


# Hygiene Knowledge of Food Staff in Catering Industry: A Sample From Turkey

SAGE Open  
 April-June 2015: 1-7  
 © The Author(s) 2015  
 DOI: 10.1177/2158244015580376  
 sgo.sagepub.com  


Hülya Yardımcı<sup>1</sup>, Gülperi Haklı<sup>1</sup>, Funda Pinar Çakiroğlu<sup>1</sup>, and Ayşe Özfer Özçelik<sup>1</sup>

## Abstract

This study, designed as a cross-sectional study, was carried out to determine the hygiene knowledge of the staff ( $N = 317$ ) employed in kitchen and service departments of catering firms in Ankara. It was found that the mean scores of the staff with regard to personal hygiene, food hygiene, and kitchen and equipment hygiene were  $10.7 \pm 1.6$ ,  $19.8 \pm 4.0$ , and  $13.6 \pm 2.0$ , respectively. Male staff achieved higher mean scores in personal hygiene knowledge test compared with female staff ( $p < .01$ ). The staff receiving a hygiene training were determined to have higher mean scores in terms of hygiene knowledge tests compared with those who have not received, and the production staff had higher knowledge as to hygiene than the other groups ( $p < .01$ ). The mean scores for hygiene knowledge tests were found to be increasing with age. Hygiene knowledge scores of the staff were quite lower than what must be taken. For that reason, periodical training programs should be organized to increase the awareness of the staff about hygiene.

## Keywords

catering industry, food staff, hygiene knowledge

## Introduction

Food safety is one of the significant goals to be achieved for global health, because foodborne diseases are important threats to health (Velusamy, Arshak, Korostynska, Oliwa, & Adley, 2010). Both in the developed and developing countries, foodborne diseases are considered among the most common public health problems with an increasing trend (Domínguez, Gómez, & Zumalacárregui, 2002; WHO, 2007).

The Food and Agriculture Organization (FAO) and the Expert Committee on Food Safety of WHO also pointed out that foodborne diseases are among the most common health problems (FAO/WHO, 2002).

Every year, a great number of people are hospitalized or die throughout the world due to the consumption of contaminated foods (Mead et al., 2006). Centers for Disease Control and Prevention (CDC) declared that known pathogens cause an estimated 9.4 million foodborne illnesses annually in the United States. During 2009-2010, a total of 1,527 foodborne disease outbreaks (675 in 2009 and 852 in 2010) were reported, resulting in 29,444 cases of illness, 1,184 hospitalizations, and 23 deaths (CDC, 2013).

Foods are contaminated with a few microorganisms by human activities through fecal or oral ways or through contaminated waters. In a study carried out in European countries, the most common places for food poisoning were listed as homes (42.0%), restaurants, motels, and bars (19.0%), while

this rate was reported as 3.0% for hospitals. A study conducted by WHO between the years 1993 and 1998 in 42 different countries to control food poisoning revealed that a total sum of 23,538 food-poisoning cases were reported (Domínguez et al., 2002; FAO/WHO, 2002).

As given by the Turkish Ministry of Health, the number of bacteria-borne food-poisoning cases was reported as 26,298 for Turkey in 2005 (Turkish Republic of Ministry of Health, 2005).

Consumption of safe foods is one of the basic issues for societies. Foods produced respecting hygiene standards are of importance in improving and protecting human health; however, insufficient control is regarded as one of the major risk factors that cause foodborne diseases (WHO, 2006).

In addition, food safety is still an important subject as foodborne diseases causing considerable expenses to people, food industry, and national economies alike (Kafarstein, Motarjemi, & Bettcher, 1997). In a recent study, foodborne diseases of bacterial, parasitic, and viral origin are estimated to cost the U.S. economy almost US\$152 billion every year (Scharff, 2010).

<sup>1</sup>Ankara University, Ankara, Turkey

## Corresponding Author:

Hülya Yardımcı, Department of Nutrition and Dietetics, Ankara University, Ankara, 06320, Turkey.  
 Email: hulya\_yardimci@yahoo.com



The changing living conditions have brought about various changes in lifestyle and food consumption behaviors, and increased the food consumption outdoors (Osaili et al., 2013). Especially in the highly industrialized countries, about 70.0% of populations eat out once a day at least. This has also increased the importance of good hygiene practices in catering services. In Turkey, the rate of eating out has also been quite high in the recent years (Turkish Republic of Ministry of Health, 2008).

