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Original Article

The Impact of Training on the Knowledge, Attitude, Performance, and Risk Perception of Food Handlers in Food Preparation and Distribution Centers Regarding the Ways to Prevent and Contract COVID-19

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Abstract

Background: The most fundamental solution to control pandemics is to promote public awareness and attitudes toward infectious diseases. Food handlers in food preparation and distribution centers have a very effective role in the transmission, prevention, and control of diseases due to the high level of contact with the general public. The present study aimed to investigate the impact of training on the knowledge, attitude, and performance of food handlers in food preparation and distribution centers in Amlash, Iran regarding the ways to prevent COVID-19 in 2021.

Methods: The participants in this interventional study were 300 food handlers in food preparation and distribution centers selected through multistage random cluster sampling. A list of the participants was prepared and classified based on the type of their businesses, and the participants were randomly assigned to intervention and control groups using the random allocation software. The intervention focused on training for the prevention of COVID-19. Before and after the intervention, the knowledge, attitude, and performance of the participants in the two groups were assessed using the questionnaire developed by Honarvar et al. The validity and reliability of this questionnaire were confirmed. The collected data were analyzed using non-parametric Mann-Whitney U, Wilcoxon signed-rank, and Kruskal-Wallis tests.

Results: After controlling the effect of pre-test scores with multivariate analysis of covariance (MANCOVA), the results showed that the knowledge, attitude, and performance scores for the participants in the intervention group increased by 31%, 6.16%, and 10%, respectively, after the training intervention and the scores for these variables were significantly higher than those obtained by the participants in the control group ($P<0.001$). There was also a significant relationship between age and knowledge ($P<0.001$) and attitude ($P=0.043$). However, the participant's age was not significantly correlated with their performance ($P=0.845$). There was also a significant relationship between the participants' gender and performance ($P=0.028$).

Conclusion: Training can have an impact on the knowledge, attitude, and performance of food handlers in food preparation and distribution centers. Thus, continuous training is essential for preventing COVID-19 among food handlers in food preparation and distribution centers.

Keywords: COVID-19, Training, Attitude, Performance, Knowledge

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Introduction

In late 2019, the Chinese government officially announced the occurrence of an epidemic caused by an acute respiratory disease, i.e. the new coronavirus or COVID-19 (1). According to the evidence, the coronavirus was transferred from animals to humans in the seafood market of Wuhan, China, and quickly spread to other countries (2). Many people in Iran were also infected with this disease (3).

The spread of the COVID-19 pandemic has physical, psychological, economic, social, and cultural consequences. Approximately 10% of people who test positive for COVID-19 experience long-term complications of the disease. This, in turn, affects their quality of life and well-being due to the aggravation of COVID-19-induced unemployment, trauma, and stress (4).

In general, airways including droplets, aerosol, and indirect transmission through touching contaminated surfaces and eating food are different ways of transmitting COVID-19 from one person to another (5). Meanwhile,

food safety became one of the main concerns of people and was widely discussed (6). Food health and safety have always been of concern to consumers. For this reason, it is very important to pay attention to the training of people who deal with, prepare, and distribute food. Such training became important for food handlers during the COVID-19 epidemic and after that, requiring new training efforts with new technologies, especially mobile phones (7-9). Moreover, some preventive measures during the epidemic, include isolation, quarantine, washing hands frequently with soap and water or alcohol-based disinfectants before preparing or eating food, social distancing protocols, wearing masks, keeping raw food separate from other foodstuffs, and meat cooking at the right temperature to kill harmful bacteria and microbes (10,11). However, the effectiveness of such measures depends on public awareness of these recommendations. Food handlers in food preparation and distribution centers are often exposed to the highest risk of contracting COVID-19 or spreading the virus in the community. Although these people are at a higher risk of contracting and spreading the infection, most of the studies conducted so far have focused on the general public and little information is available on food handlers' knowledge about COVID-19 and preventive behaviors (12).

