

Knowledge and practice of food handlers on food safety and health: A cross sectional study in one of Tehran's districts

Ehsan Haghi¹, Fariba Razeghi¹, Ahmad Ahmadi², Gholamreza Jahed Khaniki^{3*}

¹ Food Safety Division, Department of Environmental Health, School of Health, Tehran University of Medical Sciences, Tehran, Iran

² Department of Food Safety, School of Veterinary, Tehran University, Tehran, Iran

³ Department of Environmental Health, Faculty of Health, Tehran University of Medical Sciences, Tehran, Iran

Corresponding author and reprints: Gholamreza Jahed Khaniki. Food Safety Division, Department of Environmental Health, Faculty of Health, Tehran University of Medical Sciences, Tehran, Iran.

Email: ghjahed@sina.tums.ac.ir

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Abstract

Background: The people involved in food preparation play a major role in contaminating it due to improper food handling. The goal of this study was to examine the knowledge and practice of food handlers in district two of Tehran.

Methods: A cross sectional descriptive- analytical study was designed and data were collected via questionnaires. The reliability of the questionnaires were measured using Cronbach's alpha and Intra-class correlation obtained from test and re-test in an interval of 10 days. The reliability indices of the questionnaires were found to be above 70%, which were acceptable. The participants were selected by a simple random method (n=390). Correlation coefficient was used for analysis.

Results: The highest number of male participants, with diploma education belonged to the age group of 20 to 29 years old with a job experience of two to five years and more than 50% of them had passed the public health course. The results showed that there was a significant relationship between knowledge and practice ($P<0.001$). In knowledge section 215 (55.3%) of respondents were at middle level. About the practice, although 195 (50%) of participants were placed at a good level, in some cases, such as how to find out the optimal temperature for cooking burgers and chicken, the right way to defrost food and the time needed to reheat the food were found lacking.

Conclusion: Knowledge and practice in food handlers must be improved specially about the importance and role of temperature in food safety.

Keywords: Cooking; Knowledge; Food Handling; Food Safety; Practice

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Introduction

The people involved in the production of food play a major role in contaminating the food due to improper handling. According to a report of the World Health Organization, more than one third of the population in developing countries become ill from food-borne diseases (1). It estimated that in 2000, about

one million people died due to diarrheal diseases, with a large part of these cases being attributed to contaminated food and drinking water (2). According to the European Food Safety Authority (EFSA) report, about 48.7% of food-borne diseases are caused by eating food provided in public places (3). The World Health Organization reported that in 2005,

1.8 million people died due to diarrhea related food-borne diseases (4). An analysis of the outbreak of food-borne diseases in worldwide has showed that a large number of these diseases had been due to improper food handling in food service places (5, 6). Food poisoning occurs mainly due to poor personal hygiene and health, cross-contamination of raw and cooked foods, inadequate baking, and improper storage (3)

The growing trend of dining outside the home, in restaurants, and other eateries plays an important role in increasing the risk of food-related illnesses(7). In several countries, the most common cause of food-borne diseases is food service businesses (8). The use of proper health practice in the food business is essential to protect consumers from food-borne disease so food handlers must have the necessary knowledge and skills as laid down by the public health regulations (9). knowledge, attitudes, and practice of food-handlers can affect the occurrence of food contamination and can have a direct effect on improving the level of food safety and quality of services(5, 10, 11).

With regard to the above, this study aimed to measure the knowledge and practice of food handlers on food safety and health.

Methods

This study was a cross-sectional, descriptive analytical and data were collected via questionnaires. The statistical population were food-handlers working in food service businesses in district two of Tehran. For this study, 400 participants were obtained using the formula $n=(Z_{1-\alpha/2}.S)^2/d^2$. Where in:

n: required sample size

S: standard deviation of society, which was considered by examining similar studies=2

d: accuracy degree was calculated as 0.2.

The inclusion criteria for the study were chefs or chef assistants, or those who were involved with food handling and had at least one month of work experience as food-handlers. The exclusion criteria

involved respondents that did not deal with food and had less than one month of work experience also questionnaires with 3 or more than unanswered questions were considered as incomplete replies and were removed.

The survey questionnaires used were adapted from Lazou et al. (12) with minor revisions to suit the food culture . The participants were selected by a simple random method. For this purpose, a list of centers that prepare and cook food, restaurants, and fast-food establishments was obtained from the Environmental Health Unit of the West Health Center of Tehran. Each establishment was allotted a code, the codes were entered in an Excel 2010 software, and the number of required samples was selected by drawing lots.