The current knowledge level of people are directly related to healthy and qualified food consumption by people, hygienic cooking and storage of foods by kitchen staff, and transferring the prepared foods by service staff (Baş, Kızıltan, Karabudak, & Çiğirim, 2002).

Cross-contamination, personal hygiene failures, and errors made in handling foodstuff, regardless of time-temperature relation, are the most common mistakes made by workers in catering firms during cooking, cooling, and re-heating phases of foods (Amjadi & Hussain, 2005; Walker, Pritchard, & Forsythe, 2003).

These mistakes have been pointed out in various studies in the literature (Baş, Ersun, & Kıvanc, 2006; Jianu & Chis, 2012; Martins, Hogg, & Otero, 2012; Walker et al., 2003).

In some studies (Açikel et al., 2008; Baş et al., 2002; Şanlıer, Bilici, Çelik, & Memiş, 2012; Ünal, 2000) conducted with regard to the issue in Turkey, it has been reported that workers in catering industry have inadequate level of knowledge about food safety, and the rate of good hygiene practices and knowledge level as to hygiene have increased with the training on hygiene issues.

The present study was planned and carried out to determine hygiene knowledge of staff employed in kitchen and service departments of catering firms in Ankara.

## Material and Method

The sampling group of the study included a total sum of 317 voluntary staff employed in 11 different catering firms. The data of the study were collected with a self-administrable questionnaire between February and April, 2013. The questionnaire form was developed by the researchers by searching literature (Çiğirim & Beyhan, 2002; Marriott, 1999). The questionnaire consisted of two parts. In the first part, general information of the participants was given, and food hygiene knowledge test (Appendix A) made up of 27 items (Cronbach's  $\alpha = .76$ ), personal hygiene knowledge test (Appendix B) made up of 14 items (Cronbach's  $\alpha = .62$ ), and kitchen and equipment hygiene knowledge test (Appendix C) composed of 18 items (Cronbach's  $\alpha = .69$ ) were included in the second part.

The correct answers to the items of personal hygiene, food hygiene, and kitchen and equipment hygiene tests were scored as 1, and the wrong answers were scored as 0. Items 2, 5, 9, and 13 in the personal hygiene knowledge test; Items 1, 3, 9, 15, 17, and 22 in food hygiene knowledge test; and Items 2, 3, 4, 5, 7, 15, and 17 in kitchen and equipment hygiene knowledge test were negative statements, and therefore, they were reverse scored. The highest scores obtained from the personal hygiene knowledge test, food hygiene

knowledge test, and kitchen and equipment hygiene knowledge test were 14, 27, and 18, respectively.

In all analyses, the SPSS statistical software package was used. Independent *t* test was applied for binary variables, while one-way ANOVA (confidence interval 95%) was applied for more than two variables, and post hoc least significant difference (LSD) test was used to determine the group causing difference. In addition, chi-square test was used to determine the difference in frequency at which the staff took health check before and after their employment (5% significance). Statistical significance level was set to  $p < .01$  and  $p < .05$  for all analyses. Explanatory variables included sex, age groups, education level, receiving training on hygiene, and job responsibilities.

Cooks were grouped as production staff, waiters were grouped as service staff, while dishwashers and cleaners were grouped as dishwashing and cleaning staff to create job responsibilities, which were one of the explanatory variables.

## Results

### General Information About Staff

Of the 317 staff, 77.0% were male, while 23.0% were female. However, 40.4% were at the age of 30 and below, 36.9% were 31 to 40 years old, and 22.7% were 41 years of age and older. The age of staff varied from 20 to 70 years, and the mean age was  $34.4 \pm 9.3$  years ( $M = 34.7 \pm 9.5$  and  $F = 33.5 \pm 8.4$ ).

