

## Food safety knowledge of food handlers working in hotel kitchens in Turkey

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### ABSTRACT

This study was aimed to examine the food safety knowledge of food handlers in hotels' kitchen, to determine existing knowledge gaps in food safety, and to examine relationship between food safety knowledge and some sample characteristics such as gender, age, education level, professional experience, and past attendance to food safety training course. A total of 378 food handlers working in hotel kitchens, located at six different cities in Turkey, participated in the cross-sectional study. The food safety knowledge score of participants was average with 53.70%. Knowledge scores related the different food safety aspects including personal hygiene (53.60%), food hygiene (53.91%), cross contamination (61.13%), health problems that would affect food safety (52.14%), symptoms of foodborne illnesses (52.00%), HACCP (51.00%) and food allergy (50.89%) were found average level. The most striking result of this study is that although the number of employees receiving food safety training is considerably high (82.3%), the food safety knowledge score was found less than expected. When viewed from this aspect, this work is remarkable about examining into content and adequacy of food safety training in Turkey.

**Keywords:** Food safety, Hotels kitchen, Food handlers, Knowledge, Turkey

## Introduction

Recent studies show that foodborne illnesses affect more than one-third of the total population in developing countries (Sani and Siow, 2014). Several foodborne illness outbreaks are associated with various factors, with the most common being food personnel's poor hygiene (Pichler et al., 2014). Presence of pathogenic microorganisms on food handlers' hands contributes to the existence of those illnesses (Egan et al., 2007; Rebouças et al., 2017). The Centre for Disease Control and Prevention (CDC) has reported that food handlers cause as much as 20% of food-related infections (Assefa et al., 2015). Furthermore, the mishandling of food seems the source of 97% of all foodborne illnesses spread through catering outlets (Egan et al., 2007). Inconvenient practices which are responsible for foodborne microbial illnesses are cross-contamination of raw and cooked foodstuffs, inadequate cooking or reheating of foods, usage of unsafe ingredients, storing food at incorrect temperatures, and cooling food inappropriately (Egan et al., 2007; Webb and Morancie, 2015). All of these factors are generally associated with a low level of knowledge and practices (Webb and Morancie, 2015). Lack of knowledge about food safety of food handlers contributes to the spread of those pathogens during food processing (Pichler et al., 2014). Thus, increase the comprehensive knowledge of food handlers about food safety and the efficient application of current information in food processing are crucial to maintaining safe food production (Bolton et al., 2008). Many studies have been conducted about the food safety knowledge of food handlers in different countries so far, for instance Brazil (Rebouças et al., 2017; Soares et al., 2012), Malaysia (Sani and Siow, 2014), Vietnam (Samapundo et al., 2016), Ghana (Kunadu et al., 2016), Jordan (Osaili et al., 2017; 2018) and Turkey (Baş et al., 2006; Tokuç et al., 2009). In many of these studies' results show that participants had limited knowledge about food safety.

Food that consumed at food and beverage establishments have been continuing to be a significant source of foodborne illnesses. The eating habit of many people have changed especially in large cities, therefore the safety of food is extremely important for trade success of food businesses. As individuals continue to become busier, the number of people eating outside is expected to continue to increase (Choi and Rajagopal, 2013). According to the report of the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control, about twenty-five percent of the foodborne epidemic, occurred in European Union countries, had been found associated with restaurants, cafes, pubs, and hotels (ECDC - European Food Safety Authority and European Centre for Disease Prevention and Control, 2017). Similarly, catering services has also a critical role in the spread of those infections. In the USA, Europe, and Ireland

those had been partially traced to catering establishments (approximately 45%, 22%, and 50% respectively) (Giritlioglu et al., 2011).

Hotels, as an important part of the tourism industry, are one of the most common food production places. Hence, food safety, hygiene, and sanitation are the most critical issues need to be considered by hotel management. If the importance that required is not given to those issues during the preparation and service of the food, it might cause to the health threat for both personnel and customers (Baser et al., 2017). Bolton et al. (2008) stated that the food preparation personnel, and also customers may seriously be affected by the improper hygienic conditions in the hotel kitchens. In Turkey, there were some regional studies had been made for the evaluation of the food safety knowledge of food handlers working in hotel kitchens (Baş et al., 2006; Sanlier et al., 2010; Baser et al., 2017). However, there is no comprehensive study that includes the whole country. The current study aims to examine the food safety knowledge of food handlers working in hotels' kitchen in different cities of Turkey.

