EVALUATION OF A HEALTH EDUCATION PROGRAM TO ENHANCE KNOWLEDGE AND PRACTICES RELATED TO FOOD SAFETY AMONG CONSUMERS IN SOME SELECTED GOVERNORATES OF EGYPT IN 2016

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ABSTRACT

Ensuring safe food requires cooperation across multiple sectors, including food business operators, governmental bodies, and consumers. Approximately 25% of reported foodborne outbreaks result from improper food handling within households. Understanding consumer food safety knowledge and behavior is critical for identifying gaps and designing effective educational interventions to prevent foodborne illnesses. This study aimed to evaluate the effect of a health education program designed to improve consumers' food safety knowledge and practices. A one-group pre-test/post-test interventional study design was employed. A total of 438 participants from Cairo, Menia, and Gharbia governorates were selected through convenience sampling. Statistical analysis included independent variables such as age, gender, and education. Data were collected using a structured interview questionnaire, developed based on a comprehensive review of relevant literature and questionnaires used in previous studies. More than half of participants (57.7%) were aged 40 years or younger, most were female (84.9%). Nearly one-third (37.4%) were illiterate, and half (50%) were housewives. Before the intervention, about one-third of participants did not follow proper handwashing procedures before preparing food, or after contact with a sick person. The training program resulted in statistically significant improvements in participants' food safety knowledge, particularly in four key areas: personal hygiene, cross-contamination, time/temperature control, and food purchasing. Properly designed food safety education programs can effectively enhance consumer Food safety knowledge and practices. Public awareness campaigns on food safety principles should be initiated through both non-governmental organizations and governmental bodies responsible for food safety management as well as other communication media (television and social media).

Keywords: Consumer, Educational Program, Safe Food Handling, Knowledge, Practices.

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INTRODUCTION

According to the World Health Organization (WHO), unsafe food causes 600 million cases of foodborne diseases and 420,000 deaths worldwide in 2010. Almost 30% of foodborne deaths occur among children under 5 years of age. In addition, the years of life lost (YLLs) and the years lived with disability due to foodborne disease are estimated at around 27 million and 6 million years, respectively, and these numbers are likely underestimations (WHO, 2015).

Providing safe food requires cooperation between different sectors involved in the management of food safety including food business operators, the government, and consumers (Motarjemi & Lelieveld, 2014). The food business operators (FBOs) hold the primary responsibility of securing food safety and making sure that food products that will be put on the market will not cause a negative effect on consumers (Motarjemi & Lelieveld, 2014; Smigic, *et al*., 2016). The government monitors the compliance of FBOs with this obligation.

The role of consumers is equally important to that of the FBOs and government (Motarjemi & Lelieveld, 2014). The importance of good practices when preparing food at home regarding foodborne diseases is supported by epidemiological data. Several Studies have demonstrated that the main factors affecting the occurrence of epidemics of foodborne illnesses are, generally, inadequate cooking, reheating, or storage in addition to cross-contamination. Also, 25% of reported outbreaks of foodborne disease are caused by inadequate food handling by consumers, as well as bad practices during food preparation in households (McCabe-Sellers & Beattie, 2004).

Accordingly, research in consumer education/knowledge of the risks caused by unsafe food handling practices is an essential element for preventing foodborne disease (Konecka-Matyjek, *et al*., 2005; Janjic, *et al*., 2015). Furthermore, such research is required to determine gaps in consumer knowledge about food safety, to reveal the hygiene mistakes that occur most frequently in domestic kitchens, and to design effective educational programs tailored to fill such gaps.

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Most of the studies that are available in Egypt focused on improving the knowledge and practices of food handlers at restaurants (Latif, *et al*., 2013; Elsherbiny, *et al*., 2020; Ahmed & Amin, 2021; and Hassan, *et al*., 2022) and there is a shortage of studies assessing knowledge and practices of consumers in general. In addition, at the official level there was a need to assess educational materials to raise food safety awareness among consumers and improve their knowledge and practices and hence this study was proposed.

The ultimate objective of this study was to improve quality of life of Egyptian food consumers while the specific objective was to identify the consumer knowledge, attitude and practices regarding food safety before and after applying a health education program.

MATERIALS AND METHODS

Research Design: An interventional study with a one-group pre-test/post-test design was employed to assess the impact of a food safety training program.

Sample Size and Population: A convenience sample was recruited with the assistance of Non-Governmental Organizations (NGOs) in selected governorates, representing different geographic regions. The sample size was determined based on demographic reports from the Central Agency for Public Mobilization and Statistics (CAPMAS).

The participants were gathered from selected governorates: Cairo (the capital region) with 199 participants, Gharbia (Lower Egypt) with 122 participants, and Menia (Upper Egypt) with 117 participants, and the total number of participants was 438.

Time Period: The study was conducted between September 2016 and May 2017.

Data Collection Tools: A structured interview questionnaire was developed after reviewing relevant literature and previous studies (Boulos & Abouelezz, 2020; Ali *et al*., 2021; Ayad *et al*., 2022; Rabeya *et al*., 2022; Ali *et al*., 2023). The questionnaire was divided into two parts:

Sociodemographic Characteristics: Gathered basic demographic information about the participants were identified for each personnel. Food Safety Practices (Pre- and Post-Test): This section included 35 questions covering four key food safety domains, adapted from WHO's Five Keys to Safer Food and modified by the researchers. The domains

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were: Personal Hygiene (12 questions), Cross-Contamination (11 questions), Time/Temperature Control (8 questions) and Food Purchasing Practices (4 questions). Respondents' scores were calculated by summing the correct answers, with 1 point awarded for each correct response.

***Interventional Training*:** The health education sessions included a theoretical component lasting two hours, divided into 15–20-minute segments covering the four main food safety domains addressed in the questionnaire. Additionally, short videos demonstrating recommended food safety practices were presented to reinforce theoretical training.

Statistical analysis:

Data of awareness of participants for personal hygiene, cross contamination, purchase handling, time temperature control and score of total knowledge before and after training were analyzed applying General Linear Model (GLM) using Statistical Analysis System package version 9.4 (SAS Institute, Cary, N.C.). Independent factors included in the model used for the analysis were being trained (yes or no), Governorates (Cairo, Gharbia and Menia), type of province (urban vs rural), age (4 levels), gender (male & female) and level of education (5 levels) and their interactions. The statistical model used is expressed as:

$$Y_{ijklmn}= \mu + T_i+ G_j+ S_k+ R_l+ A_m+ E_{n+}(T*G)_{ij}+ (T*S)_{ik}+ (T*R)_{il}+ (T*A)_{im}+ (T*E)_{in} + (G*S)_{jk}+ (G*R)_{jl}+ (G*A)_{jm}+ (G*E)_{jn}+ (S*R)_{kl}+ (S*A)_{km}+ (S*E)_{kn}+ (R*A)_{lm} + (R*E)_{ln}+ (A*E)_{mn}+ e_{ijkml},$$

were,

Y_{ijklm} is the response of the i^{th} participants of the T training, i=1,2, j^{th} Governorate, j=1 to 3, k^{th} Gender, j=1,2 and m^{th} age of the participants, m=1 to 4, n^{th} education n=1 to 5,

μ is the overall mean, Ti is the effect of the treatment (training) on the knowledge score,

G_j represents the effect of the governorate,

S_k represents the effect of gender,

R_l represents the effect of age, Am represents the effect of education level,

En represents the effect of urban vs. rural areas,

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(T*G), (T*S), (T*R), (T*A), (T*E), (G*S), (G*R), (G*A), (G*E), (S*R), (S*A), (S*E), (R*A), (R*E), (A*E), (G*R), (G*A), (G*E), (R*A), (R*E) and (A*E) are the interactions among the main effects,

e_{ijkml} is the random error term, assumed to follow a normal distribution with mean 0 and variance $\sigma^2 e$).

Post-hoc Tests: If significant differences are found, pairwise comparisons were made using Tukey's Honest Significant Difference (HSD). Level of significance used of p value was set at ≤ 0.05 (Mohammed, *et al*., 2023).