About half of the staff (43.2%) were high school graduates, 27.2% were secondary school graduates, and 23.0% were the graduates of a primary school. The rate of university graduate staff was 6.6%. Of the staff, 42.6% were employed as service personnel, 45.1% as production personnel, and 12.3% as dishwasher and cleaning personnel.

Before their employments, 94.0% ( $n = 298$ ) of the staff underwent a health check. The rate of staff who took their periodical health examinations after employment was 89.6% ( $n = 284$ ;  $\chi^2 = 1.180$ ,  $p < .01$ ). Staff took their health controls every 3 months at most (59.2%).

In this study, the status of the staff in terms of receiving training on hygiene was investigated. The rate of those who received training was 88.3%, and the most common topics of training included personal hygiene (89.3%), general cleaning/dishwashing/garbage collection (85.0%), and food hygiene (76.1%).

### Hygiene Knowledge

Considering the scores of staff participating in the study, the mean personal hygiene knowledge score was determined as  $10.7 \pm 1.6$ ; food hygiene knowledge score was  $19.8 \pm 4.0$ , and kitchen and equipment hygiene score became  $13.6 \pm 2.0$ . Also, it can be seen that the food staff achieved 76.5% of the total score from personal hygiene, 73.3% of the food hygiene, and 76.6% of the kitchen and equipment hygiene knowledge tests (Table 1).

**Table 1.** The Mean Scores of Staff in Hygiene Knowledge Tests.

	<i>M ± SD %</i>	Minimum	Maximum
Personal hygiene	10.7 ± 1.6 76.5	5	14
Food hygiene	19.8 ± 4.0 73.3	6	26
Kitchen and equipment hygiene	13.6 ± 2.0 76.6	6	17

**Gender.** Considering the mean scores of participants in personal hygiene test, male staff had significantly higher mean scores in personal hygiene test ( $p < .01$ ).

**Receiving training on hygiene.** It was found that the staff who had received training on hygiene achieved much higher scores in all hygiene tests compared with others who had not received such training ( $p < .01$ ).

**Age.** At the end of the study, no significant difference was found in the mean scores of the groups in terms of personal hygiene and kitchen and equipment hygiene test, whereas there was a significant difference in the mean scores of food hygiene knowledge among the groups, which was the result of staff aged  $\leq 30$  years ( $p < .05$ ).

**Educational status.** In terms of educational status, the highest mean scores of personal hygiene ( $11.1 \pm 1.5$ ) and food hygiene ( $21.3 \pm 3.4$ ) were determined in the university graduate group. The mean scores of groups were close to each other in kitchen and equipment knowledge test ( $p > .05$ ).

**Job responsibilities.** The mean scores of production staff were higher than those of the others in all hygiene knowledge tests. There was a significant difference among the groups ( $p < .01$ ). It is believed that the reason of such a difference was the group of production staff.

## Discussion

At the end of the study, it was revealed that 94.0% of catering staff take a health check prior to their employment. However, the rate of those who take periodical health examinations after the employment was 89.6% ( $\chi^2 = 1.180$ ,  $p < .01$ ). The frequency of taking a health check was found maximum once in 3 months (59.2%).

However, food processors play an important role in the infection of digestion system diseases in particular by means of foods. It is true that microbiological quality of foods is closely related to the health status of employees (Baş et al., 2006; Kozak et al., 2008; Marriott, 1999; Michaels et al., 2004).

Similar to our study, Kabacık (2008) found that 98.7% of the working staff take a health check prior to their employment, and 96.0% continue to take a health control after their employment, while 52.0% of them undergo periodical health examinations every 3 months. Besides, Campos et al. (2009) reported that 51.9% of food handlers do not take periodical health examinations, and this rate was given as 58.3% by Silva, Germano, and Germano (2003).

The reason for a decline at periodical health examination after employment could be resulted from the cost concerns of the employers.

Hygiene conditions should be respected in the food production areas because hygiene comprises personal, food, and kitchen and equipment hygiene (Ünlüönen & Cömert, 2013).

Considering the hygiene scores of the staff participating in the study, the mean scores of personal hygiene, food hygiene, and kitchen and equipment hygiene were  $10.7 \pm 1.6$ ,  $19.8 \pm 4.0$ , and  $13.6 \pm 2.0$ , respectively (Table 1).

