

Effect of High School Students' Food Safety Knowledge Level on Their Attitude

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This study was conducted to determine the effect of food safety knowledge level among high school students on their attitude to the subject. A total of 912 high school students between 15 and 17 years of age were included in the study and data was collected through questionnaires. The majority of those included in the study were male (70.4 %). The food safety knowledge level of females ($\bar{x}=15.59\pm4.52$) was found to be higher than that of males ($\bar{x}=10.90\pm5.01$). Similarly, the attitude scores of females were found to be higher in comparison with male participants ($\bar{x}=46.67\pm5.98$ and 43.53 ± 7.03 , respectively). A statistically significant difference between the genders in knowledge and attitude scores was found ($p<0.001$). There was also a positive relationship between food safety knowledge level and attitude ($r=0.240$, $p<0.01$).

Key words: Food safety; Knowledge; attitude.

Foods consumed to protect health can become a serious risk to health when they are produced under inappropriate hygienic conditions and by insensible persons. Food safety is a global health goal and foodborne diseases represent a major health crisis¹. Food-borne diseases represent a widespread and growing public health problem, both in developed and developing countries. This problem appears to have more impact on the public health and economy in developing countries compared with developed nations, but reliable data is not available².

Despite difficulties in forecasting cases of foodborne diseases at the global level, 1.8 million children (excluding China) and 2.16 million children living in developing countries died of diarrhoea

caused by food- or water-borne microbiological agents in 1998 and 2004, respectively. It is argued that one third of people living in industrialized countries suffers from foodborne diseases each year, while approximately 30 % percent of the population in developed countries catches foodborne diseases. WHO estimates that 1.8 million people in the world died in 2005 from the effects of foodborne diseases²⁻⁴. It has been estimated that foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalisations and 5000 deaths in the United States each year^{5, 6}. In Turkey, according to the Ministry of Health⁷, 26,772 people were hospitalized due to foodborne diseases; 23,901 *Salmonella typhii* infections, 429 *Salmonella paratyphii* cases, 21,068 cases of *dysentaria* and 8824 *hepatitis A* infections occurred in 2004. Since the reporting of foodborne diseases to a specified agency is not obligatory in Turkey, data on foodborne infections

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and toxins are inaccurate⁸. According to various studies conducted in Turkey, products that are commonly available in the market harbour pathogenic microorganisms and/or diseases caused by the said microorganisms⁹⁻¹¹.

Regarding foodborne illnesses, misconduct in the purchasing, preparing, and servicing processes may all pose significant threats in terms of food poisoning. Negligence due to a lack of knowledge or disregarding/misunderstanding may cause foods to become microbiologically, physically or chemically risky during their processing between agricultural production and consumption. While improper practices can be observed in the process of food preparation carried out in homes¹²⁻¹⁴, such misconduct/negligence in kitchens serving large numbers of people poses a relatively more serious threat, the results of which are in turn suffered by more people^{2,15}. Therefore, raising the awareness of individuals should result in preventing their mistakes. In addition, the preferences of each individual to buy or not to buy have a strong sanction power on the food industry. Conscientious consumers can be an important motivating factor for food manufacturers to comply with food safety requirements.

Groups at the greatest risk for foodborne diseases are pregnant women, the elderly and children. In the present day, children and youths spend almost all of their time in schools, starting from an early age. Therefore, compliance with hygiene and sanitation requirements in foods consumed by children in schools should be a priority for both families and the government. Despite numerous researches carried out on food services and canteens in the foreign literature¹⁶⁻¹⁹, Turkey is experiencing difficulties in identifying studies in sufficient numbers which were carried out in dining halls in Turkey²⁰. Behaviours, knowledge of and attitudes to food safety in kindergartens/nursery schools, school and university canteens, and their personnel, teachers and/or students were assessed independently of each other²¹⁻²⁶. On the other hand, this study, aiming to assess the relationship between the level of knowledge on and attitude to food safety, and to determine the effect of knowledge on attitude, should contribute to the existing literature. Moreover, this study may bring some improvement

in raising awareness and removing inaccurate knowledge and attitudes when the study is assessed by considering the existing circumstances.