## Materials and Methods

### *Research Design and Participants*

A cross-sectional study had been made between May 2017 and September 2017 and involved 378 food handlers working in 22 different food establishments, as a participant. Assessments are comprised of four- and five-star hotels' kitchens in the following cities of Turkey: Ankara, İstanbul, Muğla, Hatay, Diyarbakır, and Nevşehir. The reason why the provinces mentioned in the research are selected as sample was related to the high number of city hotels in these provinces. Since the universe size could not be calculated exactly, the sample size scale table (Yazıcıoğlu and Erdoğan, 2004) was used for determining the sample size. In cases where the universe is 1.000.000 and above, the sample size was considered as min 323, so the 378 sample size reached in this study was sufficient. In sampling, simple random sampling was used in which each element of the universe had equal chance of entering the sample (Arıkan, 2004). After the implementation of questionnaires, face-to-face interviews were performed to guarantee the accuracy of responses which had given to survey questions. Participants were given an ample amount of time (~30 min) to answer the questionnaire.

### *Questionnaire Design*

The questionnaire was prepared from previously performed studies Baş et al., 2006; Giritlioglu et al., 2011; Osaili et al., 2011; Panchal et al., 2014; Shafie and Azman, 2015; Smigic et al., 2016). The questionnaire's reliability was tested via

Cronbach alpha test, with a reliability coefficient of 0.913 (Santos, 1999). In the first part of the questionnaire, some characteristics of subjects were collected such as gender, age, education level, professional experience, past attendance to food safety training courses, the habit of updating knowledge and self-confidence situation about food safety, and the kind of and location of their workplace (hotel). Second part included 65 questions that examined respondents' knowledge of personal hygiene (5 items), cross-contamination (8 items), food hygiene (23 items), health problems that would affect food safety (7 items), symptoms of foodborne diseases (7 items), knowledge of HACCP (Hazard Analysis Critical Control Points) (6 items) and food allergy (9 items) issues. Each question consisted of three optional answers of "yes", "no" and "do not know" in order to reduce the probability of respondents in selecting the correct answer by chance.

### **Data Analysis**

All statistical analyses were performed using the Statistical Package for the Social Sciences, Version 16.0 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics were calculated for all variables. Food safety knowledge scores were analyzed by using an independent sample t-test for two groups or Analysis of Variance (ANOVA) with post-hoc Duncan test for more than two groups.  $p < 0.05$  were considered to be statistically significant. The total food safety knowledge score of respondents' was calculated by summation of the correct answers of the 65 questions included in the seven categories (maximum score is 65). Each correct answer was given 1 point but the incorrect or not sure answer was given 0 points (Osaili et al., 2017). Additionally, the score was converted to a percentage by dividing the total score by the maximum score accessible ( $\text{score}/\text{maximum score} \times 100$ ) and a randomized scoring system was used to assess the level of knowledge (Shafie and Azman, 2015). As per that scoring system, the score that lower than 50% was considered as 'poor knowledge', the score between 50% and 75% was considered as 'average knowledge' and the score that higher than 75% was considered as 'excellent knowledge' (Samapundo et al., 2016).

## **Results and Discussion**

### **Sample Characteristics**

Characteristics of the participants were shown in Table 1. The vast majority of the participants were men (72.2%). In the previous studies, it was mentioned that there were many female kitchen employees in Turkey (Baş et al., 2006; Çakıroğlu and Uçar, 2008). This is because of cultural conditions in Turkey where females do not prefer to work in the hotels' kitchen. Almost half of the participants (53.4%) were

between the age ranges 21–30. The total of 79.3% of all participants had finished elementary and high school, whereas 14.0% had a bachelor degree. The number of food handlers who have baccalaureate is very low in Turkey and the findings of the current study are consistent with that level of education. Regarding professional experience in the food services, 20.1% of all participants had <1 year, 40.3% of them had between 1 year and 3 years, 18.3% of them had between 4 years and 6 years of and 21.2% of them had more than 7 years' work experience. About 82.3% of the participants reported that they were previously attended to training courses about food safety. About three of four all participants stated that they had a habit of following new information (77.2%) and feel confident (79.4%) about food safety. A lot of participants (43.9%) have also reported using the internet to follow new information about food safety.