Mohammadi-Nasrabadi et al examined the effect of food health and safety training intervention on 159 food handlers in restaurants in Tehran during the COVID-19 pandemic. The results indicated that food health and safety training can improve the condition of restaurants and minimize the spread of epidemic diseases, including COVID-19. Thus, such training can contribute to promoting public health (13). Faraji et al (14) investigated the adherence to health protocols in the prevention of COVID-19 in food stores in Babol. The findings showed that compliance with health protocols in food stores was poor, average, and good at 0.9%, 20.6%, and 78.5%, respectively. Moreover, 40.7% of the customers were completely satisfied with compliance with health protocols in the stores and 31.8% reported that they pay attention to the store's brand of food products when ordering food. The data also suggested that the sanitary condition of the food stores was desirable and that sanitary recommendations could be helpful. A few studies have addressed the impact of training interventions on the knowledge, attitude, and performance of food handlers in Iran. Thus, an innovative aspect of the present study is its focus on this issue.

Given the contagious nature of COVID-19, the best way to fight this disease is to control and prevent new cases i.e., to break the transmission chain. To achieve this goal, a detailed program is needed to control and prevent the disease. The most fundamental solution to control pandemics is to increase public awareness of infectious diseases. Moreover, since enhancing compliance with food health protocols is of great importance and food handlers in food preparation and distribution centers have a high level of contact with all groups in the community, awareness-raising programs for food handlers can promote their knowledge, attitude, and performance and lead to behavior change in them. Besides, previous studies have shown that people's knowledge, attitude, and performance vary in different cultural contexts, and facilities, and mass media used by the public differ in various geographic areas. In addition, previous studies have often focused on general populations and less attention has been paid to food handlers who can play a vital role in transmitting coronavirus. To this end, the present study sought to investigate the impact of training on the knowledge, attitude, and performance of food handlers in food preparation and distribution centers in Amlash, Iran regarding the ways to prevent COVID-19.

Materials and Methods

This quasi-experimental study adopted a pre-test-post-test design to investigate the effect of training on the knowledge, attitude, performance, and risk perception of food handlers in food preparation and distribution centers in Amlash, Iran in 2021.

The criteria for enrollment in the study were minimum reading and writing literacy, working as a food hander, and the willingness to participate in the study. The exclusion criteria were having vision and hearing impairments that could disrupt the training program and unwillingness to participate in the study.

The research population consisted of all the food handlers in food preparation and distribution centers in Amlash, Iran. The sample size in this study was estimated as 110 persons taking into account a 95% confidence interval and 90% test power. Following a similar study (13), the difference in the knowledge score before and after the intervention was considered to be at least 10%, and the correlation of scores was equal to 0.3. Finally, taking into account 10 persons for each variable to control the intervention effects (4 individual and social variables addressed), a total of 150 persons were selected as the participants in each group.

The participants in this study were 300 food handlers working in food preparation and distribution centers in Amlash, Iran. To this end, a list of the food handlers was prepared and classified based on the type of their businesses, and the participants were randomly assigned to intervention and control groups using the random allocation software. Accordingly, the first participant was assigned to the intervention group and the second participant was placed in the control group. This process was repeated until all participants were placed into the two groups. The pre-test data in this study were collected from the participants in the two groups using the Adult Knowledge, Attitude, Performance, and Risk Perception

Questionnaire to Prevent COVID-19 developed by Honarvar et al (15).

After reviewing the data and specifying the educational needs of the participants, a training program was developed based on the guidelines released by the Ministry of Health and Medical Education about COVID-19 symptoms and prevention and control protocols. Furthermore, the content of relevant articles published in this field was reviewed and the training program was revised accordingly. The training program was carried out for groups with 15-20 participants during four half-hour sessions in each comprehensive healthcare center with full compliance with health protocols in the form of lectures using PowerPoint slides, questions and answers, and educational pamphlets in collaboration with environmental health and infectious disease experts who were experienced nursing teachers. The intervention program was performed for the participants in the intervention group. The first session focused on introducing COVID-19 and its importance, the second session introduced the COVID-19 signs and symptoms and the way the disease is transmitted, the third session focused on the ways to prevent COVID-19, and the fourth session discussed the groups at risk of the disease. The participants in both the intervention and control groups completed the questionnaire 15 days after the completion of the training program. The participants in the control group did not receive training intervention other than routine training. Educational pamphlets were also provided to the members of the control group after the completion of the training program. To prevent information exchange between the intervention and control groups, efforts were made to ensure that if an individual in the intervention group was from a particular village or center, the one in the control group was not selected from the same location.