RESULTS

Table 1 presents key demographic data of the study participants. The mean age was 39.2 ± 14.0 years, with a median of 38.0 years (range: 15–85 years). Nearly half of the participants (231, 52.7%) fell within the 21–40-year age group, while only 7.8% were 61 years or older. The sample was predominantly females (84.9%), with males comprising only 15.1% of participants.

Geographically, most participants resided in Cairo 45.4%, followed by Gharbia 27.9% and Menia 26.7%. This distribution may reflect variations in population density across governorates. Additionally, 61.2% of participants lived in urban areas, compared to 38.8% in rural areas, which could highlight either the study's focus on urban regions or broader population trends in Egypt.

In terms of education, a substantial portion of the participants had limited schooling, with 37.4% being illiterate or possessing only basic literacy skills. Only 9.6% (42 participants) completed primary or preparatory education, while 28.1% (123 participants) had secondary education. Furthermore, 16.4% (72 participants) had attained university education, and just 8.5% had pursued postgraduate studies.

Occupationally, half of the participants identified as housewives (50%), with other professions including students (6.4%), professionals (7.1%), and food handlers (5%). This employment profile underscores the significant role of domestic duties, especially among

women, in the studied group. The mean family size was 4.7 members, with a median of 5, consistent with typical Egyptian family structures.

Regarding food preparation responsibilities, 96.4% of participants reported that housewives managed this task in their households. A small percentage (3.6%) had a maid handling food preparation, with 2.7% sharing the responsibility with the housewife and 0.9% solely relying on the maid for this role.

Table 1. Sociodemographic and Living Characteristics of Study Participants, Selected Governorates, Egypt, 2016.

ITEM	NO. (%)	ITEM	NO. (%)
Age (years)		**Education**	
Mean (SD)	39.2 (14.0)	Illiterate, Read and write	164 (37.4%)
Median (range)	38 (15-85)	Primary, Preparatory	42 (9.6%)
Number of observations	438	Secondary	123 (28.1%)
		University	72 (16.4%)
Age groups (years)		Postgraduate	37 (8.5%)
≤ 20	22 (5.0%)	**Total**	438 (100.0%)
21 - ≤ 40	231 (52.7%)		
41- ≤ 60	151 (34.5%)	**Occupation**	
≥ 61	34 (7.8%)	Housewife	219 (50.0%)
Total	438 (100.0%)	Student	28 (6.4%)
Gender		Skilled (carpenter, etc.)	4 (0.9)
Male	66 (15.1%)	Professional (physician, etc.)	31 (7.1%)
Female	372 (84.9%)	Food handler	22 (5.0%)
Total	438 (100.0%)	Other	88 (20.2%)
		Retired/ jobless	46 (10.4%)
Governorate of Residence		**Total**	438 (100.0)
Cairo	199 (45.4%)		
Gharbia	122 (27.9%)	**Family size**	
Menia	117 (26.7%)	Mean (SD)	4.7 (2.1)
Total	438 (100.0%)	Median (range)	5 (1-17)
		Number of observations	438
Type of Residence		**Responsible Person for Food Preparation**	
Urban	268 (61.2%)	Housewife	422 (96.4%)
Rural	170 (38.8%)	Maid	4 (0.9%)
Total	438 (100.0%)	Both	12 (2.7%)
		Total	438 (100.0%)

No. = Number of observations % = Percent SD = Standard deviation

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Post-Hoc Comparison of the Effect of Major Sociodemographic Attributes on Participant Knowledge before and after the Food Safety Training Session.

The effect of major sociodemographic attributes on participants' knowledge before and after the food safety training session was analyzed using a post-hoc Tukey Honest Significant Difference (HSD) test. This analysis focused on variables with more than two categories that showed statistically significant differences both before and after training, in relation to different food safety practices.

A. Personal Hygiene

Table 2 presents the effect of different sociodemographic attributes on personal hygiene practices. Among the governorates, participants from Cairo exhibited the most significant improvement, with their mean score increasing from 7.97 ± 0.167 to 10.86 ± 0.067 after the intervention. Gharbia and Menia also showed marked improvements, with post-intervention means of 10.33 ± 0.149 and 10.18 ± 0.168, respectively. According to the post-hoc Tukey HSD test, there was a statistically significant difference in the mean scores of participants from Cairo compared to those from Gharbia and Menia before the training.

Participants from urban areas had higher mean scores for personal hygiene (10.88 ± 0.058) compared to those from rural areas (9.98 ± 0.145), indicating better hygiene practices in more urbanized regions.

Regarding gender, there was no statistically significant difference between males and females. However, the slight variation in mean scores (Females: 10.53 ± 0.076, Males: 10.52 ± 0.174) suggests that females may generally practice better hygiene. Significant differences were noted across different age groups, although no statistical differences were observed between specific age groups.

Education level was a strong predictor of personal hygiene practices. Participants with postgraduate education showed the highest improvement, with a mean score of 11.41 ± 0.142, indicating that higher education correlates with better hygiene awareness and implementation compared to participants with lower educational backgrounds.

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Table 2. Post-Hoc Comparison of the Effect of Major Sociodemographic Attributes on the Participant Knowledge on Personal Hygiene Practices Before and After the Food Safety Training Session

ITEM	SUB-ITEM	N	BEFORE		AFTER		P VALUE
			Mean	± (SE)	Mean	± (SE)	
Governorate	Cairo	199	7.97 ^{C}	0.167	10.86 ^{A}	0.067	< 0.001
	Gharbia	122	7.20 ^{D}	0.251	10.33 ^{AB}	0.149	< 0.001
	Menia	117	6.94 ^{D}	0.260	10.18 ^{B}	0.168	< 0.001
	HSD Tukey	4.05045					
Area	Urban	268	7.88 ^{C}	0.146	10.88 ^{A}	0.058	< 0.001
	Rural	170	6.87 ^{D}	0.220	9.98 ^{B}	0.145	< 0.001
	HSD Tukey	3.64908					
Gender	Male	66	6.74 ^{C}	0.408	10.52 ^{A}	0.174	< 0.001
	Female	372	7.62 ^{B}	0.128	10.53 ^{A}	0.076	< 0.001
	HSD Tukey	3.64908					
Age Group	≤ 20	22	8.18 ^{B}	0.557	10.09 ^{A}	0.441	< 0.001
	21 - ≤ 40	231	7.47 ^{BC}	0.163	10.39 ^{A}	0.106	< 0.001
	41- ≤ 60	151	7.64 ^{B}	0.217	10.82 ^{A}	0.086	< 0.001
	≥ 61	22	6.47 ^{C}	0.573	10.53 ^{A}	0.232	< 0.001
	HSD Tukey	4.31001					
Educational level	Illiterate	166	7.33 ^{D}	0.202	10.61 ^{AB}	0.117	< 0.001
	Primary/ preparatory	42	7.48 ^{D}	0.446	9.67 ^{B}	0.349	< 0.001
	Intermediate education	121	7.20 ^{D}	0.247	10.50 ^{AB}	0.108	< 0.001
	University	72	7.79 ^{CD}	0.331	10.46 ^{AB}	0.133	< 0.001
	Postgraduate studies	37	8.54 ^{C}	0.218	11.41 ^{A}	0.142	< 0.001
	HSD Tukey	4.50053					

- n = number of paired responses SE = Standard Error
- P value reflects comparison between before and after training mean scores

B. Time and Temperature Control

Table 3 shows a significant improvement in time and temperature control practices across all governorates. Participants from Cairo showed the most notable improvement, with their mean score rising from 2.88 ± 0.112 to 6.73 ± 0.056. Gharbia and Menia also demonstrated improvements, though no statistically significant differences were observed between the governorates.

In terms of area types, participants from urban areas exhibited significantly greater improvement (6.68 ± 0.051) compared to those from rural areas (6.35 ± 0.090).

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When considering gender, both males and females showed similar levels of improvement, with males achieving a slightly higher mean score (6.64 ± 0.168) than females (6.54 ± 0.047). This suggests that the interventions were equally effective for both genders.

While significant differences were observed across different age groups and educational levels, no statistical differences were found between specific age groups or educational levels.