### **Results of Knowledge Scores in Relation to Sample Characteristics**

There were a significant association between food handlers' knowledge and the variables such as their gender ( $p=0.000$ ), age ( $p=0.000$ ), professional experience ( $p=0.000$ ), past attendance to food safety training course ( $p=0.000$ ), the type ( $p=0.000$ ) and location ( $p=0.000$ ) of their workplaces, the habit of updating information ( $p=0.000$ ), and confidence about food safety ( $p=0.001$ ). Male participants' knowledge score (35.95) was significantly higher than the female's (32.30) ( $p < 0.05$ ). Similarly, it was also determined by Çakıroğlu and Uçar (2008) that the different was significant between knowledge scores about kitchen and equipment hygiene from the aspect of gender. Nevertheless, unlike our study, it was also mentioned that knowledge scores of female employees about general hygiene were higher than male employees. On the other hand, Şanlıer et al. (2010) reported that there the different was insignificant ( $p > 0.05$ ) between genders in their study, which had investigated food safety knowledge levels of food handlers in the hotels' kitchen. Even though the different was found insignificant ( $p > 0.05$ ) amongst participants with regards to education levels, knowledge score of high school graduates (36.49) who are nearly half of the participants (48.9%) was slightly higher than the others. Unlike our study, the different was found significant ( $p < 0.05$ ) between general hygiene knowledge and education status in another study (Şanlıer et al., 2010). The participants who both older than 40 years and the occupational experience longer than 7 years were achieved a higher knowledge score by far (43.15 and 44.60, respectively) ( $p < 0.05$ ). Likewise, Şanlıer et al. (2010) had also pointed out the higher score of those who have had 16 years or more experience about general hygiene in their study. Additionally,

Martins et al. (2012) reported that the knowledge scores increase through age and experience. Results of those studies are concordant with our study and show a positive influence of age and experience on food safety knowledge. The food preparers' knowledge score (36.36) who had received food safety training course (82.3%) were significantly higher than those who had not (28.32%) ( $p<0.05$ ). Many studies have been declared that the most important component for ensuring food safety was a knowledge. Hence, education and training about food safety have been emphasized on various other studies as a must for prevention of foodborne diseases (Ajala

et al., 2010; Choi and Rajagopal, 2013; Mullan et al., 2013; Shafie and Azman, 2015). In terms of hotel types, the knowledge score of food handlers working in five-star hotels (39.72) was significantly higher than those working in the four-star hotels (27.90) ( $p<0.05$ ). Moreover, the knowledge score of food preparers working in hotels in different cities had remarkably varied ( $p<0.05$ ). Those who constantly update their information and declared their self-confidence about food safety have had significantly higher knowledge score than the others ( $p<0.05$ ).

**Table 1.** Characteristics of food handlers and differences in the food safety knowledge scores

		n	%	Mean (Knowledge Score)	Score percent	Within p-value
	<b>Total</b>	<b>378</b>	<b>100</b>	<b>34.91</b>	<b>53.70</b>	
<b>Gender</b>	Male	273	72.2	35.95	55.31	<b>0.000</b>
	Female	105	27.8	32.3	49.69	
<b>Age</b>	15-19	27	7.1	37.14	57.14	<b>0.000</b>
	20-24	89	23.5	32.15	49.46	
	25-29	113	29.9	33.18	51.05	
	30-34	82	21.7	35.56	54.71	
	35-39	27	7.1	34.00	52.31	
	≥40	40	10.6	43.15	66.38	
<b>Education Level</b>	Literate	25	6.6	32.04	49.29	0.197
	Elementary school	115	30.4	33.24	51.14	
	High school	185	48.9	36.49	56.14	
	Two-year degree	30	7.9	36.03	55.43	
	Undergraduate	22	5.8	32.77	50.42	
Post graduate	1	0.3	31.00	47.69		
<b>Professional experience</b>	<1 year	76	20.1	28.42	43.72	<b>0.000</b>
	1-3 years	153	40.5	31.11	47.86	
	4-6 years	69	18.3	39.42	60.65	
	≥7 years	80	21.2	44.60	68.62	
<b>Past attendance to food safety training course</b>	Yes	311	82.3	36.36	55.94	<b>0.000</b>
	No	67	17.7	28.32	43.57	
<b>Type of hotel</b>	Five-star hotel	153	40.5	39.72	61.11	<b>0.000</b>
	Four-star hotel	225	59.5	27.90	42.92	
<b>Location of hotel</b>	Ankara	71	18.8	25.66	39.48	<b>0.000</b>
	Diyarbakır	75	19.8	55.05	84.69	
	Hatay	39	10.3	36.87	56.72	
	İstanbul	81	21.4	25.48	39.20	
	Muğla	92	24.3	30.71	47.25	
	Nevşehir	20	5.3	46.45	71.46	
<b>The habit of following new information about food safety</b>	Yes	292	77.2			<b>0.000</b>
	- Book / Magazine	29	7.7			
	- Television programs	88	23.3	36.27	55.80	
	- Internet	166	43.9			
	- Others	9	2.4			
	No	86	22.8	30.40	46.77	
<b>Self-confident in food safety</b>	Yes	300	79.4	36.06	56.15	<b>0.001</b>
	No	78	20.6	30.64	45.08	

