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RESEARCH ARTICLE

Knowledge, attitude, and practice among food handlers of semi-industrial catering: a cross sectional study at one of the governmental organization in Tehran

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Abstract

Purpose food handlers have an important role in transmitting pathogens from raw materials to cooked ones. This study was conducted to determine the knowledge, attitude, and practice (KAP) of 95 food handlers on five keys to safer food based on World Health Organization questionnaires in semi-industrial catering in a government office in Tehran.

Materials and methods specialists reviewed the validity of questionnaires and reliability was measured using determination of inter rater agreement, relevancy and clarity of each question, and the tool as a whole was evaluated by the content validity method. The Cronbach's alpha and repeatability were measured with intra-cluster correlation through repeated test-piloting after one month.

Results In spite of good levels of KAP, lack of knowledge was observed in some items such as cooking thoroughly and keeping food at safe temperatures. All of the participants had good knowledge about washing hands (100% correct answers) and Low level of knowledge with 46.3% correct answers belonged to put cooked meat at room temperature question; in attitude section, 99% of the food handlers were regarded a positive attitude about the cleaning of surface in the kitchen to reduces the risk of illness; a worrying issue is 57% of participants agreed that by looking at foods can distinguish safe and spoiled ones finally 100% of the respondents were considered to have good behavior. Significant relations were found between knowledge and attitude ($p < 0.001$) and between attitude and practice ($p = 0.001$).

Conclusions Educational training and creating motivation to promote knowledge and turning it into practice seem necessary.

Keywords Knowledge · Attitude · Practice · Semi-industrial kitchens · Food handlers

Introduction

Food borne diseases cause many morbidities and mortalities and are one of the important public health problems [1]. Unsafe food has bacteria, viruses, and parasites, or chemical substances which cause 200 diseases from diarrheal to cancer. World Health Organization estimated that about 600 million people in the world have been fell ill in 2015 after having food. This means that one out of 10 people got affected, and 420 thousand and 33 million lost their lives monthly and yearly respectively [2].

It is obvious that life-styles and food consumption behaviors have changed. The commitment to food preparation at homes has decreased and the incidence of food consumption out of home has increased [3]. Reflecting the trend in rising food consumption outside homes, restaurants and other eating-out establishments are playing an increasing role in setting risk for food borne diseases [4, 5]. Food cooked at large scale has higher chances of Food Contamination due to inappropriate handling by food handlers [6]. Outbreaks of food-borne disease due to contamination by food handlers are 10 to 20% approximately. Improper food handling and paying no attention to hygiene allows pathogens to come into contact with food and sometimes survive and increase in adequate numbers and, at last, cause illness in consumers [7].

The World Health Organization has introduced five key features of safe food. These are 1. Keep clean; 2. Separate

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raw and cooked materials; 3. Cook thoroughly; 4. Keep food at safe temperature; and 5. use safe water and raw materials [8]. Three important factors are related to food handlers and have an essential role in food poisoning. These are knowledge, attitude, and practice [9]. Mortlock et al. (1999) declared that there is general agreement among numerous authors that good level of knowledge towards food safety among food handlers and the effective practice of such knowledge in food handling are essential in ensuring the safe production of food in catering operations [5]. Howes et al. (1996) showed the relationship of positive behavior, attitudes, and constant education of food handlers towards the preservation of safe food handling practices [10]. They also indicated that approximately 97.0% of food borne outbreaks in the USA were due to mishandling in food service fields [11].

Previous studies have revealed the problems which food handlers in food servicing face. These include knowledge on critical cooking, storage temperatures, and personal hygiene [3]. According to our knowledge, no study of this kind has been conducted on food handlers in Iran using W.H.O questionnaires and there are few study on food handlers KAP; hence, the objective of this study is to assess the knowledge, attitude, and practice with reference to the five principles of food safety among food handlers in semi-industrial catering in a government office in Tehran.