Table 3. Post-Hoc Comparison of the Effect of Major Sociodemographic Attributes on the Participant Knowledge on Time and Temperature Control Practices Before and After the Food Safety Training Session

ITEM	SUB-ITEM	N	BEFORE		AFTER		P VALUE
			Mean	± (SE)	Mean	± (SE)	
Governorate	Cairo	199	2.88 ^{B}	0.112	6.73 ^{A}	0.056	< 0.001
	Gharbia	122	2.89 ^{B}	0.146	6.36 ^{A}	0.095	< 0.001
	Menia	117	2.98 ^{B}	0.154	6.44 ^{A}	0.109	< 0.001
	HSD Tukey	4.05045					
Area	Urban	268	2.71 ^{D}	0.096	6.68 ^{A}	0.051	< 0.001
	Rural	170	3.23 ^{C}	0.124	6.35 ^{B}	0.090	< 0.001
	HSD Tukey	3.64908					
Gender	Male	66	2.61 ^{B}	0.174	6.64 ^{A}	0.168	< 0.001
	Female	372	2.96 ^{B}	0.085	6.54 ^{A}	0.047	< 0.001
	HSD Tukey	3.64908					
Age Group	≤ 20	22	3.09 ^{B}	0.441	6.55 ^{A}	0.252	< 0.001
	21 - ≤ 40	231	3.06 ^{B}	0.102	6.58 ^{A}	0.060	< 0.001
	41- ≤ 60	151	2.74 ^{B}	0.133	6.64 ^{A}	0.077	< 0.001
	≥ 61	22	2.47 ^{B}	0.243	6.03 ^{A}	0.233	< 0.001
	HSD Tukey	4.31001					
Educational level	Illiterate	166	2.89 ^{B}	0.121	6.51 ^{A}	0.064	< 0.001
	Primary/ preparatory	42	2.90 ^{B}	0.255	6.29 ^{A}	0.153	< 0.001
	Intermediate education	121	3.21 ^{B}	0.160	6.42 ^{A}	0.105	< 0.001
	University	72	2.61 ^{B}	0.184	6.88 ^{A}	0.110	< 0.001
	Postgraduate studies	37	2.59 ^{B}	0.203	6.84 ^{A}	0.157	< 0.001
	HSD Tukey	4.50053					

- n= number of paired responses SE = Standard Error
- P value reflects comparison between before and after training mean scores

C. Cross Contamination

Table 4 shows significant improvements in cross-contamination practices across all regions and demographic groups. The most notable gains were in Menia, where the mean scores rose from 4.45 ± 0.194 to 7.65 ± 0.199, followed closely by improvements in Cairo and Gharbia. Urban populations outperformed rural populations, with urban mean scores

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increasing from 4.70 ± 0.105 to 7.39 ± 0.102, reflecting a substantial post-intervention rise in awareness and proper handling techniques to prevent cross-contamination.

A significant difference in performance between males and females was found, particularly after the training session. While all age groups showed improvements, the least significant changes occurred in participants younger than 20 years.

In terms of education, participants with postgraduate degrees showed the greatest improvement (8.73 ± 0.267), followed by those with university education (7.47 ± 0.225). In contrast, participants with lower education levels, especially those who were illiterate, exhibited less improvement (7.25 ± 0.127). This highlights the crucial role that education plays in effective cross-contamination management.

Table 4. Post-Hoc Comparison of the Effect of Major Sociodemographic Attributes on the Participant Knowledge on Cross Contamination Practices Before and After the Food Safety Training Session

ITEM	SUB-ITEM	N	BEFORE		AFTER		P VALUE
			Mean	± (SE)	Mean	± (SE)	
Governorate	Cairo	199	4.80 ^{B}	0.128	7.32 ^{A}	0.112	< 0.001
	Gharbia	122	4.34 ^{B}	0.178	7.16 ^{A}	0.164	< 0.001
	Menia	117	4.45 ^{B}	0.194	7.65 ^{A}	0.199	< 0.001
	HSD Tukey	4.05045					
Area	Urban	268	4.70 ^{B}	0.105	7.39 ^{A}	0.102	< 0.001
	Rural	170	4.39 ^{B}	0.171	7.31 ^{A}	0.156	< 0.001
	HSD Tukey	3.64908					
Gender	Male	66	4.12 ^{C}	0.354	7.97 ^{A}	0.259	< 0.001
	Female	372	4.66 ^{C}	0.089	7.25 ^{B}	0.090	< 0.001
	HSD Tukey	3.64908					
Age Group	≤ 20	22	5.91 ^{B}	0.465	7.59 ^{A}	0.482	0.022
	21 - ≤ 40	231	4.55 ^{C}	0.110	7.24 ^{A}	0.116	< 0.001
	41- ≤ 60	151	4.62 ^{C}	0.162	7.59 ^{A}	0.154	< 0.001
	≥ 61	22	3.74 ^{C}	0.463	7.00 ^{A}	0.257	< 0.001
	HSD Tukey	4.31001					
Educational level	Illiterate	166	4.34 ^{E}	0.128	7.25 ^{B}	0.127	< 0.001
	Primary/ preparatory	42	4.48 ^{E}	0.307	6.10 ^{C}	0.195	< 0.001
	Intermediate education	121	4.45 ^{E}	0.189	7.47 ^{B}	0.175	< 0.001
	University	72	4.93 ^{DE}	0.250	7.47 ^{B}	0.225	< 0.001
	Postgraduate studies	37	5.49 ^{CD}	0.337	8.73 ^{A}	0.267	< 0.001
	HSD Tukey	4.50053					

- n= number of paired responses SE = Standard Error.
- P value reflects comparison between before and after training mean scores

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D. Purchasing Practices

Table (5) shows a smaller improvement in purchasing practices. In Cairo, for instance, the mean increased from 3.38 ± 0.068 to 3.87 ± 0.036, with similar trends in Gharbia and Menia. Unlike personal hygiene, the differences between urban and rural populations are not significant, as both show similar "After" means (Urban: 3.87 ± 0.029, Rural: 3.87 ± 0.039). This indicates that purchasing habits may be less influenced by geographical location but still respond positively to interventions.

Gender differences in purchasing practices show that males (3.94 ± 0.030) tend to perform slightly better than females (3.86 ± 0.027) after interventions, which could be due to a traditional division of household responsibilities or access to resources.

There was a slight improvement in different age groups except age groups less than 20 years after training but there is a clear difference between age groups 21 - ≤ 40, 41- ≤ 60, respectively.

Table 5. Post-Hoc Comparison of the Effect of Major Sociodemographic Attributes on the Participant Knowledge on Purchasing Practices Before and After the Food Safety Training Session

ITEM	SUB-ITEM	N	BEFORE		AFTER		
			Mean	± (SE)	Mean	± (SE)	
Governorate	Cairo	199	3.38 ^{C}	0.068	3.87 ^{A}	0.036	< 0.001
	Gharbia	122	3.32 ^{D}	0.093	3.85 ^{AB}	0.046	< 0.001
	Menia	117	3.38 ^{D}	0.091	3.89 ^{B}	0.042	< 0.001
	HSD Tukey	4.05045					
Area	Urban	268	3.37 ^{B}	0.058	3.87 ^{A}	0.029	< 0.001
	Rural	170	3.35 ^{B}	0.080	3.87 ^{A}	0.039	< 0.001
	HSD Tukey	3.64908					
Gender	Male	66	3.55 ^{B}	0.147	3.94 ^{A}	0.030	0.012
	Female	372	3.33 ^{B}	0.049	3.86 ^{A}	0.027	< 0.001
	HSD Tukey	3.64908					
Age Group	≤ 20	22	4.00 ^{A}	0.000	3.91 ^{AB}	0.063	0.162
	21 - ≤ 40	231	3.28 ^{C}	0.068	3.86 ^{AB}	0.033	< 0.001
	41- ≤ 60	151	3.36 ^{C}	0.079	3.92 ^{AB}	0.022	< 0.001
	≥ 61	22	3.50 ^{BC}	0.159	3.71 ^{ABC}	0.166	0.147
	HSD Tukey	4.31001					
Educational level	Illiterate	166	3.27 ^{C}	0.079	3.92 ^{A}	0.028	< 0.001
	Primary/ preparatory	42	3.43 ^{C}	0.164	3.90 ^{A}	0.046	0.011
	Intermediate education	121	3.42 ^{C}	0.090	3.81 ^{AB}	0.068	< 0.001
	University	72	3.36 ^{C}	0.112	3.86 ^{AB}	0.041	< 0.001
	Postgraduate studies	37	3.51 ^{BC}	0.126	3.86 ^{AB}	0.057	0.010
	HSD Tukey	4.50053					

- n = number of paired responses SE = Standard Error - P value reflects comparison between before and after training mean scores

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E. All Practices

Table 6 shows that across all measured practices, participants from Cairo showed the highest post-intervention means (28.79 ± 0.170), followed closely by those from Gharbia and Menia. Urban residents consistently outperformed their rural counterparts in overall practices, with mean scores of 28.83 ± 0.159 in urban areas compared to 27.51 ± 0.285 in rural areas.