### Total Food Safety Knowledge Score

The knowledge scores related to different food safety areas and the total knowledge status were evaluated according to the percentile score (arbitrary scoring system). The total knowledge score of participants was 53.70% (34.91/65) as shown in Table 2. This result indicated that food handlers working in hotels' kitchen had average knowledge about food safety. The total knowledge score reported in this study was found better than 43.4% as reported in Turkey (Baş et al. 2006) and 46% as reported in small and micro enterprises in South Africa (Cape et al., 2007) for food handlers. Nevertheless, our results on total knowledge of food safety was found quite lower than the studies of Pichler et al. (2014), Osaili et al. (2013), Osaili et al. (2018), Panchal et al. (2014), Gomes-Neves et al. (2007), Martins et al. (2012) and which had been found that score as 76%, 69.4%, 67.1%, 65%, 62.9%, 56%, respectively. We were expected from participants to receive relatively higher scores in food safety knowledge due to the majority of them had reported that they attended a training course about food safety (82.3%). From this point of view, the result has shown that food safety training is not sufficient alone to have knowledge about it. That result might be related to the quality of the training. Food safety educations should be repeated intermittently, their contents should be updated and its competence should be measured by conducting post-training applications and exams.

In general, knowledge score that involved to the different sections of food safety, like personal hygiene (53.60%), cross-

contamination (61.13%), food hygiene (53.91%), health problems which may affect food safety (52.14%), symptoms of foodborne diseases (52.00%), HACCP (51.00%) and food allergy (50.89%) was average level. The highest percentage of correct answers belonged to “knowledge of cross-contamination” (61.13%), while the lowest one belonged “knowledge of food allergy” (50.89%). Food allergy is a more recent issue than the other aspects and it is just mentioned as the subject of food safety training. For that reason, it seemed quite normal to get a lower score. As a result of our study, the knowledge score of personal hygiene (53.60%) was found immensely higher than those in the reports of Martins et al. (2012) and Baş et al. (2006), 51.5% and 31.8%, respectively. Similarly, the knowledge score of cross-contamination in our study (61.30%) was extremely higher than the score calculated both for food handlers at the main campus of University Kebangsaan Malaysia, which reported by Sani and Slow (2014) (44.6%), and at Residential Colleges and Canteen in Malaysia, which reported by Nee and Sani (2011) (46.9%).

### Food Safety Knowledge Related to Different Food Safety Areas

Food safety knowledge related to different food safety areas was examined individually and determined some food safety gaps in these areas. All data related to this section are shown in Table 3.

**Table 2.** Knowledge scores (mean and percentage) related to different food safety areas and total knowledge scores for food handlers in a hotel kitchen in Turkey

Food safety areas	Mean	The possible range of scores	Score percent
Personal hygiene	2.68	0-5	53.60
Cross contamination	4.89	0-8	61.13
Health problems that would affect food safety	3.65	0-7	52.14
Symptoms of foodborne illnesses	3.64	0-7	52.00
Food hygiene	12.40	0-23	53.91
HACCP	3.06	0-6	51.00
Food allergy	4.58	0-9	50.89
<i>Total food safety knowledge score</i>	<i>34.91</i>	<i>0-65</i>	<i>53.70</i>