Instruments

The data in this study were collected using the Adult Knowledge, Attitude, Performance, and Risk Perception Questionnaire to Prevent COVID-19 developed by Honarvar et al (15). The questionnaire contains 52 items that assess the knowledge, attitude, risk perception, performance, and source of news about COVID-19. The knowledge section contains 17 items including 8 three-choice items and 9 two-choice items. The attitude and risk perception section contains 14 items that should be responded to as very high, high, moderate, low, very low, or none. The items in the performance section are answered always, often, sometimes, rarely, and never. Finally, the last 3 items in the questionnaire address the source of news used by the respondent to obtain information about COVID-19. The items in the questionnaire are scored on a Likert scale, with a score of less than 40% indicating poor assessment, a score of 40% to 70% indicating a relatively good assessment, and a score of greater than 70% indicating a good assessment of the respondent' knowledge, attitude, performance, and risk perception. Honarvar et al (15) confirmed the face and content validity of the questionnaire. Accordingly, Cronbach's alpha values for the knowledge, attitude, and performance sections were 64.1, 78.1, and 82.3, respectively.

The collected data were analyzed with SPSS-20 software using non-parametric Mann-Whitney U, Wilcoxon signed-rank, and Kruskal-Wallis tests. *P* values less than 0.5 ($P<0.05$) were considered statistically significant.

Results

The participants in the present study were 149 food handlers in the intervention group and 146 food handlers in the control group (Figure 1). The reason for the smaller number of participants in the control group was the unwillingness of some food handlers to continue cooperating in the study. Table 1 shows the demographic characteristics of the participants in the two groups.

Table 2 compares the scores for knowledge, attitude, and performance based on individual and social variables. As can be seen, the participants' age had a significant relationship with their knowledge ($P<0.001$) and attitude ($P=0.043$). However, the participants' age had no significant correlation with their performance ($P=0.845$). The participants over 60 years of age had a higher mean score for knowledge and attitude than the participants in other age groups. There was also a significant relationship between gender and performance ($P=0.028$) and the female participants had a higher mean performance score than the male participants. However, other demographic variables (occupation and education) had no significant

