlers' knowledge about food safety, previous Egyptian study by Elsherbiny et al. (2019) in Ismailia city hospitals revealed that only one third of the survey participants had adequate knowledge. This might be attributed to lack of implemented training courses. So, it was very important to conduct that study which clarified that most food handlers had a high significant improvement in total knowledge regarding the 5 items of food safety with mean 67.6 ± 13.23 / 94.80 ± 11.60 (pre/post-intervention) ($p < 0.0001$) (Table 3). Ramadan et al. (2019) in Egypt and Khalifa et al. (2018) in Saudi Arabia revealed the same changes. However, Adesokan et al. (2015), in their study on Nigerian food service workers discovered that

training programs did not always result in increased knowledge.

Concerning food handlers' attitudes towards food safety, the present study revealed that the mean attitude score of food handlers overall toward the five items related to food safety substantially increased following intervention to 87.1 ± 12.14 ($p < 0.0001$) (Table 3). Pirsaeheb et al. (2010) from Iran and Mahyudin (2013) from Malaysia discovered that following the guideline intervention, unfavorable views regarding hand washing and food storage safety had changed. These changes in food handlers' attitudes may be the result of their improved understanding following the health education courses.

About food safety practices among food handlers, according to previous study conducted at Zagazig university cafeterias demonstrated that about two thirds of the studied food handlers had unsatisfactory food safety practice. This might be due to inadequate knowledge of food handlers and insufficient supervision (Mahmoud et al., 2021). Moreover, in the Pagotto et al. (2018) research, 14.7% of the food handlers continued to work while suffering from diarrhea, hand sores, wounds, or other ailments. In the present work;

health education had effect on food handlers practice with high significant improvement pre/post intervention, the mean of practice was $50.4 \pm 9.0 / 80.55 \pm 6.9$ ($p < 0.0001$) (Table 4). This agreed with Malavi et al. (2017) who conducted a study in Kenya and noticed that most of food handlers had good practice level. Ghaffari et al. (2020) from Iran indicated that, after two months of intervention, there was a substantial difference between the intervention and control groups' mean behavior ratings. This might be attributed to continuous training courses. The current results were higher than the findings of studies in Bahir Dar, Ethiopia (Derso et al., 2017) and in Nigeria (Iwu et al., 2017), respectively, and were not consistent with Mullan and Wong (2010) from Australia, as their educational intervention did not manage to improve participants' behavior. These variations might be due to the difference in the study design, variation in training, and the provision of food hygiene and safety inputs. That is supported by previous findings which suggested that food safety training may raise knowledge, but it may not necessarily result in better behavior (Cunha et al., 2014).

Looking to the food safety

checklist, all cafeterias were in a satisfactory condition, with a high statistically significant improvement after the intervention (Table 5). As regarding personal hygiene, the results were in line with those of Limon (2021) from Philippines, who observed a considerable improvement in proper hand washing. As regarding waste disposal, most cafeterias handled waste in an appropriate manner. Previous Egyptian research found similar result (Elsersy et al., 2018). It can be explained by the fact that almost all cafeterias in the Egyptian Universities are operated by private companies, that need to provide high-quality service to ensure clients' satisfaction, including students, staff, and employees. In contrast, Ahmed et al. (2014) found that there were no clear plans for waste disposal at the Khartoum State Hospital (Sudan) due to lack of stricter waste management policies and regulations.

However, following intervention, there was no difference in the way that foods were handled, stored, cleaned, or sanitized. The present findings conflict with research of Odipe et al. (2019) from Nigeria, which found that 75% of the studied cafeterias have the facilities required for the safe storage of cooked food. Additionally, Limon

(2021) discovered that 44.4% of the participants had effective cleaning and disinfection processes as well as good storage procedures at the appropriate temperature. Also pest control didn't change in the current study (Table 5). The same was reported by Ramadan et al. (2019) from Egypt, as they documented that cafeterias were not free of insects (such as flies and cockroaches) and pesticides were not readily accessible. The absence of strict regulations and standards may account for this.

Conclusion and Recommendations:

Knowledge, attitude and practice of the participants as regards food safety significantly improved after intervention. One method for enhancing food safety practices and providing long-term advantages to the food establishments is food handlers' training. Every six to twelve months, training should be provided, and its effectiveness must be assessed. It is essential to emphasize that food safety education should be carried out using strategies that support behavioral change and develop practical skills.

Conflict of interest

The authors declared that they have no conflict of interest.

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