The highest score obtained in the personal hygiene knowledge test was 14, food hygiene knowledge test was 27, and kitchen and equipment hygiene knowledge test was 18. The study revealed that the food staff have correctly answered approximately three fourths of the hygiene knowledge questions.

Training food handlers on hygiene is quite important. In the current study, the scores of the male staff in food hygiene and kitchen and equipment hygiene knowledge tests were found close to those of the female staff. Such a case might be caused by the fact that the male and female staff attended to the same training. The male staff achieved higher mean scores in personal hygiene knowledge test than the female staff ( $p < .01$ , Table 2). The results of similar studies support the findings of the present study (Şanlıer & Türkmen, 2010; Ünlüönen & Cömert, 2013; Ural, 2007).

Of the staff participating in the study, 88.3% stated to have received in-service training about hygiene. These participants were determined to have higher mean scores over personal hygiene, food hygiene, and kitchen and equipment knowledge tests compared with the others who did not receive such a training ( $p < .01$ , Table 3).

Training of food handlers on hygiene is quite important. The status of food safety in foodservice institutions can be improved through training courses for food handlers on food safety, periodical assessment of staff knowledge about food safety issues, and better payment (Osaili et al., 2013).

There are some studies indicating that in-service training increases the hygiene knowledge level (Arslan & Çakıroğlu, 2004; Çakıroğlu & Uçar, 2008; Cohen, Reichel, & Schwartz, 2001; Dağ & Merdol, 1999; Kabacık, 2008; Şanlıer, Cömert, & Durlu-Özkaya, 2010; Ünlüönen & Cömert, 2013; Ural, 2007).

However, Baş et al. (2006) indicated that despite the results of many studies reporting that food safety training increases the knowledge of staff, it does not always make a positive change in food-handling behavior. This result is compatible with the findings of Clayton, Griffith, Price, and Peters (2002) stating that most of the food handlers in the United Kingdom acknowledge that they do not always respect all the food safety practices they know.

Therefore, besides providing training on hygiene, availability and continuity of training are also quite important for healthy food production.

Considering the scores by age groups, the mean scores of the items of personal hygiene, food hygiene, and kitchen and equipment hygiene were found to increase with age (Table 4). This could be attributed to the increasing professional

**Table 2.** The Results of *t* Test Toward Hygiene Knowledge Tests of Staff Based on Gender.

	Male	Female	<i>t</i>	Significant
Personal hygiene	10.8 ± 1.7	10.3 ± 1.0	3.505	.001*
Food hygiene	19.8 ± 4.9	19.7 ± 3.7	0.188	.851
Kitchen and equipment hygiene	13.6 ± 2.1	13.7 ± 1.9	-0.615	.539

\**p* < .01.**Table 3.** The Results of *t* Test Toward Hygiene Knowledge Tests of Staff Based on the Status of Receiving Training on Hygiene.

	Trained	Untrained	<i>t</i>	Significant
Personal hygiene	10.8 ± 1.5	9.9 ± 1.8	3.386	.001*
Food hygiene	20.6 ± 3.5	16.1 ± 5.4	4.548	.000*
Kitchen and equipment hygiene	13.9 ± 1.9	11.7 ± 2.3	5.908	.000*

\**p* < .01.**Table 4.** The Results of Variance Analysis Toward Hygiene Knowledge Tests Based on Age Groups.

	Aged ≤ 30	Aged 31-40	Aged ≥ 41	<i>F</i>	Significant	Difference
Personal hygiene	10.6 ± 1.6	10.7 ± 1.5	10.9 ± 1.5	0.662	.516	
Food hygiene	19.0 ± 4.2	20.2 ± 3.6	20.3 ± 4.0	4.010	.019*	1-2, 1-3
Kitchen and equipment hygiene	13.4 ± 2.2	13.6 ± 1.8	13.7 ± 2.1	0.419	.658	

\**p* < .05.**Table 5.** The Results of Variance Analysis Toward Hygiene Knowledge Tests Based Educational Status.