While both males and females showed significant improvements post-intervention, there was no statistically significant difference between their scores.

In terms of age, participants in the 41-60 age group had the highest post-intervention scores (28.97 ± 0.250), whereas the youngest (<20 years) and oldest (≥ 61 years) groups showed slightly lower scores. Education remained a key factor, with individuals holding postgraduate degrees showing the greatest post-intervention improvement (30.84 ± 0.464).

Table 6. Post-Hoc Comparison of the Effect of Major Sociodemographic Attributes on the Participant Knowledge on All practices Before and After the Food Safety Training Session

ITEM	SUB-ITEM	N	BEFORE		AFTER		P VALUE
			Mean	± (SE)	Mean	± (SE)	
Governorate	Cairo	199	19.04 ^{C}	0.271	28.79 ^{A}	0.170	< 0.001
	Gharbia	122	17.75 ^{D}	0.389	27.70 ^{B}	0.288	< 0.001
	Menia	117	17.76 ^{D}	0.411	28.16 ^{AB}	0.371	< 0.001
	HSD Tukey	4.05045					
Area	Urban	268	18.65 ^{C}	0.235	28.83 ^{A}	0.159	< 0.001
	Rural	170	17.85 ^{D}	0.353	27.51 ^{B}	0.285	< 0.001
	HSD Tukey	3.64908					
Gender	Male	66	17.02 ^{C}	0.726	29.06 ^{A}	0.504	< 0.001
	Female	372	18.57 ^{B}	0.194	28.19 ^{A}	0.152	< 0.001
	HSD Tukey	3.64908					
Age Group	≤ 20	22	21.18 ^{B}	0.755	28.14 ^{A}	1.127	< 0.001
	21 - ≤ 40	231	18.37 ^{C}	0.262	28.06 ^{A}	0.187	< 0.001
	41- ≤ 60	151	18.36 ^{C}	0.326	28.97 ^{A}	0.250	< 0.001
	≥ 61	22	16.18 ^{D}	0.922	27.26 ^{A}	0.567	< 0.001
	HSD Tukey	4.31001					
Educational level	Illiterate	166	17.83 ^{E}	0.274	28.28 ^{B}	0.186	< 0.001
	Primary/ preparatory	42	18.29 ^{E}	0.687	25.95 ^{C}	0.519	< 0.001
	Intermediate education	121	18.28 ^{E}	0.400	28.21 ^{B}	0.315	< 0.001
	University	72	18.69 ^{DE}	0.596	28.67 ^{B}	0.373	< 0.001
	Postgraduate studies	37	20.14 ^{D}	0.562	30.84 ^{A}	0.464	< 0.001
	HSD Tukey	4.50053					

- n = number of paired responses SE = Standard Error
- P value reflects comparison between before and after training mean scores

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Effect of Major Sociodemographic Attributes on Participant Knowledge After Training Intervention

Table 7 presents a comprehensive overview of the differences in mean scores for food safety knowledge across various domains among study participants before training. It also provides a multifactorial ANOVA analysis, examining the effects of Governorate, Area, Gender, Age Group, Education Level, and Time on five dependent variables: Personal Hygiene, Time/Temperature Control, Cross-Contamination, Purchasing, and the overall sum of practices. These factors were analyzed to determine both individual and interactive contributions to variations within these categories.

Significant differences were observed across age groups in personal hygiene, time-temperature control, and cross-contamination practices. Age group also had a substantial impact on the overall score ($p < 0.001$), indicating marked variations in food safety practices across different age groups. Education level emerged as a highly significant factor in most attributes, particularly in cross-contamination ($p < 0.0001$) and the overall score ($p < 0.001$), with more educated individuals displaying better practices, likely due to heightened awareness.

The table also displays changes in these scores after the training session. Overall, there was a statistically significant improvement in participants' knowledge across all four evaluated food safety domains ($p < 0.001$), as well as in the collective mean score for all questions ($p < 0.001$).

Each independent variable was analyzed in depth, considering its significance levels (Pr> F) and mean squares (MS), offering a comprehensive understanding of the factors influencing improvements in food safety knowledge. For example, an interaction between area of residence and gender revealed notable gender differences in certain food safety knowledge domains, such as time/temperature control practices. These varied significantly by area; in urban areas, mean scores for time/temperature control among males and females were 2.53 and 2.73, respectively, compared to 2.68 and 3.37 in rural areas. This suggests that urban and rural environments may affect food safety knowledge differently for men and women.

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Further interactions were observed between the type of residence and age group regarding food safety knowledge. For example, mean scores for knowledge on time/temperature control practices among urban residents across age groups ≤ 20, 21–40, 41–60, and ≥ 61 years were 4.25, 2.68, 2.60, and 2.82, respectively. In rural areas, the corresponding scores were 2.43, 3.58, 3.09, and 1.83. In terms of cross-contamination practices, mean scores in urban areas across the same age groups were 4.75, 4.66, 4.79, and 4.45, compared to 6.57, 4.41, 4.20, and 2.42 in rural areas (MS = 8.848, Pr > F = 0.0224). These findings highlight significant interactions, indicating that age influences food safety practices differently depending on the area. The overall mean scores for these age groups in urban areas were 22.00, 18.42, 18.81, and 17.95, respectively, compared to 20.71, 18.30, 17.25, and 12.92 in rural areas, demonstrating a significant difference for the combination of area and age group on overall food safety knowledge (MS = 40.113, Pr > F = 0.0036).

Another interaction between gender and age group was found in purchasing practices, which were influenced by both gender and age. Mean scores for purchasing practices among men across the age groups ≤ 20, 21–40, 41–60, and ≥ 61 were 4.00, 3.59, 3.11, and 4.00, respectively, while women scored 4.00, 3.23, 3.39, and 3.29, respectively. These differences suggest that men and women of different ages prioritize food safety practices differently.

Education level also had a differential impact on men's and women's responses to food safety knowledge questions, particularly in preventing cross-contamination (MS = 12.665, Pr > F = 0.0034) and in food purchasing practices (MS = 3.735, Pr > F < .0001). The effect on the overall score was similarly significant (MS = 35.019, Pr > F = 0.0079), confirming that the combination of gender and education level significantly influences overall food safety practices.

Additionally, the impact of education on food safety knowledge varied by age group. Statistically significant effects were noted in personal hygiene practices (MS = 18.616, Pr > F < .001), prevention of cross-contamination (MS = 8.622, Pr > F = 0.0011), and the overall knowledge score (MS = 33.720, Pr > F = 0.0001), highlighting the strong influence of the combined effects of age and education on food safety practices.

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Table 7. Effect of Major Sociodemographic Attributes (Governorate, Area, Gender, Age Group, Educational Level) and Their Interactions on Participants' Knowledge and Practices Before and After the Food Safety Training Session.

MS refers to the mean squares obtained from the comprehensive analysis of variance for each attribute.

