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Evaluation of Food Safety Knowledge Among Food Handlers

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ABSTRACT This study aimed to evaluate food handlers' knowledge regarding personal hygiene and food safety. A total of 200 food handlers from 30 independent food businesses in Kars, Turkey has been questioned in this survey. One (1) point was given for each correct response and zero (0) point for the false and "Do not know" answers. The questionnaires having 29 points were scored with 5. The knowledge of the respondents who got ≥3 was considered as adequate. Most of the participants were male (66.5%) and mainly under the age of 24 (42.5%) or between the age of 25-34 (33.5%). Nearly half of the participants (46.5%) had high school education (11 years). Only 25% of the workers who were mainly cooks declared that they had attended to a food safety training course. Seventy six percent of the respondents were waitress/waiter. Almost half (43%) of the food handlers got ≤2.9 (out of 5 points) point which indicated that they did not have adequate knowledge about personal hygiene and food safety. Male workers were more successful at the questionnaire while age had not a significant effect. Personal hygiene, cross-contamination, thawing frozen meat and reheating of foods were the sections in which the respondents gave false answers frequently. The knowledge of participants neither about food safety nor personal hygiene is enough to prepare or serve safe food. But it was observed that education level and attending training courses had a positive effect on responding questions correctly.

Keywords: *Food safety knowledge, Food handlers, Training, Public health*

ÖZ

Gıda İşçilerinin Gıda Güvenliği Hakkındaki Bilgilerinin Değerlendirilmesi

Bu çalışmada, gıda işçilerinin kişisel hijyen ve gıda güvenliği bilgilerinin değerlendirilmesi amaçlanmıştır. Araştırmada, Kars'ta yer alan 30 farklı işletmeden 200 gıda işçisi anket yoluyla sorgulanmıştır. Her bir doğru yanıt için bir (1), yanlış veya "Bilmiyorum" yanıtları için sıfır (0) puan verilmiştir. Tam 29 puan alanlar beş (5) ile skorlanmıştır. Buna göre ≥3 ve üzeri skora sahip olanların bilgisi "Yeterli" olarak değerlendirilmiştir. Profil sonuçlarına göre katılımcıların çoğunluğunun (%66.5) erkek ve 24 yaş altı (%42.5) ya da 25-34 yaş arasında (%33.5), yaklaşık yarısının (%46.5) lise mezunu, sadece %25'inin gıda güvenliği eğitimi almış ve %76'sının garson olduğu görülmüştür. Ankete katılanların neredeyse yarısı (%43) ≤2.9 ile skorlanmıştır ki bu kişisel hijyen ve gıda güvenliği konusunda yetersiz olduklarına işaret etmiştir. Erkekler daha fazla başarı gösterirken yaş etkili bulunmamıştır. En fazla yanlış yanıta, kişisel hijyen, çapraz kontaminasyom, dondurulmuş etlerin çözünmesi ve gıdaların yeniden ısıtılması kategorilerinde rastlanmıştır. Katılımcıların genel olarak gıda güvenliği ve kişisel hijyen konularında, güvenli gıda hazırlayıp servis edecek yeterlikte bilgiye sahip olmadığı görülmüştür. Ancak eğitim seviyesi ve gıda güvenliği eğitimlerinin doğru cevaplar vermede olumlu etki gösterdiği ortaya konmuştur.

Anahtar Kelimeler: *Gıda güvenliği bilgisi, Gıda işçileri, Eğitim, Halk sağlığı*

INTRODUCTION

Foodborne diseases are serious problem, both in developed and developing countries, causing a significant social and economic burden (Martins et al. 2012). The most frequent cause of outbreaks are mass catering and food service facilities (Todd et al. 2007). Therefore, the European Commission has recognized the importance of controlling food-poisoning outbreaks owing to the increasing number of meals consumed outside the home, in parallel with the ever-expanding range of pre-prepared meals. This changing consumer lifestyle emphasizes the need for better, effective ways of controlling food hygiene (Baş et al. 2006).