A re-test method was used to determine the reliability of this study. In this test, questionnaires were given to 20 food handlers. Then, 10 days later, the same participants were again tested. Intra-cluster correlation coefficients (ICC) of 0.75 and Cronbach's alpha 0.72 indices were obtained using the statistical tests, which indicated desirable reliabilities of the questionnaires. The validity of these questionnaires were examined and confirmed by two health and food safety experts and the needed changes were applied in terms of vocabulary and transparency of the questions.

The first part of the final questionnaires included the respondents' demographic characteristics, the second part included 32 questions, 16 questions related to the practice and 16 other questions related to knowledge of food preparation and distribution with regards to food safety and health. Each correct practice reported scored four; where as a score of zero to three was considered for other options.

The level of knowledge and practice of the employees was determined as per the total score, which could vary from zero to 64, based on the response to questions sectioned as knowledge and practice (each of 16 questions).

Table 1. Demographic characteristics of the study population (n=390)

Demographic variables		N (%)
Gender	Male	294 (75.4)
	Female	96 (24.6)
Age group	20-29	162 (41.5)
	30-39	108 (27.7)
	40-49	104 (26.7)
	50-59	16 (4.1)
	Over 60	0
Education level	Primary	71 (18.2)
	Middle school	91 (23.3)
	High school	24 (6.2)
	Diploma	119 (30.5)
	Associate degree	62 (15.9)
	License	16 (4.9)
	MA	4 (0.1)
Work experience	Less than one year	48 (12.3)
	2-5 year	78 (20.0)
	6-10 year	111 (28.5)
	11-15 year	108 (27.7)
	Over 16 year	45 (11.5)
Kind of job	Server	117 (30.0)
	Cook and chef assist	176 (45.1)
	Storage in charge	53 (13.8)
	Chef	6 (1.6)
	Others	38 (9.7)
Food poisoning	Yes	213 (54.6)
	No	177 (45.4)
Passing general health course	Yes	233 (59.7)
	No	157 (40.3)

The scores were classified, and the three levels of knowledge and practice were coded as good, moderate, and poor levels in re-coding. Regarding the determination of knowledge and practice level of the food practitioners, from a score of 64 that was considered the maximum score rate, respondents who scored anything from 0-21 were considered to have poor knowledge and was coded as one, a code of two for moderate knowledge ranged from 22-43 and code three was assigned for good knowledge that ranged from scores 44-64. The same scoring pattern was repeated for calculating the practice scores.

Spearman correlation coefficient test was used to determine the correlation between knowledge and practice using SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc. *P* value of lower than 0.05 was considered statistically significant.

Results

Demographic characteristics of the study participants are illustrated in Table 1. Ten questionnaire were removed because they had 3 or more than unanswered questions.

In the knowledge section, 215 (55.3%) of participants were placed in the middle level and 77 (19.5%) in the good rank. the most correct responses with 304 (77.9%) were to the questions "best time for rinse and cleaning the cutting boards and kitchen" and the next category "Safe texture of egg in Food after cooking" (77.2%, n= 301) and the least knowledge related to "the type of food that has the lowest poisoning rate" and " least safe method for thawing a frozen food" with 21% (n= 82) and 26.4% (n=103) respectively (Table 2).

In practice part, 195 (50.1%) of respondents were set as the good level and 54 (13.6%) as the weak rank.