SOCIODEMOGRAPHIC ATTRIBUTES	PERSONAL HYGIENE		TIME TEMPERATURE CONTROL		CROSS CONTAMINATION		PURCHASING PRACTICES		TOTAL	
	MS	Pr > F	MS	Pr > F	MS	Pr > F	MS	Pr > F	MS	Pr > F
Governorate	0.311	0.9063	0.284	0.8314	0.360	0.8767	0.257	0.5672	0.663	0.9269
Area	54.174	<.001	2.178	0.2347	21.711	0.0051	0.026	0.8123	186.472	<.001
Gender	19.691	0.013	0.191	0.7248	34.111	0.0005	1.437	0.0756	90.552	0.0014
Age Group	16.006	0.0019	11.151	<0001	11.502	0.0061	0.862	0.1283	100.707	<.001
Education Level	18.692	0.0001	2.238	0.215	35.023	<.0001	3.055	<.0001	108.729	<.001
Governorate* Area	0.224	0.7901	0.309	0.654	1.270	0.4962	0.103	0.6338	2.342	0.6049
Governorate*Gender	0.091	0.9718	2.837	0.1594	0.586	0.8075	0.895	0.1399	3.103	0.7012
Governorate*Age Group	1.451	0.8386	0.491	0.9268	4.743	0.1122	0.264	0.7435	11.703	0.2381
Governorate*Education Level	1.600	0.8519	2.188	0.1849	0.948	0.9473	0.195	0.9025	4.759	0.8223
Area*Gender	7.927	0.1142	8.079	0.0224	3.732	0.2437	0.163	0.5489	63.894	0.0071
Area*Age Group	7.053	0.0843	4.197	0.0437	8.848	0.0224	0.203	0.7193	40.113	0.0036
Area*Education Level	5.061	0.1736	2.455	0.1743	6.200	0.0617	0.753	0.1576	13.838	0.1776
Gender*Age Group	7.173	0.0802	1.032	0.57	4.388	0.1882	6.026	<.0001	15.242	0.1572
Gender*Education Level	2.582	0.4854	0.354	0.8755	12.665	0.0034	3.735	<.0001	35.019	0.0079
Age Group*Education Level	18.616	<.001	2.644	0.0827	8.622	0.0011	2.021	<.0001	33.720	0.0001
Time	273.503	<.001	307.577	<.000	468.732	<.0001	5.389	0.0006	3369.499	<.001
Governorate* Time	0.0081	0.9974	2.116	0.2537	10.376	0.0234	0.012	0.9737	22.458	0.0777
Area*Time	0.243	0.7816	13.705	0.003	18.707	0.0093	0.015	0.8545	58.633	0.0099
Gender*Time	47.423	0.0001	0.153	0.7526	60.689	<.0001	2.003	0.0361	271.697	<.001
Age Group*Time	1.896	0.6157	1.666	0.3559	10.419	0.0104	1.955	0.0052	19.400	0.0852
Education Level*Time	9.940	0.0146	8.916	0.0002	7.752	0.0245	1.957	0.002	29.211	0.0104

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DISCUSSION

The current study analyzed data collected from 438 participants, with a mean age of 39.2 ± 14.0 years. Most participants (382, 87.2%) were in the 20–40 age group, while only 7.8% were over 60 years old.

Several studies have reported younger participant ages, especially in those involving women living in rural areas. In Lower Egypt, Mohamed *et al*. (2021) assessed food safety knowledge, practices, and attitudes among 373 rural women in Abo Sower Elbald village, Ismailia governorate, where the mean age was 34.35 ± 10.5 years. Mahmoud & Ibrahim (2021) found an even lower mean age of 26.02 ± 3.88 years in their study of mothers with children under six years old living near Zagazig City. These differences in mean ages across studies could be attributed to the inclusion of rural women, while the current study had a majority of urban residents (61.2%).

The current study had a predominance of female participants (372, 84.9%), similar to findings by Hassan *et al*. (2018), who reported that females constituted 84.6% of participants in a study of food safety knowledge and practices among Lebanese food handlers. Tomaszewska et al. (2018) found lower female participation in their study, with females comprising 60% of Polish and 56% of Thai consumers. In contrast, Ali *et al*. (2021) reported that 100% of their study participants were female. These differences can be attributed to variations in the study settings.

Regarding education, almost one-third of participants (164, 37.4%) in the current study were illiterate or could only read and write. Ali *et al*. (2021) reported a higher illiteracy rate of 50%, likely due to their focus on rural communities in Upper Egypt, where women are less likely to complete their education.

In the current study, 28.1% (123 participants) had completed secondary school, and 8.5% (37 participants) had a university degree. In comparison, Getachew *et al*. (2018) found that over one-third of mothers in their Ethiopian study had moderate education levels, while over one-quarter were university graduates. Mahmoud & Ibrahim (2021) reported a higher percentage of university graduates (27.2%), whereas Mohammed et al. (2023) found a slightly lower percentage (13.3%).

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In terms of occupation, half of the respondents (219, 50%) in this study were housewives. Mahmoud & Ibrahim (2021) and Mohammed *et al*. (2023) reported higher percentages of housewives in their studies, 78.6% and 79.2% respectively. This discrepancy could be attributed to the rural focus of their studies, whereas the current study included both rural and urban participants.

In the current work, the mean number of family members living in the same house was 4.7 ± 2.1, with half of the participants having at least 5 family members living in the same house. Mohamed *et al*. (2023) noted that about two-thirds (66.7%) of their study participants had more than 5 family members, while Ali *et al*. (2021) in Minia Governorate, Egypt, noted that more than one-third of participants had more than 5 family members in the same house. These differences might be due to variations in study settings and socioeconomic characteristics.

The present study showed that the role of the maid in preparing food at home is still limited, with only 12 respondents (2.7%) reporting that the maid shared the responsibility with the housewife, and 4 respondents (0.9%) indicating that the maid took full responsibility. In contrast, Alsayeqh (2015) found that in Saudi Arabia, the housewife cooked for the house in 73.5% of cases, the maid in 4.0%, and both the housewife and maid in 22.5%.

According to international organizations like the World Health Organization (WHO, 2009) and Centers for Disease Control and Prevention (CDC, 2024), the risk of foodborne illness can be reduced by washing hands with warm water and soap for 20 seconds before food preparation and at key moments (after touching garbage, after using toilets, etc.) (Fawzi and Shama 2009; Mihalache *et al*. 2023).

Not all participants in the current study followed the appropriate method of washing hands, and the frequency of participants who washed their hands with warm water and soap varied on different occasions requiring hand washing. Before training, the highest frequency of washing hands with warm water and soap was reported in the case of handwashing after using toilets at home (377, 86.1%) and the lowest noted in the case of handwashing after contact with a sick person (262, 59.8%). Reported frequencies of washing hands with warm

water and soap on other occasions were (75.1%) after changing diapers, (73.3%) after throwing garbage, (67.8%) before eating, (66.0%) before food preparation, and (63.7%) after arrival at home and (62.1%) after using toilet outside home.

Washing hands with only water ranged from (21.9%) in the event of washing hands before food preparation to (5.0%) in the event of washing hands after changing diapers. Moreover, some of the respondents reported never washing their hands and the frequency of those participants ranged from (10.3%) in the event of washing hands after contact with sick person to (0.5%) in the event of washing hands changing diapers and after using toilets outside home.

Fawzi and Shama (2009) reported that only 20% of the studied women properly cleaned their hands before starting food preparation using warm water and soap. Mahmoud & Ibrahim (2021) reported a lower percentage, with only 13.6% of mothers washing their hands with soap.

In Riyadh, Saudi Arabia, Alsayeqh (2015) found that less than half (47%) of the studied Saudi women reported that hand washing with soap and water should be performed before and after food preparation, and this percentage decreased to only 17.2% before eating. In another Saudi study in the Al-Ahsa Region, Al-Asmari *et al*. (2023) found that 82.4% of participants said they always wash their hands before preparing food, and about 76% of women reported always using soap for washing their hands before preparing food, while about 14% only used water.

In Slovenia, 57.1% of respondents reported washing their hands properly with soap and warm water during food preparation, although a significant number (33.9%) washed their hands with water only or did not wash at all (1.6%) (Jevsnik *et al*. 2008).