	Primary school	Secondary school	High school	University	<i>F</i>	Significant
Personal hygiene	10.9 ± 1.5	10.5 ± 1.8	10.6 ± 1.4	11.1 ± 1.5	1.424	.236
Food hygiene	20.0 ± 4.2	19.4 ± 4.1	19.6 ± 3.9	21.3 ± 3.4	1.423	.236
Kitchen and equipment hygiene	13.7 ± 2.2	13.4 ± 2.1	13.7 ± 2.0	13.5 ± 2.3	0.347	.791

**Table 6.** The Results of Variance Analysis Towards Hygiene Knowledge Tests Based on Job Responsibilities.

	Production staff	Service staff	Dishwashing and cleaning staff	<i>F</i>	Significant	Difference
Personal hygiene	11.7 ± 1.5	10.3 ± 1.5	10.3 ± 1.2	17.853	.000*	1-2, 1-3
Food hygiene	21.4 ± 3.1	18.2 ± 3.8	19.2 ± 5.3	26.486	.000*	1-2, 1-3
Kitchen and equipment hygiene	14.0 ± 1.9	13.3 ± 2.1	13.1 ± 2.4	5.049	.007*	1-2, 1-3

\**p* < .01.

experience with age. In some other studies, it was reported that knowledge scores of catering staff increase in parallel with age (Çakıroğlu & Uçar, 2008; Martins et al., 2012; Şanlıer et al., 2010; Siow & Norrakiah, 2011; Ünlüönen & Cömert, 2013; Ural, 2007).

Depending on the education levels of staff, the highest mean scores of personal hygiene knowledge (11.1 ± 1.5) and food hygiene knowledge (21.3 ± 3.4) were found in university graduate group. This was followed by primary school graduate group. In-service training given regardless of education status could be the reason for the higher knowledge scores of primary school graduates compared with those of secondary and high school graduates (Table 5). Some studies reported that hygiene knowledge

level of staff increases with education level (Martins et al., 2012; Ünal, 2000; Ural, 2007).

Preparation and cooking are the phases of food production in catering services. In these phases, food could be infected with bacteria through the equipment used in the food preparation and other foods. Mishandling of foods is one of the most important factors that cause foodborne diseases (Baş et al., 2006; Ciğerim & Beyhan, 2002). Employing individuals having awareness of hygiene in food production areas could reduce the occurrence of foodborne diseases/poisoning. In this study, production staff had higher knowledge of hygiene than the other groups (*p* < .01, Table 6).

It was reported in other studies carried out in Turkey that production staff had higher scores as to hygiene than the

other groups (Durlu-Özkaya, Şanlıer, & Cömert, 2008; Şanlıer et al., 2010; Şanlıer & Türkmen, 2010; Ünlüönen & Cömert, 2013).

## Conclusion

The study revealed that food staff have correctly answered approximately three fourths of the hygiene knowledge questions. Catering industry is a sector that constantly renews itself by staff and does not provide long-term employment. In the case of long-term employment, it is clear that the staff do not refresh their knowledge and tend to forget it. For this reason, it is quite important for staff to learn not only what they will do but also how and why they do. Periodical training programs should be organized by experts to increase the awareness of the staff about personal and food hygiene.

After staff training, applications should be frequently controlled, the importance of hygiene should be emphasized, hygiene checklists should be developed, and the current lists should be updated.

## Appendix A

### Knowledge About Food Hygiene

Statements	True	False
1. Raw food and cooked foods can be stored together (-).		
2. Frozen food cannot be frozen again after being defrosted.		
3. Vegetables should be first chopped and then washed (-).		
4. Freezing process of foods does not kill bacteria but prevent their growth.		
5. Repeatedly heating foods causes foodborne poisoning.		
6. Fresh vegetables and fruit should be well washed under running water.		
7. While buying vegetables and fruit, it should be paid attention that they are not withered, soil- or mud-covered, rotten, and damaged.		
8. While buying meat, it is necessary that it should be branded.		
9. Frozen foods are defrosted in the room temperature (-).		
10. Smashed canned food cannot be used.		
11. Vegetables and fruit are immediately consumed after being chopped.		
12. Pre-cooling process of foods should be completed within 2 hr.		
13. Samples are taken from each meal for laboratory controls, and these samples are stored in refrigerator for 48 hr.		
14. Raw food should be stored in lower shelves within cold storage.		