MATERIALS AND METHODS

Research design

This study was planned and executed between September and December 2009 in order to determine the knowledge and attitude of students on food safety and the effect of their knowledge level on their attitude. The number of questionnaires that could be assessed was 912. The students were compared in terms of food safety knowledge level and attitude by gender, and the effect of knowledge level on their attitude was evaluated.

Participants

Class 10 and class 11 students from 32 high schools in Ankara, the capital of Turkey, were included in the study. By determining the number of samples from each school by considering their grade concentrations, questionnaires were applied in line with the minimum number of students capable of representing the schools for data collection purposes. First, the students were informed of the subject and purposes of the study and how to fill in the questionnaire form. The questionnaire was applied to those who volunteered to be involved in the study through face-to-face interviews with the researchers.

Instrumentation

The questionnaire form that was used to collect data was composed of demographic information (such as gender, age, and the way the student receives education), an achievement test on food safety, and an attitude scale on food safety. The scales used were developed by the researchers. The achievement test was a 25-question multiple-choice test with 5 different choices for each question. Regarding food safety knowledge level questions, each correct answer was worth 1 point and each wrong one worth no points. Scores that showed the knowledge level of each participant were obtained. The maximum number of points that could be collected was 25 and the minimum was 0.

For the food safety attitude scale, 18 statements, composed of 9 affirmative and 9 negative statements were given in the form of a 3-

point Likert scale (“I agree” = 3 points, “I partially agree” = 2 points, and “I don’t agree” = 1 point). The scoring system was reversed for the negative statements. Particular attention was given to having a balanced distribution of affirmative and negative statements in the attitude-related statements, in addition to the inclusion of cognitive, affective and behavioural statements²⁷. The attitude scale was concentrated on two different factors, a 9 statement internalisation and a 9 statement consideration. As the attitude scale was on a 3-point Likert scale, points between 1.5 and 2.5 were considered to be mid-values.

The pilot test

The achievement test was a 40-question multiple-choice test applied on 116 students as the pilot test. By considering the difficulty levels and discrimination indices of the test items and their total item correlation the number of questions was reduced to 25. Cronbach’s alpha for the achievement test was found to be 0.88.

The food safety attitude test was applied through a test scale to a group of 243 people other than the participant students who were involved in the real study. After the validity and confidence analyses were conducted the number of items was reduced to 18 by eliminating 12, which formed the final version of the scale. According to the pilot test, the KMO value, alpha coefficients for Factor I (the consideration aspect of attitude) and Factor II (the internalisation of attitude), and total alpha values were found to be 0.87, 0.83, 0.78, and 0.85, respectively. On the other hand, according to the real test, the KMO value, alpha coefficients for Factor I and Factor II, and total alpha values were found to be 0.901, 0.860, 0.868, and 0.863, respectively.

Statistical analysis

All statistical analyses were conducted using SPSS for Windows (version 11.0, 2001, Chicago, IL). Statistical significance was set at $p < 0.05$. Genders, ages of the participants and the way they receive education were expressed in terms of numbers and percentages. Their attitude and knowledge scores by gender, in addition, were compared through the t-test, and the correlation between their knowledge level and their attitude was judged according to the Pearson Correlation Coefficient.

RESULTS AND DISCUSSION

The demographic characteristics of the participants are given in Table 1.

Of the students who were involved in the study, 70.4 % were male and the remaining 29.6 % were female; a majority of the students were 15–16 years of age. 81.3 percent of the participants were day students (Table 1).

Distribution of the students according to their food safety knowledge level is given in Tables 2 and their distribution according to attitude is given in Tables 3.

A majority of the students gave wrong answers to the questions “What is the most appropriate way to thaw frozen foods?”, “Which of the following items of tableware are used for serving food does not have an unfavourable effect in terms of food safety?”, and “Which of the following includes the colour used for cutting boards that are used for vegetables and fruits?” (81.5 %, 73.8 %, and 90.5 %, respectively). On the other hand, the questions “Which of the following features is suitable for places where dried foods are stored?”, and “Which of the following is an obligatory application in terms of food safety?” scored the highest rates of correct answers (69.8 %, and 74.5 %, respectively).