In many cases, food from sources which are unsafe, inadequate cooking, improper holding times, temperatures, storage or reheating, cross-contamination and poor personal hygiene are the causes of the issue in question (Pichler et al. 2014). Especially food handlers

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play an important role in foodborne illnesses. Food workers can carry food poisoning organisms asymptomatically or be responsible from cross-contaminating raw and processed foodstuffs, and improper food cooking/storing (Cruickshank 1990). A lack of food hygiene awareness or implementation is the major cause of these contributory factors. Those premises are strongly linked with low levels of training and poor practices (Audit Commission 1990). Management attitude towards training, standards of food handling practice and levels of food hygiene knowledge are also correlated (Kitcher 1994). Good hygiene practices must be applicated in food businesses to protect consumers from foodborne diseases. Therefore, food handlers should have the knowledge and skills to apply these practices (Martins et al. 2012). The need for training of food workers is an essential part of HACCP concept and is thus recognized by EU legislation (EU Regulation 852/2004) and by international organizations such as the WHO (World Health Organization 2000). Food safety training has also become legislated in many countries (Abushelaibi et al. 2015).

In Turkey, the workers employed in the catering sector have a low level of formal education and have a limited average stay with the same employer. The majority of employees work in plants with fewer than 10 employees (Baş et al. 2006). All Turkish food businesses must provide food hygiene training commensurate with the work activities of their staff according to new regulations in Turkish Food Codex (Sağlam 2000). From this point of view, this study was conducted to evaluate the educational level of food handlers and determine their knowledge on food safety and personal hygiene in province of Kars, Turkey. By this means, it was aimed to provide baseline data to assess the effectiveness of training programs used in the Turkish food sector.

MATERIALS and METHODS

Population under study

In this study 200 food handlers from different plants were interviewed. Questionnaires were responded individually, in the presence of the researcher, 30 minutes time required for completion.

The questions were based on the research which was conducted by Pichler et al. (2014) with some additions and modifications. The first seven questions were about the characteristics of food businesses and food workers' age, gender, education, profession and attendance to a food safety course. The remaining 29 were intended to assess knowledge of participants in relation to personal hygiene and food safety. The responses to those 29 questions were measured on a nominal scale. One (1) point was given for each correct response and zero (0) point for the false and "Do not know" answers. The questionnaires having 29 points were scored with 5. The knowledge of the respondents who got ≥3 was considered as adequate. The detailed data were presented in Tables 1-6.

Statistical analysis

The statistical analysis of data was performed using SPSS Statistics 20.0. Pearson's Chi-square, Mann Whitney U and Kruskal-Wallis tests were used to analyse and detect statistical differences between samples. Statistical significant was set at a *p value* <0.05.

RESULTS AND DISCUSSION

Characteristics of the businesses

In this study, 30 independent food businesses were visited. Twenty-seven of these plants were restaurants or cafés which were serving animal originated foods while the other 3 were small businesses serving homemade traditional foods. Most of them were small scale (46.6 %). Details are presented in Table 1.

Characteristics of food handlers

Most of the participants were male (66.5%). They were mainly under the age of 24 (42.5%) or between the age of 25-34 (33.5%). Nearly half of the participants (46.5%) had high school education (11 years). Only 25% of the workers who were mainly cooks declared that they had attended to a food safety training course. Seventy six percent of the respondents were waitress/waiter. The detailed data were presented in Table 2 and Table 3.

Table 1. Characteristics of the food businesses and the number of the participants who work for those places

		Frequency (Plants/Food Handlers)	Percentage (Plants/Food Handlers)
Type	Restaurants and cáfes serving animal originated foods	27 / 166	90.0 / 83.0
	Small businesses serving homemade traditional foods	3 / 34	10.0 / 17.0
Capacity	Small scale	14 / 75	46.6 / 37.5
	Medium scale	9 / 31	30 / 15.5
	Large scale	7 / 94	23.3 / 47.0
Cleaning	Done by a cleaning company	1 / 4	3.3 / 2.0
	Done by plant's own staff	29 / 196	96.6 / 98.0
Pest Control	Done by a private pest control company, regularly	11 / 116	36.6 / 58.0
	Done by plant's own staff, regularly	9 / 31	30 / 15.5
	Done by plant's own staff when it is needed	4 / 22	13.3 / 11.0
	I don't know	6 / 31	20 / 15.5