Table 3. Percentage (%) of correct answers for each question

	Correct answer	
	n	%
<b>Health problems would affect food safety</b>		
<b>Sneezing would affect food safety</b>	196	51.90
Hypertension would affect food safety	202	53.40
<b>Diarrhea would affect food safety</b>	179	47.40
<b>Flu would affect food safety</b>	212	56.10
<b>Fever would affect food safety</b>	217	57.40
Smoking would affect food safety	205	54.20
Covered wound in the hand with wearing a glove would affect food safety	172	45.50
<b>Symptoms of foodborne illness</b>	<b>n</b>	<b>%</b>
Hypertension is a symptom of foodborne illnesses	135	35.70
<b>Diarrhea is a symptom of foodborne illnesses</b>	227	60.10
<b>Nausea is a symptom of foodborne illnesses</b>	206	54.50
<b>Vomiting is a symptom of foodborne illnesses</b>	201	53.20
Pain in the bone is a symptom of foodborne illnesses	199	52.60
Bacteria is the only cause of foodborne diseases	190	50.30
<b>Pathogens in food can cause diseases and even death</b>	220	58.20
<b>Personal hygiene</b>	<b>n</b>	<b>%</b>
<b>Duration of hand washing <math>\geq</math> 20 s</b>	206	54.50
<b>Washing hands after touching money</b>	215	56.90
<b>Washing hands after handling raw meats or poultry</b>	191	50.50
<b>Washing hands before preparing meals</b>	200	52.90
<b>Food-services staff with abrasion or cuts on fingers or hands should not touch unwrapped foods</b>	202	53.40
<b>Cross contamination</b>	<b>n</b>	<b>%</b>
Use same cutting board to cut raw meat or poultry and to chop vegetables	231	61.10
Use same knife to cut raw meat or poultry and to chop vegetables	254	67.20
Wash cutting board used to cut raw meat or poultry with cold water before using it to chop vegetables	227	60.10
Store vegetables salad in the lower shelf in refrigerator if raw meat or chicken in the middle shelf	258	31.70
Store vegetables salad in meat or poultry refrigerator	234	61.90
<b>Wash knife used to cut raw meat or poultry with water and soap then apply sanitizer before using it to chop vegetables</b>	201	53.20
Wash knife used to cut raw meat or poultry with cold water before using it to chop vegetables	239	63.20
<b>Use cap, masks, protective gloves, and adequate clothing reduces the risk of food contamination</b>	206	54.50

\*Sentences in bold indicate the correct expressions.

Table 3 continues. Percentage (%) of correct answers for each question

Food hygiene (safe temperatures, purchasing, storage, thawing, cooking and reheating of the foods)	n	%
<b>5°C is known as minimum temperature danger zone</b>	198	52.40
<b>Refrigerator operating temperature is 1–5 °C</b>	195	51.60
<b>Freezer operating temperature is –18 °C</b>	202	53.40
<b>Reheat food to temperature of 74 °C</b>	202	53.40
<b>Hot food needs to be kept and served at 60 °C or hotter</b>	178	47.10
<b>Cracked, dirty, broken eggs should not be purchased</b>	208	55.00
<b>Damaged and swollen cans should not be purchased</b>	199	52.60
<b>Conserving cooked food and raw food together causes foodborne illness</b>	234	61.90
<b>Store leftover in the refrigerator</b>	201	53.20
Store leftover on the countertop or table in the kitchen	249	65.90
Store leftover in the oven	215	56.90
<b>Frozen foods should be stored in their own packages</b>	220	58.20
<b>The total time in the temperature danger zone must not be longer than 4 hours</b>	225	59.50
Thaw frozen raw meat or poultry on the kitchen counter in an open container	230	60.80
<b>Thaw frozen raw meat or poultry in the refrigerator</b>	206	54.50
<b>Thaw frozen raw meat or poultry in running tap water</b>	205	54.20
<b>Thaw frozen raw meat or poultry in the microwave</b>	110	29.10
Thaw frozen raw meat or poultry on the kitchen counter in a covered container.	185	48.90
<b>It is necessary to check thermometer settings of refrigerators, freezers and store at least twice a day</b>	211	55.80
<b>Improper heating of food causes foodborne illnesses</b>	206	54.50
<b>Check poultry is sufficiently cooked by thermometer</b>	202	53.40
It is perfectly safe to consume food that tastes and smells normal	188	49.70
<b>Food should be served no later than two hours after preparation</b>	221	58.50
<b>HACCP</b>	<b>n</b>	<b>%</b>
<b>HACCP is an international food safety system</b>	208	55.00
<b>HACCP is a preventive system that ensures food safety in all stages of food production</b>	203	53.70
<b>HACCP is a mandatory system in Turkey's food law</b>	184	48.70
<b>The HACCP system requires staff training in hygiene</b>	191	50.50
Microbiological hazards cannot be included in HACCP	161	42.60
<b>HACCP is not a very effective system to provide food safety</b>	211	55.80
<b>Food allergy</b>	<b>n</b>	<b>%</b>
<b>A food allergy is an abnormal response of the immune system to an ordinarily harmless food</b>	202	53.40
<b>Food allergy can result in death</b>	214	56.60
Customers with food allergies can safely consume a small amount of that food	157	41.50
Eczema can be a symptom of food allergy	133	35.20
<b>Asthma can be a symptom of food allergy</b>	198	52.40
<b>Food additives may cause an allergic reaction</b>	204	54.00
<b>Peanut is one of the major foods that cause serious allergic reactions</b>	205	54.20
<b>Labels on food give information about allergic content</b>	203	53.70
Food-allergic reactions occur within from 2 min to 12 h after ingestion	219	57.90