Material and methods

This study is the second phase of a project. The first step relates to translation and standardization of World Health Organization questionnaires on the five principles of food safety: these were sourced from an Iranian journal [12]. This study is the second phase of this project, wherein these questionnaires have been applied in the field. Hence, a descriptive-analytical study was designed and conducted in a cross-sectional manner. The statistical population was food-handlers of semi-industrial catering in one of the government office in Tehran. A total of 100 food handlers were included in this study, but five questionnaires were considered invalid due to incomplete responses. Questionnaires were taken from the manual of the World Health Organization for food handlers, titled “Five keys to safer food” [8]. WHO had introduced these in a poster in 2001, and we used the manual of the five keys available in the WHO site in PDF format. This manual has two sections. There are three forms at the end of Section 2 to evaluate food safety knowledge, attitude, and behavior of the participants. As was mentioned before, at first phase these questionnaires were standardization. The knowledge questionnaire had 11 questions, to which the specialist added one question to the first key and modified some of them to ensure transparency and better understanding of each questions. Two questions related to the first, second, third, and fifth keys, and three to the fourth key. Each of these questions was answered with yes, no, or don’t know options.

In the attitude section, the questionnaires were distributed in the same way as above and questions were answered with agree, disagree, and not sure. The specialist also added one question to the fifth key, which increased the number of questions to 11. Regarding practice, a total of 10 questions were answered with always, most times, sometimes, not often, and never: for each key two were added. No modifications were done in this part.

The following steps were performed for standardization: 1) getting permission of the World Health Organization; 2) translating the questionnaire twice in Persian and again in English; 3) using expert ideas and determining the inter rater agreement (IRA), relevancy, and clarity of each question and the tool as a whole; 4) measuring reliability with Cronbach’s alpha, and then repeatability with intra-cluster correlation through repeated test-piloting after one month. Using a conservative and mean approach, the IRA for the overall relevancy and clarity of the tools were 81%, 90%, 90%, 95%, 95%, and 97.5% respectively. The overall Cronbach’s alpha for the KAP were 70%, 73%, and 99% respectively, and the intra-cluster correlation (ICC) that were obtained by comparing the overall score of the questionnaire in the pre-test and the test phase were 0.69%, 0.75%, and 0.99% respectively.

The questionnaires finally distributed included four parts. The first part of the final questionnaire was the respondents’ demographic characteristics, such as age, sex, education, job status, and work experience; the others were KAP questions.

The level of knowledge of the food handlers was determined this way: for each correct answer two points, for wrong ones one point, and for don’t know zero point. This score allocation was applied for attitude as well. Based on the response to 12 knowledge questions, the scores could vary from 0 to 24. Three levels were considered for this: scores between 0 to 8 were classified as poor, 9 to 16 as moderate, and 17 to 24 as good. Total scores could differ for 11 attitude questions: 0 to 22 were classified, and classifications were as 0 to 7 being negative, 8 to 14 being neutral, and 15 to 22 being positive levels of attitude. For 10 practice questions, the answers were pointed from 1 to 5 where 1 refers to never and 5 to always.

ANOVA and t-test were used to analyze the relationship between the three variables of knowledge, attitude, and practice with demographic characteristics and variables of the research. The Pearson correlation coefficient test was used to determine the correlation between knowledge, attitude, and practice.

Results

A high number of participants were male, with no diploma education, and belonged to the age group of 31 to 40 years old: 92.6 % passed the public health course (Table 1).

Table 1 Demographic characteristics of the study population ($n = 95$)

Demographic variables	Status	Percent
Gender	male	87.4
	female	12.6
Age group	20–30	24.4
	31–40	32.6
	41–50	26
	51–60	11
	Over 61	2
Education level	No diploma	55.8
	diploma	33.7
	Associate degree	3.1
	License	7.4
Kind of job	Cook	34.6
	cook assist	23
	storage in charge	28
	servant	7.4
	others	7
Passing general health course	Yes	92.6
	No	7.4

In the knowledge section, questions numbers 4, 6, 7, and 8 were negative items where participants could choose a "No" option.