Table 2. Characteristics of food handlers

		Frequency	Percentage
Gender	Female	67	33.5
	Male	133	66.5
Age (Years)	<24	85	42.5
	25-34	67	33.5
	>35	48	24.0
Education	Primary School	62	31.0
	High School	93	46.5
	University	45	22.5
Food Safety Training Course	Yes	50	25.0
	No	150	75.0
Profession	Waiter/Waitress	152	76.0
	Cook	48	24.0

Table 3. Food safety training status of food handlers

Profession	Yes (%)	No (%)	Total
Waiter/Waitress	25 (16.4)	127 (83.6)	152
Cook	25 (52.1)	23 (47.9)	48
Total	50 (25)	150 (75)	200
X^2= 24.708; p<0.001			

Table 4. Knowledge scores of food handlers from food safety test

Score	Frequency (Person)	Percentage
<1	46	23.0
1.0-1.9	9	4.5
2.0-2.9	31	15.5
3.0-3.9	77	38.5
≥4	37	18.5
Total	200	100.0

Table 5. Food safety knowledge scores among different categories

Categories		Mean	Standard Error	Mann Whitney U, Kruskal Wallis Test	P
Gender	Female	2.705	0.1672	3492.50	0.012*
	Male	3.043	0.1194		
Age (Year)	<24	2.808	0.1551	3.862	0.145
	25-34	3.096	0.1710		
	≥35	2.915	0.1820		
Education	Primary School	2.876	0.1709	9.465	0.09*
	High School	2.707	0.1526		
	University	3.464	0.1613		
Food Safety Training Course	Yes	3.815	0.0603	1713.00	0.000*
	No	2.635	0.1192		
Profession	Waiter/Waitress	2.777	1.4153	2491.00	0.001*
	Cook	3.414	1.1449		

*P<0.05

According to surveys from different parts of the world, the percentage of male and female food workers is almost equal and the mean age is around 35 ranging between 19 and 65. Majority of the food handlers has six or less years of education and the number of the persons who attended a food safety training program is still low although it is mandatory by law in many countries (Buccheri et al. 2010; Jianu and Chis 2012; Martins et al. 2014; Pichler et al. 2014; Sani and Siow 2014; Liu et al. 2015). Comparing to other studies, respondents in our study are younger and have higher educational level. However, the rate of participating to a food hygiene course is quite low like the other researchers declared previously.

Results in relation to sample characteristics

Of the 200 food handlers questioned in this study, 43% got ≤2.9 (out of 5 points) point which indicated that almost half of the participants did not have adequate knowledge about personal hygiene and food safety.

In a previous study conducted in our country, Baş et al. (2006) obtained even worse results. The mean knowledge score of food workers participated their survey was 43.4 (100 possible points).

Many researchers from different countries also reported poor knowledge of food handlers. In one of these food handlers from Portugal were assessed and the average score of questions answered correctly was found as 13 out of 23 (56.5%) (Martins et al. 2012). A couple of years later, Martins et al. (2014) evaluated the food hygiene knowledge of respondents in Portugal and they discovered that the average score was 13.9, corresponding to 60.7% of the questions. The situation was almost the same in western Romania; Jianu and Chis (2012) questioned food handlers of small and medium-sized companies and recorded the mean value of hygiene knowledge of the food handlers as 63.2%. Osaili et al. (2013) from Jordan reached relatively better scores. Workers in fast food restaurants participated in their survey and the knowledge of food handlers on food safety concept was considered as fair. The overall score of correct answers for the food safety tested aspect was 46.47 out of 67 points (69.4%).

Table 6. Frequencies of correct responses to food safety knowledge questions of food handlers