(continued)

## Appendix A (continued)

Statements	True	False
15. Cooked food should be stored in lower shelves within cold storage (-).		
16. Clean water controlled in laboratory should be used in the kitchen.		
17. There is no problem in placing foods within cold storage after being cooked (-).		
18. First-in-first out (FIFO) principle should be applied while taking foods out of storage.		
19. Vegetables can be disinfected with chlorinated water.		
20. Purchased food should be immediately transferred to the relevant storage if they are not used right away.		
21. The temperature should be between 20°C and 30°C in dry storage.		
22. The single important thing in buying eggs is that eggshells should not be cracked (-).		
23. Eggs can be stored for 1 month after being placed in storage.		
24. Pasteurized milks should be stored for 1 day.		
25. The temperature of the refrigerator should be between 0°C and 4°C.		
26. The minimum temperature of deep freezer should be -18°C.		
27. The temperature of hot foods ready for consumption should be more than 65°C.		

## Appendix B

### Knowledge About Personal Hygiene

Statements	True	False
1. Staff should wear the uniforms provided by their firms at work.		
2. There is no need to wear other accessories (bonnet/cap/mask/overshoe) at work except for the uniform (-).		
3. Working costumes should be changed every day.		
4. It is required to take a shower before and after work.		
5. It is unnecessary to shave for work regularly (-).		
6. Hands should be washed with warm water + soap in a way to include wrists.		
7. Hands should be washed before starting to prepare meals.		
8. Hands should be washed before and after handling raw foods.		
9. There is no need for washing hands before eating (-).		

(continued)

## Appendix B (continued)

Statements	True	False
10. Hands should be washed before and after using the toilette.		
11. Hands should be washed after handling garbage.		
12. Hands should be washed after touching earth-covered and packed products.		
13. There is no need to wash hands after touching face, ear, and hair (-).		
14. Hands should be washed after contacting with upper respiratory tract secretions.		

## Appendix C

### Knowledge About Kitchen Equipment Hygiene

Statements	True	False
1. Bacteria can grow on broken and/or cracked dishes.		
2. One cannot be infected with bacteria from the edges of glasses, forks, dishes, and knives (-).		
3. Washed dishes do not spread infection (-).		
4. Rinsed containers and equipment should be wiped with a dish towel (-).		
5. Cold storages should be opened and ventilated frequently (-).		
6. Water and heating pipes passing through storages do not cause any problem if they are well isolated.		
7. Because materials are placed on shelves, it is not important if there are fractures on the ground (-).		
8. Sinks are only allowed to wash hands in the production area.		
9. Different equipment should be used for vegetables and meat.		
10. Wood chopping block should be salted after being washed and rinsed, while polyamide chopping block should be disinfected.		
11. Meat grinder should be washed and rinsed with warm water and a soap and disinfected every day.		
12. The saucepans should be made of stainless steel.		
13. There should be a slope in the kitchen to allow easy water flow.		
14. Items and materials touching foods should not be kept beside cleaning materials.		
15. Dry storage or cellar should receive direct sunlight (-).		
16. Effective pest and rodent control should be made in storages and cellars.		
17. Using wood materials in storages is more convenient for hygiene (-).		
18. Insecticides and pesticides should be applied for pest control.		

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research and/or authorship of this article.