Most levels of knowledge belonged to the fifth and first keys with 96.4% and 95.4% correct answers relating to each of these keys. The least level related to the fourth and the third keys with 54.7% and 65.8% correct answers belonging to each of these questions. Second key with 86.8% correct answers were placed on the third level (Table 2).

In the attitude section, question numbers 1, 4, and 11 were negative items and the respondents could select the "disagree" option.

The highest level of attitude related to the first key with 94.7% and the least level belonged to the second key with 80% correct answers relating to each of these questions. The fourth key had 87.4%, the third key 86.3%, and fifth key with 84% correct answers: these gained second, third, and fourth levels respectively (Table 3).

In the practice section, the best level of behavior related to the fifth key with 97% and improper practice belonged to the third key with 73% correct answers relating to each of these questions. The fourth key with 97.5% the first key with 86%, and The second key with 85% correct answers were in next levels respectively (Table 4).

The level of knowledge, attitude, and practice of the food practitioners were determined and based on the responses and methodology of our research: 88% of the participants scored above 17 and were considered to have good knowledge, while 12% were considered to have moderate knowledge. Regarding attitude, 94% of the food handlers who scored above 15 points were regarded as having a positive attitude and the remaining 6% were placed in the neutral group. For practice, 100% of the respondents scored above 37 and were considered to have good behavior (Table 5).

Significant relations were found between knowledge and attitude and also attitude and practice: these were (p <0.001) and (p= 0.001) respectively. There was no significant relation between knowledge and practice. A significant relation was also found among attitude and sex (p= 0.03), job status (p= 0.004), and passing the public health course (p = 0.045). The Schefee test showed that mean differences in variable of job status related to participants who worked as cook assistants and worker of storage wards. Moreover, a significant relation was also found between age and practice at p= (0.001) where the age group ranged between 40 to 50: the next bracket, 40 to 50, showed better behavior. Lastly, the level of education was found to not have a significant relation with KAP.

Discussion

Knowledge, attitude, and practice were found to have good levels in this research.

In the knowledge section, participants were good in terms of separation of raw and cooked materials and using healthy water and material. They were found to be poor in terms of keeping food at safe temperatures (fourth key) and cook thoroughly (third key). This shows that our findings are consistent with several studies. [3, 13–19]. Osili et al. (2013) showed that the lowest levels of knowledge belonged to safe storage, defrosting, and cooking and reheating of food [3]. This is consistent with this study. In some works very few respondents gave correct answers on keeping food at the right temperatures [17, 18, 20]. Although scores for knowledge, attitude, and practice were found to be good in these recent studies, the participants had poor knowledge on reheating and on safe temperature for food.

Sharif et al. (2013) found that in spite of good knowledge levels among food handlers, they had poor knowledge on defrosting and safe temperature (fourth key) [21]. Fadei (2015) found that although the level of knowledge among food workers was good, many answered the question relating to safe temperatures wrongly [22]. Cuprasitrut et al. (2011) showed that the participants did not reheat ready-to-eat foods [19]. Furthermore, Buccheri et al. (2007) showed that nursing staff had little knowledge about the correct temperature for storing ready-to-eat (warm and cold) food: 61% of the respondents were found to defrost frozen foods at room temperature [23]. All of these studies are consistent with this study.

Our findings indicate that the importance of food temperature and its relationship with the control of microbial dangers is not clear or understood by people who work in the food