\*Sentences in bold indicate the correct expressions.

### ***Health Problems Would Affect Food Safety***

Infected food handlers might contaminate foods and surfaces, thus, leading to spreading foodborne diseases (Todd et al., 2008). For that reason, having knowledge about health problems that would affect food safety has become a considerable aspect. The percentages of participants who knew that sneezing, diarrhea, flu, fever, and smoking would affect food safety during food processing were 51.9%, 47.40%, 56.10%, 57.40%, 54.20%, respectively. On the other hand, even though that is not scientifically relevant, almost 53.40% of participants were believed that hypertension would affect food safety. Less than 50% of them thought that wearing a glove with a covered wound on their hand would affect food safety. The data obtained from our study indicated that about half of the participants were not aware of 'health problems would affect food safety'. As higher than ours, Osaili et al. (2017) have reported that more than 70% of the food service staff, working in hospitals in Jordan were known that sneezing, fever, diarrhea, and smoking during working hours had an impact on food safety. However, there are also studies which have lower results than the current one such as the reports of Jianu and Chis (2012) that mentioned only 31% of the food handlers in Western Romania had knowledge about coughing and/or sneezing might have an effect on food contamination.

### ***Symptoms of Foodborne Illness***

When people suffer from food poisoning they cannot be able to understand it is related to food unless they have poor or no knowledge about symptoms of foodborne illnesses. This condition increases the contamination risk since infected food handlers can contaminate food, surface, and other workers (Todd et al., 2008). The most common symptoms of foodborne diseases were reported as diarrhea, nausea, vomiting, and stomach cramps (CDC, 2018). In the current study, more than half of the participants knew that diarrhea (60.10%), nausea (54.50%) and vomiting (53.20%) are the typical symptoms of foodborne illnesses. Although this result showed that the relevant knowledge level is at a moderate level, it is unfortunate that it is a very low rate compared to other studies. For instance, in contrast to that result, Osaili et al. (2013, 2017) reported that 90% of foodservice staff working in the hospitals and restaurants had knowledge about the most common symptoms of foodborne diseases such as diarrhea, vomiting, abdominal pain, and nausea. Similarly, Jianu and Chis (2012) were pointed out that most of the food handlers (77%) in Western Romania could explain these symptoms. Diarrhea, in general, is defined as the most common symptom of those infections in many studies [Tokuç et al., 2009; Osaili et al., 2013, 2017]; because of being the most

emphasized one in the media (Osaili et al., 2017). Hypertension and bone pain are not symptoms of foodborne diseases. Amongst participants, 35.7% of them knew that that statement was not correct for hypertension and 52.60% knew that was not correct for bone pain. Similarly, in the study of Osaili et al. (2017), in which less than 42% of the participants assumed that hypertension and bone pain were symptoms of foodborne diseases.

### ***Personal Hygiene***

Hygienic practices in the responsibility of food handlers are considered as the most effective method to reduce food contamination risk in food establishments. Amidst these hygienic practices, hand hygiene is a more effective method for preventing foodborne diseases when compared with the cleaning and disinfection of surfaces that contact food (Todd et al., 2007). As a matter of fact, it is crucial to have sufficient knowledge about handwashing and concerned staff should pay more attention to this issue. In the current study, the knowledge about the handwashing of employees was determined and the correct response rate was around 50% and this result was quite low compared to other studies (Osaili et al., 2013, 2017). Similar to our finding, Tan et al. (2013) and Rebouças et al. (2017) showed that the majority of food handlers had inadequate knowledge about handwashing. On the other hand, "Duration of handwashing must be minimum 20 sec." statement was correctly identified as true by 54.50% of attendees. When it comes to practice, the time of handwashing is usually shorter than required and not correctly performing by the employees. Although, it is a good result that more than half of the attendees responded correctly to this statement. Unlike our results, Debess et al. (2009), Osaili et al. (2017) and Osaili et al. (2018) reported that only 39%, 29.5%, and 31.9% knew the time that should be spent during hand washing, respectively.