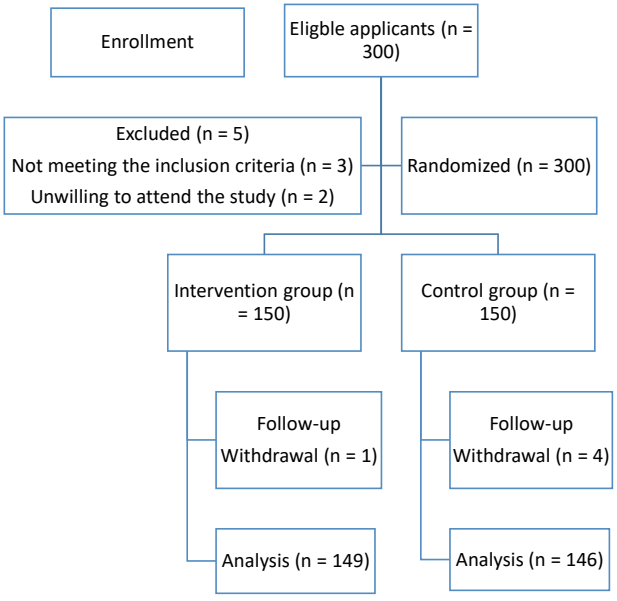

Figure 1. The consort flowchart

Table 1. The demographic characteristics of the participants in the two groups

Variable	Categories	Groups		Total	*P* value
		Intervention	Control		
		No. (%)	No. (%)	No. (%)	
Age group (y)	<30	29 (19.5)	28 (19)	57 (19.3)	0.965
	31-40	35 (23.5)	40 (27.25)	75 (25.3)	
	41-50	37(24.8)	35 (23.8)	72 (24.3)	
	51-60	31 (20.8)	29 (19.75)	60 (20.3)	
	>60	17 (11.40)	15 (10.2)	32 (10.8)	
Age (mean ± SD) (Min-Max)		43.60 ± 13 (20-79)	43.44 ± 13.44 (16-73)	43.52 ± 13.20 (16-79)	0.916
Gender	Female	36 (24.2)	35 (24.)	71 (24.1)	0.970
	Male	113 (75.8)	111 (76)	224 (75.9)	
Marital status	Single	30 (20.1)	24 (16.4)	54 (18.3)	0.412
	married	119 (79.9)	122 (83.6)	241 (81.7)	
Education	Illiterate	1 (0.7)	1 (0.68)	2 (0.7)	0.039
	Lower education	48 (32.2)	56 (38.36)	104 (35.3)	
	Diploma	54 (36.2)	62 (42.47)	116 (39.3)	
	Associate's degree	19 (12.8)	6 (4.1)	25 (8.5)	
	Bachelor's degree	17 (11.4)	18 (12.33)	35 (11.9)	
	Master's degree	10 (6.7)	3 (2.06)	13 (4.3)	
Occupation	Fast food	6 (4)	7 (4.8)	13 (4.4)	0.019
	Tea shop	15 (10.1)	17 (11.6)	32 (10.8)	
	Grocery store	65 (43.6)	65 (44.2)	130 (43.9)	
	Butcher's	7 (4.7)	25 (17)	32 (10.8)	
	Chicken store	7 (4.7)	5 (3.4)	12 (4.1)	
	Food workshop	12 (8.15)	7 (4.8)	19 (6.4)	
	Restaurant	8 (5.4)	8 (5.4)	16 (5.4)	
	Vegetable store	3 (2.)	2 (1.4)	5 (1.7)	
	Baker's	26 (17.4)	11 (7.5)	37 (12.5)	

relationship with knowledge, attitude, and performance ($P > 0.05$).

Table 3 compares the knowledge, attitude, and performance scores of the participants in the two groups before and after the training intervention. An intragroup comparison of the knowledge scores before and after the intervention revealed that the knowledge score for the intervention group increased significantly by 9.39 (about 31%) after the training intervention compared to the pre-intervention phase ($P < 0.001$). Similarly, the knowledge score for the control group increased significantly by 6.1 (about 20%) after the intervention compared to the pre-intervention phase ($P < 0.001$). In general, the knowledge score for the intervention group increased by 1.5 times that of the control group. In addition, an intergroup comparison of the knowledge scores before the training intervention indicated that the knowledge scores for the two groups were almost the same and had no significant difference ($P = 0.839$), but the average knowledge score after the training intervention was significantly different between the two groups ($P = 0.001$).

A comparison of the attitude scores for the participants in the two groups before and after the intervention indicated that the attitude scores for the participants in the intervention group increased significantly by 7.94 after the intervention compared to before the intervention ($P < 0.001$). However, the attitude scores did not change significantly in the control group after the intervention compared to before the intervention ($P = 0.610$). An intergroup comparison of the participants' attitude scores before the intervention indicated that the attitude score in the control group was significantly higher than that of the intervention group ($P < 0.001$). However, after the intervention, the attitude score in the intervention group increased and was significantly greater than that of the control group ($P < 0.001$). Accordingly, the attitude score for the participants in the intervention group increased by 16.6% and that of the control group decreased by about 2%.

A comparison of the performance scores for the participants in the two groups before and after the intervention indicated that the performance score increased significantly for the participants in the intervention

Table 2. Comparing the knowledge, attitude, and performance scores based on individual and social variables in the two groups before the intervention