As for following the appropriate practices to dry hands, only 17.9% of the current study respondents reported drying hands after washing using appropriate methods such as paper towels or air drying. Fawzi and Shama (2009) reported a similar percentage of study participants using disposable tissues (24, 8.9%) for hand drying, while most participants in their study reported using special towels (186, 68.9%). This contrasts with 84% of

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participants identifying tissues as the proper way to dry hands after washing in a Saudi study (Alsayeqh, 2015).

The current study demonstrated a lack of knowledge among a considerable percentage of participants regarding the importance of storing different types of food items in the refrigerator according to a specific order to avoid cross-contamination. Before training, only 27.2% of participants responded correctly to the knowledge question on the appropriate order of sorting different types of food in the refrigerator. After training, this percentage increased to 74.5%. In Elmanagil City, Sudan, Ahmed *et al*. (2020) noted that most women (53%) in their study recognized the importance of storage practices of different types of food items and agreed that raw foods should be stored separately from cooked food.

Around one-third (34.4%) of participants washed eggs before storing them in refrigerators. Mahmoud & Ibrahim (2021) reported that only 10.7% of mothers in their study washed eggs before storage. Hassan *et al*. (2018) found that 19.5% of participants washed eggs with soap and water before storage, 40.3% wiped them with a dry cloth, and 40.2% stored eggs directly in the refrigerator and washed their hands afterward.

Cross-contamination can occur between raw meat and cooked or ready-to-eat food, often due to using contaminated knives or cutting boards without proper washing (Jevsnik *et al*., 2008; Goh *et al*., 2014; Al-Asmari *et al*., 2023).

The current study showed that separate cutting boards and utensils were available for use with different food items for 52.5% and 58.9% of participants, respectively. After training, these percentages increased to 91.0% and 84.9%, respectively. Fawzi and Shama (2009) reported that 68.1% of participants knew that using the same cutting boards for raw and cooked food could lead to food poisoning.

Shahid *et al*. (2022) found a similar result in Malaysia, with 59% of participants using separate cutting boards for raw and cooked food. In Saudi Arabia, Alsayeqh (2015) noted a higher percentage (79.49%) of participants using separate cutting boards and knives for meat and vegetables. Al-Asmari *et al*. (2023) reported smaller percentages, with 36% and 42.7% of participants always using different knives and cutting boards for raw meats and cooked food, respectively.

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Regarding washing utensils before use with different food items, 82.3% of participants in the present study reported following this practice before training. After training, this percentage increased to 94.2%. This compares to the findings of Alsayeqh (2015), where 97.38% of participants reported washing utensils before use.

The importance of using sanitizers in addition to hot water and soap for cleaning utensils and shelves was not well perceived by participants in the current study. Only 11.3% and 26.1% of participants used sanitizers in addition to water and soap for washing utensils and shelves, respectively. In Malaysia, Shahid *et al*. (2022) reported a similar finding, with only 22% of participants washing cutting boards with antimicrobial or sterilization solutions.

Wooden cutting boards are not recommended because their surfaces are difficult to clean thoroughly, especially when cracked (Saipullizan *et al*., 2018). The current study showed that about 36.2% of participants reported using wooden cutting boards, while 27.9% reported using plastic cutting boards. Langiano *et al*. (2012) noted a higher percentage of wooden cutting board use (76.3%) compared to plastic ones (23.7%), increasing the potential risk of cross-contamination.

The percentage of study participants who left utensils to air dry after washing or dried them with paper towels increased from 61.7% before training to 71.3% after training. The use of cloth towels decreased from 36.6% to 28.6%. Shahid *et al*. (2022) noted that about 56% and 23% of respondents wiped their cutting boards with clean cloth and tissue, respectively.

The present study found that storing eggs in refrigerators was a common practice among participants (98.1%). After training, this percentage slightly increased to 99.5%. Langiano *et al*. (2012) found that 23.9% of households in Italy stored eggs at room temperature. The differences between the findings in the two studies may be due to geographical and cultural differences.

The United States Food and Drug Administration (FDA) recommends four methods for thawing meat safely: in refrigerators, under running water, in microwaves, and as part of the cooking process. Defrosting meat at ambient air temperature for more than four hours can cause food poisoning due to pathogenic bacteria growth (Ayad *et al*., 2022; FDA, 2022).

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The present study shows that almost one-third (134, 31.8%) of participants reported thawing meat in refrigerators before training. The risky practice of thawing meat at ambient air temperature was reported by around one-fifth (89, 21.1%) of participants before training. After training, 68.7% (276) of participants claimed they would thaw meat in refrigerators, while 5.1% (20) still followed the faulty practice. Collectively, the percentage of participants reporting appropriate defrosting practices increased from 71.2% to 87.8% after training with a statistically significant difference, showing better compliance with FDA-approved methods.

Several studies have shown that defrosting meat at ambient air temperature is still common, both in Egypt and internationally. In Egypt, Fawzi and Shama (2009) reported that 43% (116/270) of participants knew that frozen food should not be thawed at room temperature. They also found that thawing frozen food of animal origin was usually done in the chiller (29.6%, 80/270) or during cooking of small pieces (10.4%, 28/270).

In Saudi Arabia, Alsayeqh (2015) reported a percentage like that in the current study, with 46.9% of Saudi participants thawing meat on the kitchen counter at ambient air temperature. The same study reported meat thawing in the fridge (20.5%), under tap water (24.2%), and using the microwave (8.5%).

Before training, 98.5% of the study participants reported using various methods to verify the completeness of the cooking process, including the release of vapor, color change of meat, both methods together, and examining the texture with a fork. Only 1.5% of participants reported using thermometers. After training, the percentage of participants using thermometers to verify the completeness of cooking increased to 12.8%, while the use of other methods slightly decreased. Fawzi and Shama (2009) reported using similar methods to verify the completeness of cooking but with different frequencies. They noted that 11.5% (31/270) of participants checked the adequacy of food cooking by examining internal and external color changes, while 58.9% (158/270) examined the texture with a fork. Similar techniques were reported by Hassan et al. (2018) in Lebanon, where 54.4% of respondents checked the color of meat to ensure hamburgers were cooked enough, 41.1% checked the

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firmness of meat, and only 4.5% measured the temperature at the center of the meat with a thermometer.

In the current study, most participants reported keeping food leftovers in the refrigerator (94.1%). In Saudi Arabia, Al-Asmari *et al*. (2023) noted a smaller percentage (nearly 73%) keeping leftover food under refrigerating or freezing conditions, while only 9.6% kept the remaining food at room temperature until the next meal.

In the present study, almost half (55.4%) of participants reported always reheating food before eating. Cagri-Mehmetoglu (2009) reported a similar finding, with 44% of respondents always and 50% sometimes reheating leftovers before eating. Additionally, before training, 63.6% of participants reported reheating food until boiling. Alsayeqh (2015) reported a similar finding, with 58.1% of participants heating food leftovers until boiling, while the rest (41.9%) only heated it until warm.

Furthermore, 38.7% of the current study participants reported purchasing TCS (Time/Temperature Control for Safety) food at the end of shopping before training, and the duration between purchasing TCS food and reaching home was less than two hours for 95% of participants. Al-Asmari *et al*. (2023) noted a similar finding, with most of their study participants (70%) not caring about the time of buying frozen products during shopping, which may cause thawing of frozen products and food spoilage. They also indicated that almost 62% of participants took two hours or less to transport frozen products from the supermarket to home, while 22.2% took longer (2 to 4 hours).

In the current study, more than three-quarters (77.7%) of the participants reported buying food from street vendors. Mahmoud & Ibrahim (2021) noted a lower percentage (25.2%) of mothers in their study reporting eating from street vendors. Cagri-Mehmetoglu (2009) also showed that 77% of respondents purchased milk from supermarkets, while the remainder obtained milk from street vendors or directly from farms.

In the present study, almost three-quarters (74.4%) of the participants reported that they would never buy food cans with a close expiry date. Fawzi and Shama (2009) reported a similar percentage, with 77.0% (208/270) of participants reading the expiry date before purchasing. Cagri-Mehmetoglu (2009) noted that among respondents questioned about

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checking expiration dates when shopping, 28% always and 41% usually looked for the expiration date, compared to 9% who ignored it.