### ***Cross Contamination***

Cross-contamination is one of the most contributory risk factors related to foodborne diseases. Cross-contamination and contaminated equipment are referred to as risk factors in England and Wales (25%), and in the US (26%) of general epidemics, respectively. In the catering industry, it was well known that cross-contamination of food via receptacles, hands and surfaces were major risk factors (Bolton et al., 2008). Therefore cleaning those surfaces and equipment is essential to prevent cross-contamination. Over 60% of participants answered "Use the same cutting board to cut raw meat or poultry and to chop vegetables" and "Use the same knife to cut raw meat or poultry and to chop vegetables" statements correctly. 53.20% of participants correctly knew the procedures for cleaning and sanitizing containers. Previous studies

have reported better knowledge level about sanitization procedures of equipment and surfaces than reported in the current one (Tokuç et al., 2009; Jianu and Chiş, 2012; Osaili et al., 2013).

The number of those who knew that raw meat and vegetables must not be chopped on the same cutting board (61.1%) and knew to must change the knife to cut raw meat or poultry and to chop vegetables (67.20%) was substantially high. Pieces of equipment, especially cutting boards have a crucial role with respect to cross-contamination. It was found that more than 50% of selected cutting boards used in hotels in Spain had been contaminated with superfluous levels of microorganisms (Doménech-Sánchez et al., 2011). The number of correct responses given to questions about cross-contamination is higher than in the other food safety areas in the current study, even though this rate is still unsatisfactory and there is still a high risk of cross-contamination. Similarly, in another study which made by Bolton et al. (2008) with 200 chefs and managers of restaurants in Ireland, the risk of cross-contamination sourced from the tools and surfaces were determined as high in kitchens of restaurants. Taking necessary precautions by food handlers such as the hygiene of their hands, bodies, and items of clothing, equipment, and workplace will help to lessen the incidence of cross-contamination (Assefa et al., 2015).

#### ***Food Hygiene (Safe Temperatures, Purchasing, Storage, Thawing, Cooking and Reheating of the Foods)***

Foodborne diseases have been associated with improper storage, thawing, cooking or reheating of the food and those are frequently due to a lack of awareness or applications about food hygiene. In the current study, the rate of correct answers to statements about this food safety area was usually above 50%. When the statements are viewed singly, it was seen that more than half of the participants (61.9%) had correctly known how to separate raw meat from other food during storage. Unluckily, this result was found weaker than the studies of Walker et al. (2003) and Bolton et al. (2008), in which had been reported that results as 84% for the US, as 97% for the UK and as 92% for Ireland, respectively. 60.80% and 48.90% of attendees stated that they thaw frozen raw meat or poultry on the kitchen counter, sequentially the open and closed container. The distribution of participants who knew the correct thawing procedures was: 54.50% use the refrigerator and 29.10% use the microwave and 54.20% use the tap water. In some other studies, such as Osaili et al. (2013, 2017, 2018) responses related to thawing in a microwave (8.1%, 4.1%, 1.1%, respectively) were similarly low. These results showed that thawing in the microwave is not a common process in the hotel kitchens. About 53.40% of participants knew the right process to determine whether poultry is cooked well by using

a thermometer. Unlike this study, a lower rate (12.7% and 19.5%) of attendees had been found correctly answered that question in the study of Osaili et al. (2017, 2018). The statements about correct refrigeration and freezing temperature, the reheating temperature of food and minimum danger zone were correctly answered by more than half of participants (51.60%, 53.40%, 53.40%, and 52.40%, respectively). This finding showed that the majority of participants knew the correct temperature about refrigeration, freezing, reheating and the danger zone. Unlike our results, in many studies (Baş et al. (2006); Tokuç et al., (2009); Martins et al., (2012); Osaili et al., (2013); Webb and Morancie (2015); Kunadu et al., (2016); Osaili et al. (2017)), it was reported that a lack of knowledge among food service staff about critical temperatures.