Table 2. Frequency distribution of knowledge questions

Questions	Best answers with maximum score	N (%)	Mean \pm SD
Some bacteria cause food poisoning, how we can prevent food poisoning?	Cook thoroughly	233 (59.7)	1.90 \pm 2.47
All foods are considered safe when cooked to an internal temperature of...	70 ^{0C} AND 74 ^{0C}	217 (55.6)	1.98 \pm 2.22
In order fried eggs to be safe to eat, how should their texture be after cooking?	Solid albumen yolk	301 (77.2)	1.68 \pm 3.08
Which food is least likely to cause food poisoning?	Chocolate cake that was left on the kitchen counter overnight	82 (21)	1.63 \pm 0.84
What is the temperature freezers should be to preserve the safety of foods?	-18	241 (61.8)	1.94 \pm 2.47
Freezing eliminates harmful germs in food.	NO	179 (45.9)	1.99 \pm 1.83
The wash of dishes may include which of the aforementioned choices to prevent food poisoning.	Choices 1 and 3(wash and dry them in an automatic dishwasher, hand-wash them right after the meal and then let them air-dry)	158 (40.5)	1.96 \pm 1.62
What is considered the best way to prevent food poisoning?	Keep foods refrigerated until it's time to serve them	119 (30.5)	1.65 \pm 1.58
Which procedure for cleaning kitchen is most likely to prevent food poisoning?	Wash with a detergent, rinse, and then wipe with a sanitizing solution after that dry it.	111 (28.5)	1.65 \pm 1.46
When should kitchen utensils be washed, rinsed, and sanitized?	After each use When you begin working with another type of food at 4-h intervals if the counter is in constant use All of the above	333 (85.5)	1.41 \pm 3.41
What is the least safe method for thawing a frozen food?	Put it on the counter until it be thawed.	103 (26.4)	1.77 \pm 1.07
Which should be done when storing raw meat, fish, or poultry in the refrigerator?	All of choices (Place it in the coldest part of the refrigerator Set it in a larger container before refrigerating Place it on the lowest shelf in the refrigerator change the package they came)	235 (60.3)	1.95 \pm 2.41
What is the best way for preventing food poisoning	Keep cooked food at cool place until serve them	145 (37.2)	1.65 \pm 2.09
	Rarely or never serve leftovers	108 (27.2)	
How do you defrost frozen meat?	In the refrigerator	231 (59.2)	1.77 \pm 2.71
	Under running water	45 (11.5)	
Which procedure for cleaning kitchen counters is most likely to prevent food poisoning?	Wash with a detergent, rinse, then wipe with a sanitizing solution after that dry it.	145 (37.2)	1.67 \pm 2.01
When is/are the best time for washing and cleaning the cutting board	All of the above (After each use when you begin working with another type of food at 4-h intervals if the counter is in constant use)	304 (77.9)	1.60 \pm 3.15

Table 3. Frequency distribution of practice questions

Questions	Best answers with maximum score	N (%)	Mean±SD
After you have used a cutting board to slice raw meat or chicken and need to cut tomatoes, what do you do?	Wash the cutting board with soap and rinse it under hot water	210 (53.8)	2.51±1.73
When you cut raw meat and need to use the knife again, what do you do?	Wash with detergent and hot water	236 (60.5)	2.84±1.56
where is raw meat stored in the refrigerator?	Lowest shelf	161 (41.3)	1.70±1.96
If you have a sore on the back of your hand, do you prepare food for other people?	Yes, if I bandage the sore and wear a gloved and I don't prepare food until the sore heals	254 (65.1)	3.08±1.46
How do you check that a hamburger is sufficiently cooked?	With Thermometer	72 (18.5)	2.95±0.98
	When it has been cooked for a stated time and it looks cooked after checking the color of the meat inside	288 (73.8)	
How long do you heat leftover foods?	Until they are boiling hot	202 (51.8)	2.7± 2.00
How do you check that poultry is sufficiently cooked?	With Thermometer	163 (41.8)	1.93±1.86
	When it looks cooked after checking the color of the meat inside	52 (13.3)	
When do you place a frozen food in your cart when you go for shopping to the supermarket?	At the very end of the shopping	254 (65.1)	2.60±1.90
How do you defrost frozen meat	In the refrigerator	221 (56.7)	2.61±1.81
	Under running water	45 (11.5)	
Do you have a thermometer in your refrigerator?	Yes	240 (61.5)	2.46±1.94
In case your electricity went off and the meat, chicken, and/or seafood in your freezer thawed and felt warm, what do you do?	Throw them away	77 (19.7)	1.72±1.33
	See how they smell or look before deciding what to do	130 (33.3)	
How do you store the meal to keep it safe until this person is ready to eat it?	Store it in the refrigerator and reheat it when the person is ready to eat it	246 (63.1)	2.85±1.62
How do you wash your hands before starting preparing food or eating?	Soap and water	302 (77.4)	3.43±1.13
How do you wash fruits and vegetables?	Sanitizer and running water	269 (69)	3.05±1.40
How often the kitchen sink drain in your home is sanitized?	Daily and when it is needed	317 (81.3)	3.25±1.56
When preparing food, you wash your hands after touching which one of these?	Face, utensils, door handle	59 (15.1)	1.07±1.30

Table 4. correlation between knowledge and practice

	Practice	Knowledge
Spearman's rho correlation coefficient	1	0.720
<i>P</i>		<0.001

The most correct answers were received to the practice questions "washing the sink" and "hand washing" with 317 (81.3%) and 302 (77.4%) respectively and the lowest correct answer was related to "hand washing during working" 59 (5.1%) and

"monitoring the temperature while baking of burgers" 72 (18.5%) (Table 3).

The respondents had moderate and poor knowledge, 215 (55%) and 98 (25%), and 50% and 36% of them had good and moderate practice, respectively.

A significant relation was found between the two variables of knowledge and practice at the $P < 0.001$ (Table 4).