Group		Knowledge		Attitude		Performance	
Variable	**Categories**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age group (y)	<30	33.19	11.66	48.18	10.71	33.25	6.97
	31-40	27.39	11.12	49.96	9.85	33.68	5.41
	41-50	31.29	11.55	49.03	10.45	33.46	5.21
	51-60	26.75	12.00	49.63	10.19	32.63	5.23
	>60	35.88	10.72	54.84	8.08	32.91	4.62
P value		<0.001		0.043		0.845	
Gender	Female	30.18	12.28	48.15	11.54	34.50	5.54
	Male	30.26	11.70	50.40	9.66	32.84	5.52
P value		0.960		0.103		0.028	
Marital status	Single	31.96	12.62	47.96	10.99	33.87	6.81
	married	29.88	11.65	50.22	9.94	33.09	5.25
P value		0.242		0.140		0.353	
Education	Lower education	29.36	12.67	51.60	9.84	33.36	5.42
	Diploma	29.59	11.94	48.22	10.50	34.16	5.63
	Associate's degree	30.84	9.54	48.12	10.66	32.92	5.71
	Bachelor's degree	32.86	9.06	50.97	10.11	33.17	5.59
	Master's degree	35.08	13.41	50.38	7.16	33.23	5.33
P value		0.300		0.18		0.199	
Occupation	Fast food	30.00	12.42	48.96	9.78	33.69	5.42
	Tea shop	28.97	12.37	49.31	10.50	33.28	4.26
	Grocery store	31.95	11.72	50.64	9.75	32.82	5.88
	Butcher's	26.31	12.91	46.91	11.82	35.41	5.70
	Chicken store	32.22	14.61	51.50	8.15	33.67	4.29
	Food workshop	31.00	11.72	50.89	10.62	32.79	5.06
	Restaurant	28.25	9.39	49.44	11.86	30.75	5.11
	Vegetable store	31.00	11.98	51.60	7.06	31.80	2.39
	Baker's	28.54	10.36	49.38	10.29	34.05	6.14
P value		0.406		0.815		0.062	

Table 3. A comparison of the knowledge, attitude, and performance scores in the two groups after the training intervention

Variable Stage	Knowledge			Attitude			Performance		
	Intervention	**Control**	***P* value**	**Intervention**	**Control**	***P* value**	**Intervention**	**Control**	***P* value**
Pre-intervention	30.38±10.69	30.10±12.91	0.839	47.76±11.27	51.92±8.49	<0.001	32.32±4.54	34.19±6.31	0.247
Post-intervention	39.77±7.98	36.21±7.85	<0.001	55.69±8.70	51.00±6.26	<0.001	35.62±6.04	34.74±7.02	0.004
Mean difference	9.39±13.04	6.11±14.82	0.044	7.94±15.33	-0.92±11.01	<0.001	3.31±7.56	0.55±9.61	0.007
P value	<0.001	<0.001	-	<0.001	0.610	-	<0.001	0.488	-

group after the training intervention ($P<0.001$), but this increase was not significant in the control group ($P=488$). Intergroup comparison showed that the performance scores for the two groups before the intervention were the same ($P=0.247$), but there was a significant intergroup difference after the intervention ($P=0.004$). The performance score for the participants in the intervention group was greater than the mean and the median scores in the control group by 3.31 (about 10%), while there was a very small increase (1.5%) in the performance score for the participants in the control group.

An analysis of Pearson's correlation coefficients between the knowledge, attitude, and performance scores showed that the knowledge score before the intervention and the performance score after the training intervention in the intervention group ($r=0.190$; $P=0.020$) and the control group ($r=0.220$; $P=0.007$) had a significant positive correlation. The knowledge score after the intervention had no significant correlation with the performance score after the intervention in the intervention group

($r = 0.016$; $P = 0.728$). The attitude score before and after the intervention had no significant correlation with the performance score ($P < 0.05$). These results indicated that as knowledge and attitude increase, a person will perform better.

The multivariate analysis of covariance (MANCOVA) results in Table 4 indicated that the training intervention was significantly effective in the knowledge scores ($F = 932.5$, $df = 1$, $P = 0.001$) and attitude scores ($F = 1274.7$, $df = 1$, $P < 0.001$) after adjusting the effects of the covariates before the intervention ($F = 35.2$, $df = 1$, $P = 0.357$). In other words, the training intervention had a positive effect on the participants' knowledge and attitudes. By keeping constant the effect of the intervening factors, the mean values of the dependent variable for different values of the independent variable were analyzed.

An analysis of the risk perception items indicated that 12.5% of the participants had contact with a sick person, 34.8% traveled outside Amlash, 29.4% had increased water consumption, and 33.4% had decreased transportation. Concerning the first action taken when suspected of contracting COVID-19, 35.1% of the participants stated that they tried self-treatment and 64.9% reported that they went to the pharmacy to take a medicine.

The majority of participants (84.1%) reported that they received information about COVID-19 from the TV shows and news, 55.7% received COVID-19-related information in person from doctors and other medical staff, and 39.5% of the participants reported they received information from family, friends, and colleagues. However, a few number of the participants reported that they received COVID-19-related information on Instagram (27.7%) and through SMS (20.95).