Regarding checking food packages for other defects that could impact food safety, various percentages of participants reported never purchasing food cans with defects, ranging from 99.1% for leaking packages to 74.4% for packages about to expire. Tabrizi *et al*. (2017) indicated that about 87.7% of respondents checked food cans for buckling or bulging, while Al-Asmari *et al*. (2023) reported that about 80.8% of participants always checked food expiration dates and for defects like dented, leaking, cracked, or bulging lids before buying products.

The current study also showed that training resulted in an improvement in the mean score of the four groups of knowledge questions (personal hygiene practices, prevention of cross-contamination, time/temperature control, and food purchasing practices) and consequently in the overall scores of all food safety knowledge questions. The mean score increased from 20.40 ± 4.87 before the training intervention to 26.94 ± 3.40 after the intervention, with a p-value < 0.001, indicating a significant difference in food safety knowledge levels between pre- and post-intervention scores. This finding agrees with Elsherbiny *et al*. (2020), who implemented an educational program about food safety in Ismailia city hospitals and found that knowledge scores increased significantly from 9.2 ± 5.3 before the intervention to 18.5 ± 3.9 after the intervention ($P \leq 0.05$).

This is also in line with the findings of several other studies that have also highlighted a statistically significant increase in the total mean score of safe food handling practices after implementing an educational package (Park *et al*., 2010; Ghaffari *et al*., 2020; Hassan *et al*., 2022).

Multiple studies have highlighted the effect of sociodemographic factors on participants' food safety knowledge, including age, gender, education, and occupation. For instance, Mohammed *et al*. (2023) noted that younger mothers, those with a university education, and employed mothers had significantly higher odds of scoring better in safe handling practices. Similarly, Mohamed *et al*. (2021) reported statistically significant differences in food safety practices among 373 rural women in Abo Sower Elbald village,

Ismailia governorate, based on their educational level, working status, and family income ($p<0.05$).

The current study explored the impact of several sociodemographic factors on the effectiveness of the training intervention, including age, gender, education, and occupation. Results indicated that the training session had a different impact on the food safety knowledge of various age groups, with statistically significant differences. In general, an improvement was noted across all age groups, with the highest mean change in knowledge observed in the elderly (those over 60 years old). A statistically significant relationship was found between the overall mean score of knowledge questions before training and the different age groups. This aligns with Mohamed *et al*. (2021), who reported a significant relationship between age and food safety knowledge among rural women ($p<0.001$). In contrast, Madilo *et al*. (2023) in Ghana found that age had no influence on participants' food safety practices, and Ayaz *et al*. (2018) in Saudi Arabia showed no significant relation between mothers' age and their practices.

Regarding gender, females demonstrated better knowledge about food safety compared to males in the current study, with higher overall mean scores before training. Similar findings were reported by Cagri-Mehmetoglu (2009) in Turkey and Tabrizi *et al*. (2017) in Iran.

As for the relationship between education and food safety knowledge, the present study detected a statistically significant difference between the educational levels of participants regarding their knowledge of food safety ($p = 0.0104$). These findings are consistent with Mohamed *et al*. (2021) who reported a statistically significant relationship between educational level and food safety knowledge among rural women ($p < 0.001$).

The effect of the training session, indicated by the percent change in the mean score of knowledge questions before and after training, was highest in the illiterate group and lowest in the group with postgraduate certification.

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CONCLUSIONS AND RECOMMENDATIONS

The current study demonstrates that food safety knowledge and practices among consumers can be significantly improved through well-designed educational programs. These programs should consider various sociodemographic factors, with particular emphasis on overcoming barriers faced by rural and less-educated populations to bridge existing gaps.

Recommendations for Public Awareness Programs

1. Launch comprehensive public awareness campaigns on food safety principles. These should be implemented both by non-governmental organizations and as part of the responsibilities of relevant governmental bodies.
2. Utilize various media platforms to reach a broader audience, ensuring that the information is accessible and understandable to all demographic groups.

For Larger Scale Studies

1. Conduct extensive studies to assess food safety knowledge and practices among consumers. These studies should include a sizable and diverse sample from multiple governorates and different contexts to provide a more comprehensive understanding of the current state of food safety awareness.
2. Use the findings from these studies to tailor educational programs more effectively and address specific needs identified in different regions and among various demographic groups.

By implementing these recommendations, we can enhance food safety knowledge and practices, ultimately leading to safer food handling and consumption habits across diverse populations.

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تقييم برنامج توعية صحية لتعزيز المعرفة والممارسات المتعلقة بسلامة الغذاء بين المستهلكين في بعض محافظات مختارة من مصر عام 2016

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1) كلية الدراسات العليا والبحوث البيئية، جامعة عين شمس 2) الهيئة القومية لسلامة الغذاء 3) كلية الزراعة، جامعة عين شمس 4) كلية الطب، جامعة عين شمس

الملخص

يتطلب ضمان سلامة الغذاء التعاون بين قطاعات متعددة، تشمل مشغلي المنشآت الغذائية والهيئات الحكومية والمستهلكين. وتنجم حوالي 25٪ من حالات تفشي الأمراض المنقولة بالغذاء المبلغ عنها عن سوء التعامل مع الأغذية داخل الأسر . لذا يعبر فهم معرفة وسلوك المستهلك فيما يتعلق بسلامة الغذاء أمر بالغ الأهمية لتحديد الثغرات وتصميم تدخلات تعليمية فعالة للوقاية من الأمراض المنقولة بالغذاء. هدفت الدراسة تقييم تأثير برنامج توعية صحية مصمم لتحسين معرفة وممارسات سلامة الغذاء لدى المستهلكين. تم استخدام تصميم دراسة تدخلية قبل/ بعد الاختبار لمجموعة واحدة من 438 مشاركًا من محافظات القاهرة والمنيا والغربية من خلال أخذ عينات ملائمة. وتضمن التحليل الإحصائي متغيرات مستقلة مثل العمر والنوع والتعليم. وتم جمع البيانات باستخدام استبيان تم استيفاء البيانات التي يتضمنها من خلال مقابلة المشاركين وسؤالهم، كما تم تصميم الاستبيان بناءً على مراجعة شاملة للمراجع ذات الصلة وبالاستعانة بالاستبيانات المنشورة في دراسات سابقة. أظهرت النتائج أن أكثر من نصف المشاركين (57.8٪) في سن 40 عامًا أو

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أقل، ومعظمهم من الإناث (84.9٪). وما يقرب من ثلث المشاركين (37.9%) أميين، ونصفهم (50%) ربات بيوت. قبل التدخل، لم يتبع حوالي ثلث المشاركين إجراءات غسل اليدين الصحيحة قبل تحضير الطعام، أو بعد الاتصال بشخص مريض. حقق برنامج التدريب تحسنًا كبيرًا ذو دلالة إحصائية في معرفة المشاركين بسلامة الغذاء، وخاصة في أربع مجالات رئيسية: النظافة الشخصية، والتلوث التبادلي، والتحكم في الوقت/درجة الحرارة، وشراء الغذاء. خلصت الدراسة إلى إمكانية برامج تعليم سلامة الغذاء المصممة بشكل صحيح أن تعزز بشكل فعال معرفة وممارسات سلامة الغذاء لدى المستهلك. وتوصي الدراسة بضرورة إطلاق حملات توعية عامة حول مبادئ سلامة الغذاء من خلال كل من المنظمات غير الحكومية والهيئات الحكومية المسؤولة عن إدارة سلامة الغذاء، بالإضافة إلى وسائل الاعلام ووسائط التواصل الاجتماعي.