Table 2 Responses to knowledge questions about 5 keys to safer food

	Question		True	False	Don't know	Total
1	Washing hands with water and soap for 20 s before handling food is important	count	95	0	0	95
		Percent%	100	0	0	100
2	Wiping cloths can spread microorganisms	count	84	2	9	95
		Percent%	88.4	2.1	9.5	100
3	Insects) for examples flies and beetles) and rattles (e.g. mouse) can cause and spread disease.	count	93	2	0	95
		Percent%	97.9	2.1	0	100
4	The same cutting board can be used for raw and cooked foods provided it looks clean	count	17	72	6	95
		Percent%	18	75.8	6.2	100
5	Raw food needs to be stored separately from cooked food.	count	93	2	0	95
		Percent%	97.9	2.1	0	100
6	Cooked foods do not need to be thoroughly reheated.	count	35	56	4	95
		Percent%	36.8	59	4.2	100
7	When meat and poultry were cooked thoroughly (e.g. for kebab and chicken barbeque) their color should be pink.	count	38	48	9	95
		Percent%	40	50.5	9.5	100
8	Cooked meat can be left at room temperature overnight then put them in the refrigerator	count	50	44	1	95
		Percent%	52.6	46.3	1.1	100
9	Cooked food should be kept very hot before serving	count	77	12	6	95
		Percent%	81.1	12.6	6.3	100
10	Refrigerating foods only slows Food spoilage	count	67	14	14	95
		Percent%	70	15	15	100
11	Safe and plumbing water must be used for preparing and cooking	count	92	2	1	95
		Percent%	96.8	2.1	1.1	100
12	Damaged or rotting fruits and vegetables should be separated and then fresh and safe ones should be washed.	count	91	4	0	95
		Percent%	96	4	0	100

industry. This issue is a critical point in preparing food and implementing food safety programs [14].

With reference to the attitude part, questions relating to keeping clean and safe temperature had best scores. This was consistent with Buccheri et al.(2007) who found that the best attitude belonged to keeping food at safe temperature [23].

The least scores belonged to separating knives and cutting board for raw and cooked materials and a question that we added to this questionnaire.

In Cuprusitrut et al. study (2007) 76.9% of food handlers used separate knives and boards [19]. Rosnani et al. (2014) founded that 80% of respondents did not agree to separate raw and cooked food [15]; in another research by liu et al. (2015) separating did not happen in practice although it had good score in knowledge [17]. Kitagawa et al. figure out 93% of participants did not have separate storage for raw and cooked foods [24].

Our added question was: "I think I can distinguish safe foods and spoiled ones by looking at them and this is a safe way." This is a worrying issue because food handlers did not know they cannot trust their eyes to figure out whether foods are healthy or not. They put the other people in danger of food born diseases so authorities should pay attention about content of health courses to train them correctly and effectively.

In practice or self-reported behavior, best scores belonged to using safe water and raw materials; lowest scores related to cooking thoroughly. Our finding was consistent with Buccheri et al. (2007) who found that participants rarely separated raw and cooked materials. This was also consistent with Sharif et al. (2013) [21]. Also, washing raw materials in Soares et al. (2012) were low: this study is inconsistence with our research [18].

Regarding Alpha Cronbach's, ICC, and answers to the practice questionnaire, these were good and had strong levels. It seems that most of the respondent did not answer the questions honestly and they intentionally chose the best response for satisfaction of the authorities—or, maybe, the questions overlapped with each other. During visits to these kitchens, we rarely saw food handlers washing their hands during preparation or using separate cutting boards for raw and cooked materials unless their supervisors reminded them. Meanwhile, 98% of them had reported that they washed their hands and used separate cutting boards always or most of the time. The situation in some kitchens where the supervisors were not sufficiently alert about food safety principles was worse. Again, 94% mentioned that they always or most of the time defrost frozen food in a cold place, but our observation

Table 3 Responses to attitude questions about 5 keys to safer food

	Question		Agree	Not sure	Disagree	Total
1	Frequent hand-washing during food preparation wastes time.	count	3	6	90	95
		Percent%	3.2	6.3	90.5	100
2	Keeping kitchen surfaces clean reduces the risk of illness.	count	94	1	0	95
		Percent%	99	1	0	100
3	Keeping raw and cooked food separate helps to prevent illness.	count	92	2	1	95
		Percent%	97	2	1	100
4	Using different knives and cutting boards for raw and cooked foods is worth the extra effort.	count	19	12	64	95
		Percent%	20	12.6	67.4	100
5	Looking at the colors of meat and poultry, touching and testing them or thermometer are necessary for ensuring food is cooked thoroughly	count	72	8	8	95
		Percent%	83.2	8.4	8.4	100
6	Soups and stews should always be boiled to ensure safety.	count	85	7	3	95
		Percent%	89.5	7.4	3	100
7	Thawing food in a cool place is safer.	count	83	8	4	95
		Percent%	87.4	8.4	4.2	100
8	I think it is unsafe to leave cooked food out of the refrigerator for more than two hours.	count	83	5	7	95
		Percent%	87.4	5.2	7.4	100
9	Inspecting food for freshness and wholesomeness is valuable.	count	92	2	1	95
		Percent%	97	2	1	100
10	I think it is important to throw away foods that have reached their expiry date.	count	93	1	0	95
		Percent%	98	2	0	100
11	I think I can distinguish safe foods and spoiled ones by looking at them and this is a safe way.	count	54	17	24	95
		Percent%	57	18	25	100