While a majority of students replied to the negative-attitude sentences with the answer “I don’t agree”, more than half of them exhibited positive attitudes about positive statements, by marking the choice “I agree”, except the questions “I follow food hygiene-related developments closely.”, “I voluntarily attend activities of all kinds

Table 1. Distribution of the participants by gender (n=912)

| Demographic Characteristics | n | % |
|-----------------------------|-----|------|
| Gender | | |
| Male | 642 | 70.4 |
| Female | 270 | 29.6 |
| Age (year) | | |
| 15 | 401 | 44.0 |
| 16 | 374 | 41.0 |
| 17 | 137 | 15.0 |
| Type of education | | |
| Boarding | 171 | 18.7 |
| Day | 741 | 81.3 |

about food hygiene.”, and “If it was in my power, I would ensure the hygiene of all foods.” (38.4 %, 31.1 %, and 47.1 %, respectively).

Means and standard deviation values of food safety scores by gender are given in Table 4.

Table 5 shows the correlation between the knowledge level and attitude of the participants.

The food safety knowledge level, aspects of attitude and total attitude scores of female students were all found to be higher than those of

Table 2. Distribution of Participant Students by Their Food Safety Knowledge

| Questions | Correct n (%) | Wrong n (%) |
|--|------------------|----------------|
| Which of the following is a high-risk group? | 286 (31.4) | 626 (68.6) |
| What is the most appropriate way to thaw frozen foods? | 169 (18.5) | 743 (81.5) |
| Which of the following features is suitable for places where dried foods are stored? | 637 (69.8) | 275 (30.2) |
| Which of the following is an obligatory application in terms of food safety? | 679 (74.5) | 233 (25.5) |
| Some types of food can be kept at room temperature. Which of the following is used for cooking such food? | 633 (69.4) | 279 (30.6) |
| Which of the following features is desirable for the kitchen environment? | 395 (43.3) | 517 (56.7) |
| Which of the following stages affects food safety? | 573 (62.8) | 339 (37.2) |
| Which of the following items of tableware using for serving food does not have an unfavourable effect in terms of food safety? | 239 (26.2) | 673 (73.8) |
| Which of the following terms is used for “the process of removing microorganisms existing in the food environment through application of heat or chemical means, without affecting the nutritional features of foods, in order to prevent contamination of foods”? | 335 (36.7) | 577 (63.3) |
| Which of the following terms can be expressed by the statement “All measures that should be taken to ensure food safety”? | 349 (38.3) | 563 (61.7) |
| Which of the following includes the colour used for cutting boards that are used for vegetables and fruits? | 87 (9.5) | 825 (90.5) |
| Which of the following causes food-borne diseases to arise? | 573 (62.8) | 339 (37.2) |
| Which of the following is a way for food-borne diseases to spread? | 593 (65.0) | 319 (35.0) |
| Which of the following includes the drawback caused by storing detergents in kitchens? | 603 (66.1) | 309 (33.9) |
| Which of the following is the most important benefit of preparing foods in kitchens in accordance with food safety requirements? | 402 (44.1) | 510 (55.9) |
| Why does keeping food between temperatures of 4 °C and 63 °C cause negative results to arise in terms of food safety? | 333 (36.5) | 579 (63.5) |
| Which of the following is the reason for the higher risk of spoilage of foods of animal-origin, in comparison with leguminous plants? | 346 (37.9) | 566 (62.1) |
| Why shouldn't kitchen personnel work in the kitchen when they catch a cold or flu? | 578 (63.4) | 334 (36.6) |
| Which of the following is the negative effect of chopping up or dicing both uncooked and cooked food on the same surface? | 496 (54.4) | 416 (45.6) |
| Why should personnel having a cut or wound on his/her hand not work during the phase food preparation phase? | 614 (67.3) | 298 (32.7) |
| Which of the following complaints that may be experienced after eating a meal does not indicate the likelihood of food poisoning? | 588 (64.5) | 324 (35.5) |
| Why is it advantageous to code equipment with different colours, such as cutting boards and knives, used for different food groups such as uncooked meat, cooked meat, vegetables, and fruit? | 365 (40.0) | 547 (60.0) |
| Which of the following is the most significant problem that may be experienced due to personnel working in kitchens not using masks? | 524 (57.5) | 388 (42.5) |
| Which of the following is the problem that may be caused by mopping dishes after they are washed? | 442 (48.5) | 470 (51.5) |
| Hot food should be kept at a temperature equal to or greater than 63 °C by use of a chafing system in the course of food delivery. Which of the following is the most important reason for that? | 369 (40.5) | 543 (59.5) |