الكلمات المفتاحية: المستهلك، البرنامج التعليمي، التعامل الآمن مع الغذاء، المعرفة، الممارسات.Annex

استبيان تقييم ممارسات ومفاهيم سلامة الغذاء لدى المستهلك المصري – Pre

رقم الاستمارة: ( ) تاريخ المقابلة: ---/ -----/ -----

الجزء الأول

أولا البيانات التعريفية:

1- المحافظة: ---------- 2- القسم/ المركز: ----------

3- اسم المدينة/ القرية: ----------

4- توزيع المنطقة: حضر (1) ريف (2) بدو (3)

ثانيا البيانات الشخصية:

5- اسم الشخص (اختياري): ----------

6- العنوان بالتفصيل (اختياري): ----------

7- النوع: ذكر (1) أنثي (2)

8- العمر (بالسنوات): ---------- سنة

9- المهنة:

(1) طالب (2) لا يعمل
(3) مهن تخصصية (طبيب/ مهندس...) (4) مهن حرفية (نجار/ سباك...)
(5) متقاعد (6) ربة منزل
(7) أخرى (تذكر): ----------

10. هل لديك وظيفة في مجال إنتاج أو صناعة الغذاء: (1) نعم (2) لا
في حالة الإجابة بنعم، أذكر الوظيفة: ----------

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11-التعليم:

(1) أمي (2) يقرأ ويكتب (3) الابتدائية (4) الإعدادية
(5) تعليم متوسط/ فوق المتوسط (6) جامعي (7) دراسات عليا

ثالثا الأحوال المعيشية:

12- المسؤول عن إعداد الوجبات بالمنزل:

(1) ربة البيت أو المبحوث نفسه (2) الخادمة (3) الاثنين معا

13- نسبة الإنفاق على الطعام من قيمة دخل الأسرة الشهري:

(1) ربع الدخل (2) نصف الدخل
(3) ثلاثة ارباع الدخل (4) أكثر من ثلاث ارباع الدخل

14- عدد أفراد الأسرة: -------- فرد

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رابعا: بعض الممارسات العامة المرتبطة بسلامة الغذاء

النظافة الشخصية

15 (غسيل الأيدي): ضع علامة (√) أثناء الاختيار

العنصر	دائما		أحيانا		إطلاقا	لا ينطبق
	ماء فقط	ماء وصابون	ماء فقط	ماء وصابون		
أ. قبل طهي أو تجهيز الطعام						
ب. قبل تناول الطعام						
ج. بعد السلام على مريض						
د. بعد دخول الحمام (بالمنزل)						
هـ. بعد دخول الحمام (خارج المنزل)						
و. بعد إلقاء القمامة						
ز. بعد تغيير حفاضات الأطفال						
ح. بعد الوصول للمنزل مباشرة						

16- الوقت المعتاد لغسل الأيدي:

(1) دقيقة (2) نصف دقيقة (3) أقل من نصف دقيقة (4) غير محدد

17- طريقة تجفيف الأيدي بعد الغسيل:

(1) تركها لتجف في الهواء (2) بفوطة قماش (3) بمناديل ورقية (4) أخرى (تذكر): --------

شراء الأغذية:

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18- شراء أغذية من الباعة الجائلين: (1) دائما (2) أحيانا (3) إطلاقا

19- التعامل مع المعلبات أثناء الشراء (مثال زبادي – ألبان- تونة- سمن): **ضع علامة (√) أثناء الاختيار**

العنصر	لا اشتريها	اشتريها عندما تكون أرخص	اشتريها عند الاضطرار	لا اهتم
أ. أقرب انتهاء صلاحية المعلبات				
ب. وجود انتفاخ بالعبوة				
ج. وجود انبعاج في العبوة				
د. وجود تسريب في العبوة				

20- أثناء التسوق متى يتم شراء منتجات الألبان واللحوم والدواجن والاسماك النيئة:

(1) في بداية التسوق (2) في نهاية التسوق

(3) لا يوجد وقت محدد – الأقرب للمنزل (4) لا اشتريها

21- تستغرق الفترة الزمنية ما بين التسوق والوصول إلى المنزل:

(1) أقل من نصف ساعة (2) نصف ساعة إلى ساعة

(3) ساعة إلى ساعتين (4) أكثر من ساعتين

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الجزء الثاني

التحكم في الوقت ودرجات الحرارة:

22- هل يوجد لديك ثلاجة لحفظ الطعام: (1) نعم (2) لا (انتقل إلى السؤال 26)

23- هل توجد طريقة معينة تقوم باتباعها أثناء ترتيب الطعام على أرفف الثلاجة:

(1) لا توجد طريقة محددة، بل أخزن وفقا لمساحات التخزين المتوفرة.

(2) نعم توجد طريقة محددة التزم بها وفقا لاعتقاد خاص بسلامة الغذاء.

24- في حالة الإجابة بنعم: أذكر طريقة ترتيب الأغذية من الرف العلوي للرف السفلي (أجبان، لحوم نيئة، دواجن نيئة):

الرف العلوي	----------
الرف الأوسط	----------
الرف السفلي	----------

25- ثم تعليق الباحث على الطريقة المستخدمة لترتيب الأغذية داخل الثلاجة: (1) صحيح (2) خاطئ

26- هل تقوم بغسيل البيض قبل تخزينه في الثلاجة؟

(1) اغسله قبل وضعه في الثلاجة (2) أضعه في الثلاجة بدون غسيل

(3) لا أضع البيض في الثلاجة

27- يتم تطرية (أو فك) اللحوم النيئة المجمدة: (يسمح باختيار أكثر من إجابة)

(1) داخل الثلاجة (2) في درجة حرارة الغرفة

(3) تحت الماء الجاري (4) داخل الميكروويف

(5) في وعاء به ماء مغلي (ليس كجزء من عملية الطهي) (6) في وعاء الطهي مباشرة

(7) أخرى (تذكر): ----------

28- التأكد من الطهي الجيد للحوم من خلال:

(1) تصاعد الأبخرة (2) تغير لون عصارة اللحم

(3) استخدام ترمومتر لقياس درجة حرارة الغذاء (4) أخرى (تذكر): ----------

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29- هل تحفظ بقايا الطعام المطبوخ بالثلاجة: (1) نعم (2) لا (انتقل إلى السؤال31)

30- إذا كانت الإجابة بنعم، بعد كم ساعة من طبخه: -------- ساعة

31- هل يتم أكل الطعام المطبوخ باردا دون إعادة تسخينه:

(1) نعم (2) في بعض الأوقات (3) إطلاقا (انتقل إلى السؤال 33)

32- يتم إعادة تسخين الطعام المطبوخ: (1) حتى الغليان (2) التدفئة

التلوث العرضي:

33 – يتم تقطيع اللحوم والدواجن النيئة:

(1) رف/منضدة بالمطبخ (2) داخل حوض المطبخ

(3) على لوحة تقطيع مخصوصة لذلك (4) أخرى (تذكر): ----------

34 – في *حالة استخدام لوحة تقطيع* اذكر نوعها: (يسمح باختيار أكثر من إجابة)

(1) خشب (2) رخام (3) بلاستيك

(4) زجاج (5) أخرى (تذكر): ----------

35- توجد لوحة تقطيع مخصصة للخضار والفاكهة وأخرى للأغذية النيئة مثل اللحوم والدواجن

(1) نعم (2) لا

36 – عند التعامل مع أكثر من صنف من الغذاء (لحم، خضار، خبز) هل يتم استخدام أدوات منفصلة (مثال: سكينة لكل صنف)؟ (1) نعم (2) لا

37 – في حالة استخدام نفس الأدوات، هل يتم غسيلها قبل استخدامها في إعداد صنف طعام مختلف (مثال غسيل نفس السكينة المستخدمة في تقطيع البصل بعد استخدامها في تقطيع اللحم)؟

(1) نعم (2) لا

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التنظيف والتطهير: ضع علامة (√) أثناء الاختيار

العنصر	ماء فقط	ماء وصابون	ماء وصابون ومطهر	اسم المطهر
38- تنظيف أدوات الطعام				
39- تنظيف أرفف المطبخ				
40- - تنظيف أرضية المطبخ				

41- تجفيف أدوات الطعام:

(1) في الهواء (2) بفوطة قماش (3) بمناديل ورقية (4) أخرى (تذكر): ----------

ممارسات أخرى:

42- هل يتم تغطية الرأي (مثلاً ارتداء ايشارب) أثناء تحضير الطعام:

(1) نعم (2) لا (3) لا ينطبق

43- خلع الخواتم أو غيره من أدوات الزينة من الأيدي قبل البدء في تحضير الطعام في المنزل:

(1) نعم (2) لا (3) لا ينطبق

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