Questions (Answers)	Correct Responses		False Responses	
	n	%	n	%
At work if you only urinated, and did not a bowel movement, you do not need to wash your hands. (True/*False*)	161	80.5	39	19.5
Do you need to have thoroughly washed hands if you use wax paper to handle food? (*Yes*/No)	163	81.5	37	18.5
Do you need to have thoroughly washed hands if you use a spatula or tongs to handle food? (*Yes*/No)	117	58.5	83	41.5
Do you need to have thoroughly washed hands if you use single use gloves to handle food? (*Yes*/No)	109	54.5	91	45.5
To wash your hands had you better use warm or cold water? (Cold/*Warm*)	135	67.5	65	32.5
About how many seconds should you lather your hands with soap? (At least *10 second*)	91	45.5	109	54.5
On what should you dry your hands? (Multiple choice question type) (*Paper towel or air dryer*)	108	54.0	92	46.0
You should avoid wearing jewellery when you prepare or serve food. (*True*/False)	131	65.5	69	34.5
When you suffered from vomiting or diarrhoea but don't feel really ill, you are allowed to handle ready to serve food like sandwiches or salad on that day. (True/*False*)	132	66.0	68	34.0
If you are ill with diarrhoea, it is okay to handle raw food as long as that food will be cooked. (True/*False*)	115	57.5	85	42.5
When you sneeze, you could contaminate food with germs and cause to food poisoning. (*True*/False)	132	66.0	68	34
When a food handler has a cut on his/her hand he/she should cover it properly and wear single use gloves. (*True*/False)	150	75.0	50	25.0
The most common symptom of food poisoning is diarrhoea; however, heart, kidneys, liver and brain also could be affected, people even could die. (*True*/False)	143	71.5	57	28.5
What kind of sources could contaminate food with germs? (Multiple choice)	124	62.0	76	38.0
Why raw and cooked foods must be stored separately and avoid their contact to each other? (Multiple choice)	102	51.0	98	49.0
Raw meat can be stored anywhere in a refrigerator as long as it is tightly sealed in plastic film. (*True*/False)	112	56.0	88	44.0
Cooked food must be portioned into small amount before the cold storage to make the cooling process faster. (*True*/False)	124	62.0	76	38.0
Frozen meat can be thawed on the kitchen bench at ambient temperature. (True/*False*)	46	23.0	154	77.0
Frozen meat can be thawed in hot water. (True/*False*)	120	60.0	80	40.0
Cooked food which is stored in the refrigerator must be bring to boiling temperature before serving. (*True*/False)	66	33.0	134	67.0
In a restaurant, ready to eat cooked food (Soup, rice etc.) must be kept at ≥65°C. (*True*/False)	128	64.0	72	36.0
Vegetables for a salad splashed with a few drops of raw chicken juice should not be rinsed but must be thrown away. (*True*/False)	48	24.0	152	76.0
Is it true that if not completely cooked, beef, poultry and egg could cause serious illness? (*True*/False)	114	57.0	86	43.0
You can be sure food is safe to eat when it smells and tastes normal. (True/*False*)	86	43.0	114	57.0
It is safe to store cleaning agents and food in the same area. (True/*False*)	149	74.5	51	25.5
It is safe to dry kitchen utensils (Forks, knives, dishes etc.) with cotton towel. (True/*False*)	106	53.0	94	47.0
You must avoid handling clean kitchen utensils with bare hands. (*True*/False)	142	71.0	58	29.0
The temperature of fridges and freezers must be checked daily. (*True*/False)	146	73.0	54	27.0
It is not safe to store drinks in plastic bottles under sun light. (*True*/False)	147	73.5	53	26.5

In contrast to these disappointing results, promising findings have been cited by other researchers. In a study, Abdul-Mutalib et al. (2012) evaluated food handlers working in restaurants in Malaysia and the results showed that they had excellent knowledge, attitude and good practices toward food (KAP). Liu et al. (2015) also evaluated the KAP among food workers in China. The score of knowledge showed that respondents could give correct answers for more than half of the items. A study conducted by Pichler et al. (2014) in Austria was also one of the questionnaire-based surveys which declared a high score (76%) of average knowledge.

In another survey in Brazil, the level of knowledge was considered as insufficient in spite of average proficiency score being >79% accuracy. It was explained this rate was low, because most participants (92.2%) had already undergone previous food safety training (Soares et al., 2012). Researchers expected to see higher performance, because according to numbers of studies, there was a strong evidence supporting the significant positive effect of both education level and food safety training programs (McIntyre et al. 2013; Jianu and Golet 2014; Martins et al. 2014; Pichler et al. 2014; Liu et al. 2015). Ansari-Lari et al. (2010) also reported in their study; there was significant positive correlation between level of education with general knowledge and knowledge of microbiological food hazards. In addition, there was positive correlation between knowledge and attitude. We also found that education level and food safety training courses had dramatic positive effect on knowledge of the participants.