## References

- Açikel, C. H., Ogur, R., Yaren, H., Göcgeldi, E., Ucar, M., & Kir, T. (2008). The hygiene training of food handlers at a teaching hospital. *Food Control, 19*, 186-190.
- Amjadi, K., & Hussain, K. (2005). Integrating food hygiene into quantity food production systems. *Nutrition & Food Science, 35*, 169-183.
- Arslan, S., & Çakıroğlu, F. P. (2004). The examination of the knowledge of the cooks as to food safety and the effect of training regarding food safety on their level of knowledge. *Journal of Vocational Education, 6*(11), 134-149.
- Baş, M., Ersun, Ş. A., & Kıvanc, G. (2006). The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in food businesses in Turkey. *Food Control, 17*, 317-322.
- Baş, M., Kızıltan, G., Karabudak, E., & Çiğirim, N. (2002). A study into the evaluation of the hygienic situation of the four- and five-star hotels serving in the city of Ankara. In *Proceedings of the Symposium of Health and Nutrition, Problems and Their Solutions at Tourism* (pp. 95-97). Alanya, Turkey
- Çakıroğlu, F. P., & Uçar, A. (2008). Employees' perception of hygiene in the catering industry in Ankara (Turkey). *Food Control, 19*, 9-15.
- Campos, A. K. C., Cardonha-Soares, A. M., Pinheiro-Galvão, L. B., Ferreira, N. R., Medeiros de Azevedo, P. R., & Stamford-Montenegro, L.C. (2009). Assessment of personal hygiene and practices of food handlers in municipal public schools of Natal, Brazil. *Food Control, 20*, 807-810.
- Centers for Disease Control and Prevention. (2013). Surveillance for foodborne disease outbreaks—United States, 2009-2010. *Morbidity and Mortality Weekly Report, 62*(3), 41-47.
- Çiğirim, N., & Beyhan, Y. (2002). *Hygiene at public nutrition systems*. Ankara, Turkey: Kök Publishing.
- Clayton, D. A., Griffith, C. J., Price, P., & Peters, A. C. (2002). Food handlers' beliefs and self-reported practices. *International Journal of Environmental Health Research, 12*, 25-39.
- Cohen, E., Reichel, A., & Schwartz, Z. (2001). On the efficacy of an in-house food sanitation training program: Statistical measurements and practical conclusions. *Journal of Hospitality & Tourism Research, 25*, 5-16.
- Dağ, A., & Merdol, T. K. (1999). Attitude and behaviors of foreign tourists regarding the Turkish cuisine. *Journal of Nutrition and Dietetics, 28*(1), 47-51.
- Domínguez, C., Gómez, I., & Zumalacárregui, J. (2002). Prevalence of salmonella and campylobacter in retail chicken meat in Spain (Short Communication). *International Journal of Food Microbiology, 72*, 165-168.
- Durlu-Özkaya, F., Şanlıer, N., & Cömert, M. (2008). The food safety knowledge level of the people working at the food and drink services at the hotels in Turkey. In *Proceedings of the 10th Food Congress of Turkey* (pp. 1039-1043). Erzurum, Turkey.