One of the most common causes of foodborne diseases is inaccurate cooling of cooked food. Even if the food is safely cooked, the bacteria can be contaminated that food. For this reason, remainders must be put in shallow containers for quick cooling and refrigerated at 4 °C or below within two hours (USDA, 2017). In our study, 53.20% and 58.50% of participants knew that “store remainder in the fridge” and “food should be served no later than two hours after preparation”, respectively. Osaili et al. (2018) reported that a small part of the participants (15%) had known the correct retention temperature needed to eat. In contrast to Osaili et al. (2018), in our study, almost half of the attendees correctly answered this statement.

#### ***HACCP***

Large establishments adopt the HACCP system unlike in the small enterprises in the catering sector. There are some obstacles in small businesses to practice the HACCP system, such as financial constraints and attitudes that restrict the process, absence of legal arrangements, lacked expertise (Egan et al., 2007). Additionally, in catering companies, supervision of the management and lack of motivation, resources and awareness about food safety are other factors that prevent the effective sustaining of the HACCP system (Osaili et al., 2018). Less than half of participants (48.70%) knew that the system is mandatory in our country. Similar results were obtained from the study of Ulusoy and Çolakoğlu (2015) which measured the level of HACCP knowledge of food handlers in enterprises in İstanbul. In the current study, approximately half of the participants correctly responded to the statements about HACCP. Unlike our result, Bolton et al. (2008) reported that head chefs and catering managers in Ireland had inadequate knowledge about HACCP. Similarly, Rebouças et al. (2017) in their study which performed with head chefs and managers in hotels' restaurants of Salvador (Brazil), noticed

that nearly 35.0% of the participants knew what the HACCP means.

### Food Allergy

Food allergy is a prominent public health problem as well as food infections. Researchers estimate that up to 15 millions of Americans and about 17 million Europeans have food allergies (FARE, 2017; EAACI, 2017). In this point of view, food handlers might have a critical role to reduce the risk of food allergy and adverse reactions (Dupuis et al., 2016). Therefore, the level of knowledge of food handlers and behavior against food allergy reactions are very important. In the current study, it was seen that more than half of the participants responded correctly to statements such as, “food allergy is an abnormal response of the immune system to food that harmless normally” (53.40%), “food allergy may result in death” (56.60%), “asthma might be a symptom of food allergy” (52.40%), “food additives may cause allergic reaction” (54.0%) and “peanut is a significant food may cause serious allergic reactions” (54.20%). These results showed that more than half of the participants responded correctly to expressions related to food allergy. On the contrary, 41.50% of them incorrectly declared that “customers who have a food allergy can safely consume a small amount of that food”. Although food allergy is a current issue and is not frequently included in the training, it is quite a good result that attendees had accurately responded to almost 50% of the statements. The levels of food allergy knowledge and practices of food handlers had seen insufficient in many studies (Ajala et al., 2010; Choi and Rajagopal, 2013; Shafie and Azman, 2015). Food handlers are expected to increase their awareness and knowledge about food allergy since the public health authorities' more interest in food allergy over time.

### Conclusion

It is provided important information and displayed many features in that study, concerning the food safety knowledge conditions of food handlers who work in kitchens of 22 hotels located at six different cities in Turkey. The results obtained from our study showed that the level of food safety knowledge of food workers in hotels' kitchens is at an average level. However, there are some significant gaps in food safety areas, such as personal hygiene, food allergy, and HACCP. The most striking result of this study is despite the high number of employees received food safety training the level of knowledge about food safety is medium. In such a group that 82.3% had received food safety training, we would expect a better level. This result may be associated with the adequacy status of food safety training in Turkey. There is a general consensus that trained food handlers are needed to prevent and control foodborne diseases. Thus, food handlers should

be taken food safety training regularly. However, as shown in the current study, training is not just enough but the quality of those training should also be measured regularly, effective application of training should be provided and inspections should be made routinely. Not only food handlers, but also food manufacturers, consumers, food and beverage industrialists should take responsibility in this regard, besides that governments are primarily responsible for ensuring and maintaining food safety. Therefore, all these stakeholders should be trained about food safety and systematic control should be made by the government. This is especially important in developing countries such as Turkey, where the risk of foodborne diseases is loud. As this study comprises the employees who work in hotels located in various regions of Turkey, the obtained results can be generalized to all of the hotels in Turkey. Hence, this study is a comprehensive survey that measured the food safety knowledge level of the hotel kitchen staff in Turkey. In the future, some further studies might be performed to determine the relationship between the knowledge, attitudes, and practices of food handlers with food safety training.

### Compliance with Ethical Standard

**Conflict of interests:** The authors declare that for this article they have no actual, potential or perceived the conflict of interests.

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