Table 4 Responses to self reported behavior questions about 5 keys to safer food

	Question		Always	Most times	Some times	Not often	Never	Total
1	I wash my hands before and during food preparation.	count	78	15	2	0	0	95
		Percent%	82	15.8	2.1	0	0	100
2	I clean surfaces and equipment used for food preparation before re-using on other food.	count	85	7	3	0	0	95
		Percent%	90	7	3	0	0	100
3	I use separate utensils and cutting-boards when preparing raw and cooked food.	count	76	13	5	0	1	95
		Percent%	80	14	5	0	1	100
4	I separate raw and cooked food during storage.	count	86	8	1	0	0	95
		Percent%	90.5	8.4	1	0	0	100
5	I check that meats and poultry are cooked thoroughly looking at the color, touching and testing them or by using a Thermometer.	count	74	18	3	0	0	95
		Percent%	78	19	3	0	0	100
6	I reheat cooked food until it is piping hot throughout.	count	65	22	7	1	0	95
		Percent%	68.4	23.2	7.4	1	0	100
7	I thaw frozen food in the refrigerator or other cool place.	count	79	10	3	3	0	95
		Percent%	83.1	10.5	3.2	3.2	0	100
8	After I have cooked a meal I store any left-overs in a cool place within two hours.	count	72	14	7	1	1	95
		Percent%	76	15	7	1	1	100
9	I check and throw away food beyond its expiry date	count	93	1	1	0	0	95
		Percent%	98	1	1	0	0	100
10	I wash fruit and vegetables with safe water before eating them.	count	91	1	1	0	0	95
		Percent%	96	3	1	0	0	100

Table 5 Mean percentage score for knowledge, attitude, and practice

	Mean	SD
Knowledge	21.1	2
Attitude	19.5	2.1
Practice	48.7	2.8

showed that 94% was not near to reality. Thus, based on our observations, using self-reported behavior questionnaire with the current questions and answers has restrictions and it needs revision and modification, or impartial persons to fill the questionnaire.

A significant relation was found between knowledge and attitude at $p< 0.001$: this finding was consistent with several studies [5, 15]. A significant relation was found between attitude and practice at the level of $p = 0.001$. This result is consistent with these studies [5, 14, 25] but consistent with Rosnani et al. (2014) and Annor and Byden (2011) [6, 15].

Previous studies indicated that increasing the level of knowledge leads to behavioral changes in food handlers. Furthermore, the attitude of staff can improve their practices [26]. That there is no significant relation between knowledge and practice is consistent with studies by some researches [6, 22, 27–29]. These studies show that education can increase knowledge but it does not necessarily lead to changes in attitude and behavior. Moreover, Henroid et al. (2004) found that although participants who served food in school had good knowledge, they did observe safe practices during preparation [30]. Our findings are consistent with several studies [15, 19, 25, 31].

Some studies have identified knowledge as a prerequisite factor in safe food exposure [32, 33] while some studies have shown that increasing the knowledge of food handlers and knowledge alone in the field of food handling do not lead to improvements in behavior [34] Still, training is indispensable for ensuring that workers have the alertness and knowledge essential for following food hygiene standards even if does not result in positive changes in food handling behavior [29, 35]. Therefore, substitute educational strategies, such as those based on motivational health education and promotion models, are required [28, 36]. A chain of personal, social, and workplace issues influence the practices of food workers: these issues require to be studied to understand how change in behavior may take place [37]. Furthermore, other factors such as organizational atmosphere in the company, level of job satisfaction, labor situation, and relations between employees and their supervisors have a considerable effect on employees' behavior [14].