the male participants ($p < 0.001$) (Table 4). In a study in which only females were involved it had been stated that participants, in general, were concerned with food safety²⁸. In this research, the food safety knowledge level and attitude scores of female students were found to be higher in comparison with male participants, (Table 4) showing that gender is a significant factor for food safety knowledge and attitude. Among the students, female students had more positive attitudes towards food safety. However, they were still less than expected, showing the negative effect of age, as in the findings of Jevšnik *et al.*,²⁸ (Table 4). In a study conducted on this subject have also shown the level of food safety knowledge and interest in food safety increase proportionally with age¹⁴. In another study, the educational level of the participants was found to be important in terms of their interest in potential food risks, which was interpreted as meaning those with a higher educational level (high school/university) were more conscious of food-related issues²⁹. In our case it is not possible to say, by considering their

knowledge and attitude scores, that the participants were sufficiently interested in food safety, although they were in classes 2 and 3 at high schools. The reason for this may be explained by a lack of information about food safety in their curriculum, their ages, and the fact that the participants were not interested in food safety issues. Similarly, in a study conducted by Endres *et al.*,²¹ the food safety knowledge levels of students and their science teachers was compared to one another, and those of the teacher were found to be significantly higher in comparison with the students. In this case, differences in both educational level and age should be taken into account. Accordingly, considering the age group and educational level of the students who comprise the universe of the study, lower levels of food safety knowledge can be interpreted as widespread (Table 4). Hence, Wilcock, Pun, Khanona and Aung³⁰ also suggested that food safety attitudes of consumers varied according to their demographic and socio-economic status, which is in line with our results.

Table 3. Distribution of participating students by their food safety attitude

| Attitude | I agree n (%) | I partially agree n (%) | I don't agree n (%) |
|---|------------------|----------------------------|------------------------|
| Consideration (Factor I) | | | |
| The last thing that comes to my mind is hygiene. (-) | 201 (22.0) | 143 (15.7) | 568 (62.3) |
| Hygiene for food is not as important as it is assumed. (-) | 65 (7.1) | 98 (10.7) | 749 (82.1) |
| For me, the taste of food is more important than hygiene. (-) | 178 (19.5) | 231 (25.3) | 503 (55.2) |
| I don't think unhygienic food causes me to catch a disease. (-) | 168 (18.4) | 151 (16.6) | 593 (65.0) |
| For me, the appearance of food is more important than hygiene. (-) | 111 (12.2) | 187 (20.5) | 614 (67.3) |
| I don't count the hygiene of food. (-) | 91 (10.0) | 113 (12.4) | 708 (77.6) |
| For me, just feeding myself is more important than the hygienic condition of the food. (-) | 134 (14.7) | 162 (17.8) | 616 (67.5) |
| I don't mind warnings about hygiene at all. (-) | 49 (5.3) | 141 (15.5) | 722 (79.2) |
| I don't care about hygiene when I am preparing food. (-) | 70 (7.7) | 110 (12.1) | 732 (80.3) |
| Internalisation (Factor II) | | | |
| I follow food hygiene-related developments closely. | 350 (38.4) | 393 (43.1) | 169 (18.5) |
| The thing that I mind most about foods is hygiene. | 555 (60.9) | 249 (27.3) | 108 (11.8) |
| I never ignore food hygiene regardless of circumstances. | 498 (54.6) | 287 (31.5) | 127 (13.9) |
| I voluntarily attend activities of all kinds about food hygiene. | 284 (31.1) | 392 (43.0) | 236 (25.9) |
| I immediately advise those who don't respect food hygiene. | 464 (50.9) | 300 (32.9) | 148 (16.2) |
| I always keep in mind whether the food I am consuming complies with hygiene requirements. | 551 (60.4) | 246 (27.0) | 115 (12.6) |
| I would like to be sure about the hygiene of foods I buy even if they are branded ones. | 549 (60.2) | 240 (26.3) | 123 (13.5) |
| The item that attracts my attention in any environment where food-related services are provided is the hygiene. | 585 (64.1) | 236 (25.9) | 91 (10.0) |
| If it was in my power, I would ensure the hygiene of all foods. | 430 (47.1) | 314 (34.4) | 168 (18.4) |