An examination of COVID-19 symptoms two weeks before the study showed no special symptoms in the previous two weeks, and only 15.9% of the patients had a headache, 8.4% had muscle stiffness, 8.4% had a runny nose, and 4.7% had a mild fever. Other COVID-19 symptoms were very rare among the participants.

Discussion

A comparison of the knowledge, attitude, and performance of food handlers in food preparation and distribution centers showed food handlers' age had a significant relationship with their knowledge and attitude. However, the participants' age was not significantly correlated with their performance. Moreover, food handlers over 60 years of age had a higher level of knowledge and attitude toward COVID-19 and its prevention than food handlers in other age groups. Similarly, Norozi et al (6) compared knowledge, attitude, and performance related to food health and safety and showed that older adults and women had better food safety behavior and performance compared to other people. The present study also found a significant relationship between gender and performance, and the female food handlers had a higher level of performance than male food handlers. Likewise, Mohammadi-Nasrabadi et al (13) showed that women's performance score in food health and safety was higher than men's, probably because they are more involved in preparing food at home and pay more attention to COVID-19. Similarly, a study in Pennsylvania by Haapala and Probart (16) indicated that women had higher performance scores than men. Additionally, as women age, they are more likely to practice food handling and food safety issues. Qanche et al (12) assessed COVID-19 knowledge and preventive behaviors of waiters working in food and drinking establishments in southern Ethiopia and showed that the majority of participants knew the cause of this disease and how the virus spread, and a small number of participants had the wrong idea of transmission of this virus through insect bites. Besides, the participants were less likely to engage in preventive behaviors. In addition, a study by Reuben et al (17) in Nigeria also showed misconceptions about COVID-19 transmission. The cultural differences and severity of the disease at the time of study in different countries can account for consistent and inconsistent findings. Furthermore, different tools have been used to measure people's knowledge, attitude, and performance, and the research population in some studies was the general

Table 4. The MANCOVA results for the effects of the training intervention on the knowledge, attitude, and performance of the participants after the intervention

Source of changes	Dependent variables	Sum of squares	*df*	Variance	F	*P* value	Effect size
Intervention effect	Knowledge	932.487	1	932.487	15.221	0.00	0.050
	Attitude	1274.684	1	1274.684	22.59	0.00	0.072
	Performance	35.224	1	35.224	0.852	0.357	0.003
Knowledge score	Knowledge	20.112	1	20.112	0.328	0.567	0.001
	Attitude	106.963	1	106.963	1.896	0.170	0.006
	Performance	545.530	1	545.530	13.189	0.000	0.043
Attitude score	Knowledge	128.366	1	128.366	2.095	0.149	0.007
	Attitude	325.257	1	325.257	5.764	0.017	0.019
	Performance	5.140	1	5.140	0.124	0.725	0.001
Performance score	Knowledge	399.599	1	399.599	6.523	0.001	0.022
	Attitude	64.056	1	64.056	1.135	0.288	0.004

public.

The data from the present study revealed that the knowledge, attitude, and performance of the food handlers in the intervention group improved after the training intervention. In addition, the food handlers in the control group had a higher level of knowledge after the intervention. In general, the knowledge score for the intervention group increased by 1.5 times that of the control group. The attitude and performance of the food handlers in the control group did not change significantly after the intervention. Olaimat et al (18) investigated the effect of the knowledge, attitude, and performance of workers regarding COVID-19 precautionary measures on food safety at food service establishments in Jordan and found that only 20% of workers had good knowledge, 56% had positive attitudes, and 55% had good performance. Overall, 19 to 34% of participants reported that the precautionary measures they took during the pandemic improved food safety at their workplace. The findings also indicated that more training was necessary for employees and employers to ensure effective compliance with precautionary measures needed to prevent the spread of COVID-19 and foodborne pathogens through the application of good hygiene practices that enhance food safety and reduce diseases (18).