We did not find significant relation between knowledge and practice: this is consistent with several studies. In these studies, participants had knowledge about food safety but they still did not observe safety in exposures of food [17, 22, 23, 29, 38]. Thus, motivation, initiative, and training should be supplied to encourage food handlers to have proper handling and right attitudes, and follow safe processes during food preparation [39].

A significant relation was observed between passing the health course and attitude: this is consistent with a number of researches [3, 15, 25, 40] but inconsistent with several studies [7, 41–43]. Our finding asserts that passing the training course on food health results in a positive attitude. These courses may lead to increase in knowledge and improvement in the practices of food workers. Mederios et al. (2011) found that knowledge about food safety and belief in education have positive impact on practice [44]. A few studies have shown that lack of knowledge may lead to poor hygiene practices [45, 46]. Training may also help improve food handlers' practices and bring them more in line with the demands of food safety: this is critical for food safety systems because instruction and proper control increase the potential of food operators [47].

We found a significant relation between attitude and gender: this is consistent with several studies. Sharif et al. (2013) and OI Nee and Sani (2011) found that KAP scores among women are higher than men. Abdullahi et al. (2016) indicated that although women had a higher level of knowledge, men had better practice [5, 21, 48].

A significant relation was observed between job status and attitude. Cooking assistants and the respondents who were storage in-charges had better scores. Sharif et al. found scores of KAP for cooks and nutritionists had statistically similar means of 91.6, but these occupations differ significantly from waiting. Moreover, Zain and Naing [2002] found that there are differences in knowledge levels between managerial and operational jobs. It seems that individuals who follow a professional career path learn the rules and regulations of that profession from the environment, from their peers, or through training.

We found a significant relation between age and practice. Age groups ranging from 31 to 60 years had better practice than 20 to 30 years, and 50 to 59 over 61 years. This result is consistent with Siau et al. (2015) and Bredbenner et al. (2007), who believed that growing old, can promote better practices [14, 49]. This is also consistent with Annor and Bydan (2011), who did not find a relation between these two variables. Maybe people aged less than 30 years and those aged over 60 years do not have enough interest and motivation to work seriously. Some researchers believed education relating to food safety should target younger people [50, 51].

Though the levels of knowledge, attitude, and practice were high, the scores of participants in some items such as cooking thoroughly, keeping food at safe temperature, and cleaning hands frequently were low for the knowledge section. Also, in the attitude section it was found that recognizing spoilt food from its appearance and separating raw and cooked

were low: hence, these variables should be promoted to ensure safe practices among food handlers.

The World Health Organization declared in 1998 that food handlers should take proper training on food safety principles [52]. Hence, the five keys about food safety must be included in public health courses and training programs for food handlers: particular attention must be given to the third (cook thoroughly) key and the fourth (keep food at safe temperature) key. These need more attention because most of participants do not have sufficient knowledge on them. Repeating these courses at regular intervals could be effective. Besides training, managers should induce their food handlers to practice food safety and not just provide structural design requirements for hygienic practices. Lastly, food workers should take their own initiatives to enhance their knowledge on food health and attempt to be more positive towards food safety practices [37].

Conclusion

Food handlers need to be trained and motivated to promote knowledge and turning it into practice. Since a large number of people, due to their busy lifestyle buy their meals from public food services, it is necessary to ensure safe food exposure will happen. In addition, the results of such studies can be made available to relevant authorities to make known them with the weaknesses of food service providers in the three areas of knowledge, attitudes, and practice, thus aiding to develop special training programs for these people with more information and customized to their needs.

Compliance with ethical standards

Conflict of intrest The authors have no conflicts of interest with the material presented in this paper.

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Research limitation

We adopted the questionnaires for semi-industrial and non-industrial catering in Iran and studied only five keys for safer food.