Discussion

In this study, the knowledge and practice scores of approximately 50% of food workers were in medium and good levels, indicating a lack of knowledge and a poor practice in the field of safe exposure with food. In the knowledge section, questions relating to the proper temperature of storing food and its thorough cooking, proper defrosting of frozen food, and proper kitchen cleaning had the least correct responses. There was no importance given to hand washing during work, showing the low knowledge of food-handler towards the importance of temperature, cross-contamination, and infection. The most correct answers related to the time for cleaning the cutting boards and kitchen appliances and the safe texture of egg in food after cooking. The results of this study are consistent with the results of a few studies (13-17). In these studies, the lowest knowledge score was related to proper storage, defrosting, cooking, and reheating of food.

Soares et al. also showed that the percentage of people who responded correctly to questions on food storage at an appropriate temperature was low (18) Bucchri et al. indicated that nursing staffs had some knowledge about the correct temperature for storing ready-to-eat (warm and cold) food, and 61% of the respondents defrosted at room temperature (19) Lin et al. showed the lowest score of knowledge also related to keeping food at the right time and temperature (20) Akabanda explained that 60% of food workers did not know the specific temperature for food spoilage, and 59% believed that the freezing effect destroyed microbes responsible for food-borne diseases (21).

The results of the previous studies are similar with this study. However, in a Sharif study, 90% of the participants knew

that de-freezing should not be at room temperature overnight, which is not consistent with our research (13, 22)

Cuprasitrut et al. specified that none of the food sellers in the kiosks reheat the prepared food (23) which is consistent with the results of this study. Furthermore Akbanda showed that only 40% of the food workers know the exact place to store raw meat in the refrigerator (21) Bolton et al. explained only 30% of respondents said that they place raw meat at the lower floor of the refrigerator, 40 and 50% of them use a probe thermometer to diagnose the bite of red meat and chicken, respectively (24), The results of studies show that the importance of food temperature and its relationship with the control of microbial dangers is not clear or understood by workers in the food industry. This issue is a critical point in preparing food and implementing food safety programs (15). It is important for authorities and relevant units to focus on the importance of this matter, and implement training programs based on the principles of safe food preparation and cooking as defined and specified by the World Health Organization, and in the meantime, they should perform the methods to transform knowledge into practice for officials and managers, so that food practitioners encourage safe and hygienic practice. To accomplish this endeavor, factors other than training such as occupational satisfaction, working conditions, and employee-employer relationships should also be considered because they affect employee behavior (15, 17).

A significant relationship was obtained between knowledge and practice, which is consistent with the results of some studies (16, 23, 25, 26), but is not consistent with the results of the studies who showed that the knowledge of individuals was promoted by education and training, but they did not necessarily lead to a change in attitudes and behavior (17, 27-30).

Some studies consider knowledge as prerequisite for safe practice in dealing with food (20, 31), while many studies have shown that increasing the knowledge of employees in dealing with food and gaining adequate knowledge in this subject does not always lead to improving the behavior (32). Anyway, training is essential to ensure that the employees have the necessary alertness and knowledge to act on healthcare orders, although they may not always lead to behavioral changes in health (30, 33).

Also a significant relationship was obtained between passing the public health course and knowledge with the level of practice at a P value level less than 0.01 that is consistent with the study of (34), which found that a direct relationship exists between knowledge and type of occupation, the study of Rahman et al. who improved the training, attitude and the practice item skills, the study of (35) that saw a relationship between the scores of attitudes, knowledge, and practice with the participation in educational courses, as well as the results from Razeghi et al., study. The study of Buccheri et al., (19) showed that even people who had completed a training course had more knowledge, which is consistent with the current study, however there was no difference in attitudes and practice, which is inconsistent with this study. A study of Bolton et al., (24) saw no difference between passing formal food safety courses and the improvement of the chefs' and catering managers' practice. A study of Liu et al., (36) showed that the knowledge of respondents does not lead to action and this is inconsistent with this study. Knowledge about food safety and beliefs through education and training will have positive effects on the practice of individuals (37). Training and education helps to improve the overall practice of employees in the field of food safety (35). Training and education is needed and essential to ensure that employees have the necessary alertness and knowledge to act on healthcare orders, although they may not

always lead to behavioral changes in health (30, 33).

Our findings showed the knowledge and practice in food handlers must be improved specially the importance and role of temperature in food safety. Since a large number of people, due to their busy lifestyle, buy their meals from public eateries, promoting knowledge and improving the practice of food workers is necessary because it will lead the community health promotion.

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Conflict of interest

Authors declare no conflict of interests.

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