Janavi and Mardnai (19) examined the effect of information and education through social networks on public awareness during the COVID-19 pandemic and demonstrated use of social networks in information and education is very effective in increasing public awareness during the COVID-19 pandemic. Social networks can be an effective platform for information, education, and awareness, and useful instructions and information are published in these networks. Consistent with the present study, the findings also showed education has a positive effect on increasing public awareness. The International Center for Disease Control and the World Health Organization have uploaded several guidelines and instructions about COVID-19 online that are easily accessible to Internet users. Access to such reliable information can help eliminate the epidemic of misinformation, misconceptions, and ignorance of citizens about COVID-19 (17). Reuben et al (17) and Abdelhafiz et al (20) highlighted the effectiveness of education through social media and the Internet in promoting awareness about the COVID-19 pandemic. However, some media platforms often exaggerate the risk associated with the COVID-19 pandemic, and this highlights the role of well-planned education to target groups and vulnerable individuals. Cakir and Savas (21) considered enhancing public awareness and attitudes through education and information about health guidelines as an important factor in preventing COVID-19. Min et al (10) in a study in China in 2020 investigated the effects and consequences of COVID-19 on consumers' food safety knowledge and behavior. The findings showed that improving safety knowledge can significantly increase the safety behavior of consumers.

The present study showed an increase in the knowledge of the participants in the control group possibly due to the influence of external factors including information released through online platforms and media such as television, radio, and satellite. Since COVID-19 has been a global crisis and extensive programs were organized by the governments to improve public awareness, such programs could be effective in promoting the awareness of the participants in the control group. However, the greater increase in the knowledge of the participants in the intervention group highlighted the positive impact of a well-organized and focused training program.

An analysis of Pearson's correlation coefficients between the knowledge, attitude, and performance scores showed that the knowledge score before the intervention and the performance score after the training intervention in the intervention group and the control group had a significant positive correlation. The knowledge score after the intervention had no significant correlation with the performance score after the intervention in the intervention group. The attitude score before and after the intervention had no significant correlation with the performance score. These findings indicated that as awareness and attitude increase, a person will perform better. Consistent with these findings, Boudaghi and Arabi examined the mediating role of COVID-19-related attitudes in health literacy and behavior of citizens in Ahvaz and found that with an increase in knowledge about health behavior, a change in attitude begins. After some time, changing attitude causes a behavior change. That is, health-oriented behavior in the COVID-19 pandemic is a function of knowledge and attitude (4).

The data in the present study suggested that 84.1% of the participants received information about COVID-19 from TV programs. Likewise, Hosseinkhani et al (22) reported that the most important source of public information is the national media. In addition, studies conducted in Egypt (20), China (23), and Pakistan (24) investigated the knowledge and attitude of the people about COVID-19 and reported that television was one of the most important sources of information for citizens.

One of the strengths of the present study was the novelty of the subject in question and the large sample size. This study was conducted in Amlash, Iran. Thus, given that people's knowledge, attitude, and performance vary in different cultural contexts and facilities and mass media used by the public differ in various geographic areas, the findings of this study may have limited generalizability to other communities. One of the limitations of the present study was the unwillingness of some food handlers to complete the items on the checklist. Thus, the researcher tried to encourage them to cooperate in

the study by highlighting the significance of the study and the confidentiality of their responses. Future studies can adopt mixed (quantitative and qualitative) research methods and address different age groups to come up with more reliable findings. The COVID-19 pandemic is not over and it will not be the last pandemic to affect the food industry. Future quantitative studies are necessary to investigate the impact of food safety in pandemics and to examine food companies and their food safety practices to minimize the long-term negative consequences of COVID-19 and future pandemics.

Conclusion

The COVID-19 pandemic has had a wide impact on people's health, economy, and livelihood, and has caused sudden changes in the living conditions of people in the community, especially through quarantine and social distancing protocols. The present study confirmed the positive effect of education on promoting the knowledge, attitude, and performance of food handlers in food preparation and distribution centers. Thus, effective training programs should be developed for at-risk groups to promote public awareness and health.

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Competing Interests

None of the authors of this study, individuals, or institutions had any conflict of interest for the publication of this article.

Ethical Approval

The participants received some information about the objectives and procedures of the study. They also signed a written informed consent form, and were assured that their information would be kept confidential and that the results of the study would be provided to them if they wished. Besides, they were informed that they could withdraw from the study whenever they wished. The protocol for this study was confirmed with the code of ethics 1400.094IR.SBMU.SME.REC.

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