Finally, in the light of those data Soares et al. (2012) explained that; improper food handling practices are not always a result of low level of education. Personal, social and workplace factors influence the practices of the food handler. It seems that more specific training courses should be planned for food handlers. The courses should include an evaluation process to ensure the effectiveness. It is therefore necessary to evaluate the impact of the knowledge acquired in food safety training to develop methodologies to properly train food handlers.

Beside these major factors like education and food safety training other minor issues like gender and age may be effective on knowledge in some certain cases (Pichler et al. 2014, Liu et al. 2015). Our findings also showed that male workers were more successful at the questionnaire while age had not a significant effect.

Frequencies of correct responses of food handlers to food safety knowledge questions

Table 6 shows how the food handlers responded to food safety questions. These answers indicated that most of the participants were aware of necessity of hand washing after using toilets, however they were not sure how long they should lather their hands with soap and how they should dry them. Similarly, they did not have enough knowledge about the need of having thoroughly washed hands if they use a spatula, tongs or single use gloves to handle foods. It was also interesting that almost half of the food workers believed that when they are ill with diarrhoea they can handle the raw food as long as that food will be cooked. Similar results were obtained by Baş et al. (2006), they also reached low mean score for knowledge of personal hygiene (31.8 out of 100).

For this section of the questionnaire, researchers have reported different results ranging between poor and acceptable. In most of the cases food handlers responded the questions regarding good personal hygiene practice such as washing hands, the use of proper clothing, usage of gloves while handling food, avoiding wearing jewellery and covering cuts with easily identifiable plasters correctly (Jianu and Chis 2012; McIntyre et al. 2013; Osaili et al. 2013; Sani and Siow 2014) while in others hand hygiene remain issue that need to be emphasized in training programs (Martins et al. 2012; Jianu and Golet 2014).

Another section of questionnaire in which food handlers interviewed in this study responded incorrectly was cross-contamination. The ratio of the participants who did not know why raw and cooked food must be stored separately and avoid their contact to each other was nearly 50%. They did not know raw meat can be stored anywhere in a refrigerator as long as it is tightly sealed in plastic film, either. And considering all the responses one of them seemed quite serious; 76% of the food handlers did not believed that vegetables for a salad splashed with a few drops of raw chicken juice should not be rinsed, but must be thrown away. Baş et al. (2006) also obtained almost the same result, according to their findings the mean score of knowledge of cross-contamination was 53.4 out of 100. Similarly, in a study conducted by Jianu and Chis (2012), only 43.9% of the participants knew that raw materials and finished products in a refrigerator must be stored on separate shelves. Sani and Siow (2014) also reported poor knowledge about cross-contamination (44.6%).

Another weak point of the food workers participated our study was thawing frozen meat and reheating of the foods. About three quarters of the respondents thought that frozen meat can be thawed on the kitchen bench at ambient temperature and majority of them did not know the correct temperature for reheating of foods. Baş et al. (2006) and Osaili et al. (2013) also reported that food safety knowledge questions that were most frequently answered incorrectly were related to time-temperature control, cooling, thawing and hand washing practices. It has been the trend in food service establishments to cook the food earlier (Abdul-Mutalib et al. 2012). Food handlers must be aware of the risks food poisoning by preparing food in advance and of the risks related to reheating dishes prior to consumption (Buccheri et al. 2010).

Unfortunately, 57% of the respondents in our survey thought that one can be sure food is safe to eat when it smells and tastes normal. This belief was also common among the food workers participated the study conducted by Jevsnik et al. (2008) and Walker et al. (2003).

CONCLUSION

Current study revealed that majority of the food handlers in Kars, Turkey had insufficient level of education and just a few of them attended a food safety training program. Thus, the level of knowledge regarding personal hygiene, cross-contamination, thawing frozen meat and reheating of the foods was poor. Nearly half of the food workers did not even know that if not completely cooked, beef, poultry and egg could cause serious illness. Almost the same percentage was true for the participants who considered drying kitchen utensils (Forks, knives, dishes etc.) with cotton towel as safe. As a conclusion, the knowledge of participants neither about food safety nor personal hygiene is enough to prepare or serve safe food. But it was observed that education level and attending training courses had a positive effect on responding questions correctly. Therefore, there is an urgent need for food safety training programs and also researches to understand the effects of knowledge gained by these courses on food workers' attitude and practices of food safety.

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