- Food and Agriculture Organization/World Health Organization. (2002). Available from <http://www.fao.org>
- Jianu, C., & Chis, A. (2012). Study on the hygiene knowledge of food handlers working in small and medium-sized companies in Western Romania. *Food Control*, 26, 151-156.
- Kabacık, M. (2008). Determining the food safety knowledge level of the kitchen staff working for 4 and 5 star hotel kitchens (Master's thesis). Institute of Education Science, Ankara, Turkey.
- Kaferstein, F. K., Motarjemi, Y., & Bettecher, D. W. (1997). Foodborne disease control: A transnational challenge. *Emerging Infectious Diseases*, 3, 503-510.
- Kozak, M., Çakıcı, C., Kozak, N., Azaltun, M., Sökmen, A., Sarıışık, M., & Çetinsöz, B. C. (2008). *Hotel business* (2nd ed.). Ankara, Turkey: Detay Publishing.
- Marriott, N. G. (1999). *Principles of food sanitation* (4th ed.). Gaithersburg, MD: Aspen Publication.
- Martins, R. B., Hogg, T., & Otero, J. G. (2012). Food handlers' knowledge on food hygiene: The case of a catering company in Portugal. *Food Control*, 23, 184-190.
- Mead, P. S., Slutsker, L., Dietz, V., McCaig, L. F., Bresee, J. S., Shapiro, C., . . . Tauxe, R. V. (2006). Food-related illness and death in the United States. *Emerging Infectious Diseases*, 5, 607-625.
- Michaels, B., Keller, C., Blevins, M., Paoli, G., Ruthman, T., Todd, E., & Griffith, C. J. (2004). Prevention of food worker transmission of foodborne pathogens: Risk assessment and evaluation of effective hygiene intervention strategies. *Food Service Technology*, 4, 31-49.
- Osaili, T. M., Abu-Jamous, D. O., Obeidat, B. A., Bawadi, H. A., Tayyem, R. F., & Subih, H. S. (2013). Food safety knowledge among food workers in restaurants in Jordan. *Food Control*, 31, 145-150.
- Şanlıer, N., Bilici, S., Çelik, B., & Memiş, E. (2012). Food safety knowledge and practices of nursing students. *Italian Journal of Food Science*, 24, 1-8.
- Şanlıer, N., Cömert, M., & Durlu-Özkaya, F. (2010). Hygiene perception conditions of hotel kitchen staff in Ankara, Turkey. *Food Science and Technology Research*, 30, 415-431.
- Şanlıer, N., & Türkmen, F. (2010). Perception of hygiene among staff working in food companies. *Research Journal of Medical Science*, 4, 231-237.
- Scharff, R. (2010). *From foodborne illness in the United States* (Produce Safety Project). Retrieved from <http://www.producesafetyproject.org/admin/assets/files/Health-Related-Foodborne-Illness-Costs-Report.pdf-1.pdf>
- Silva, C. S., Germano, M. I. S., & Germano, P. M. L. (2003). Food hygiene in school units of the State School Network, State of São Paulo. *Higiene Alimentar*, 17(110), 49-55.
- Siow, O. N., & Norrakiah, A. S. (2011). Assessment of knowledge, attitudes, and practices (KAP) among food handlers at residential colleges and canteen regarding food safety. *Sains Malaysiana*, 40, 403-410.
- Turkish Republic of Ministry of Health. (2005). *General Directorate of Primary Health Care Studies yearbook 2005*. Retrieved from <http://www.saglik.gov.tr/TR/belge/1-2953/temel-saglik-hizmetleri-genel-mudurlugu-calisma-yilligi-.html>
- Turkish Republic of Ministry of Health. (2008). *The hygiene handbook for the workers of public nutrition systems*. Ankara, Turkey: Ministry of Health Publications.
- Ural, D. (2007). *A research on knowledge and applications of personnel working in accommodation businesses related to personal hygiene* (Master's thesis). Institute of Education Science, Ankara, Turkey.
- Ünal, G. (2000). *Knowledge level of the staff working official organizations giving collective nutrition service in Erzurum city centre about work place and individual hygiene* (Master's thesis). Institute of Health Science, Erzurum, Turkey.
- Ünlüönen, K., & Cömert, M. (2013). Identifying personnel hygiene knowledge levels of kitchen staff in hotel establishments. *Journal of Tourism and Gastronomy Studies*, 1(1), 3-12.
- Velusamy, V., Arshak, K., Korostynska, O., Oliwa, K., & Adley, C. (2010). An overview of foodborne pathogen detection: In the perspective of biosensors. *Biotechnology Advances*, 28, 232-254.
- Walker, E., Pritchard, C., & Forsythe, S. (2003). Food handlers' hygiene knowledge in small food businesses. *Food Control*, 14, 339-343.
- World Health Organization. (2006). *Globalization, trade and health, glossary of terms*. Retrieved from <http://www.who.int/trade/glossary/story027/en/>
- World Health Organization. (2007). *The world health report 2007—A safer future: Global public health security in the 21st century*. Retrieved from <http://www.who.int/whr/2007/en/index.html>

### Author Biographies

**Hülya Yardımcı** is an doctor instructor (PhD) in the Department of Nutrition and Dietetics, Ankara University. She is studying nutrition, dietetics, and hygiene issues in society.

**Gülperi Haklı** is a research assistant in Department of Nutrition Sciences, Ankara University. She is studying nutrition, dietetics, and hygiene issues in society.

**Funda Pinar Çakiroğlu** is professor doctor in the Department of Nutrition and Dietetics, Ankara University. She is studying on nutrition, dietetics, and hygiene issues in society.

**Ayşe Özfer Özçelik** is professor doctor instructor in the Department of Nutrition and Dietetics, Ankara University. She is studying on nutrition, dietetics, and hygiene issues in society.