Jevšnik, Hlebec and Raspor³¹ concluded that consumers had inadequate knowledge about food safety, and particular attention should be paid to consumers' education in order to minimize food-borne diseases. In studies conducted on food industry workers^{19, 20, 23, 32-34} and university students^{23, 35}, lack of education on food safety was underlined, as in this study (Table 4). These results show that individuals from every walk of life are in need of food safety-oriented education. From the studies conducted it was determined that hygiene education, when provided, caused significant increases in knowledge level^{20, 25}. Food safety-related information was declared to have positive effects on food preparation, cooking and storing activities^{14, 16, 19, 33}. Eves *et al.*²² found that students between 4 and 14 years of age had good awareness of food hygiene-related issues but had misperceptions about microorganisms and their effects on foods. In other research in which food safety education in secondary schools was studied, it was stated that the best education method was the demonstration method, and that shortages of materials and short class time periods posed serious obstacles²⁴. These findings show that those in power need to take action to increase the knowledge and awareness level of students,

and consequently of the community, in terms of curriculum and classroom materials.

A moderate-level positive correlation was found to exist between the food safety knowledge level of participants and their scores for the consideration aspect of attitude ($r=0.357$, $p<0.01$) while the correlation between food safety knowledge level and total attitude was low-level ($r=0.240$, $p<0.01$) (Table 5). Because the "positive attitudes" of the participants were more distributed in comparison with their actual knowledge level (Table 2 and Table 3), it must be considered that even if the participants do not have sufficient knowledge of food safety, they still take food safety seriously. Despite this, the attitudes of those that have more knowledge of food safety increase positively (Table 5). Within this framework, it can be resulted that as the level of food safety knowledge increases, more positive attitudes are improved about food safety.

With this study, it was determined that high school students had inadequate information about food safety, and that their attitude toward food safety improved with increases in their food safety knowledge level. People to which a certain service is provided have a significant sanction power in improving the quality of the service

Table 4. Arithmetical Means, Standard Deviation, and Results of t-tests of Food Safety Knowledge Level and Attitude by Gender (n=912)

| Variables | Gender | n | \bar{X} | SD | t-test | p value |
|------------------------------|--------|-----|-----------|------|---------|---------|
| Knowledgea | Male | 642 | 10.90 | 5.01 | -13.848 | 0.000 |
| | Female | 270 | 15.59 | 4.52 | | |
| Consideration of Attitudeb | Male | 642 | 22.63 | 4.08 | -7.477 | 0.000 |
| | Female | 270 | 24.55 | 3.29 | | |
| Internalisation of Attitudeb | Male | 642 | 20.91 | 4.51 | -4.022 | 0.000 |
| | Female | 270 | 22.13 | 4.03 | | |
| Total Attitudec | Male | 642 | 43.53 | 7.03 | -6.859 | 0.000 |
| | Female | 270 | 46.67 | 5.98 | | |

a: The lowest and highest scores that can be obtained are 0 and 25, respectively

b: The lowest and highest scores that can be obtained are 9 and 27, respectively

c: The lowest and highest scores that can be obtained are 18 and 54, respectively

Table 5. Correlation between Food Safety-oriented Knowledge and Attitude Scores (r)

| Variables | Consideration of Attitude | Internalisation of Attitude | Total Attitude |
|-----------|---------------------------|-----------------------------|--------------------|
| Knowledge | 0.357 ¹ | 0.054 | 0.240 ^a |

^a: $p<0.01$

because they, as consumers, in line with the law of supply and demand, prefer not to buy or purchase a service that is thought to be inappropriate or insufficient. Therefore, the knowledge and awareness level of workers and consumers is as important in ensuring food safety as legal sanctions^{36,37}. Schools have important potential in raising people's food safety-related awareness through their capability to reach large communities. By developing effective training programs, new generations and, consequently, new families, can become more sensitive to food safety. Therefore, providing students with food safety training starting in primary education may contribute to preventing food-borne diseases and ensuring food safety, which is an effective solution for both individual and social development.

Conscientious consumers determine the quality of food-related audits and controls performed by the government to protect people. Consumers, through non-governmental organizations established by them, cause the government to lay down rules that are aimed at protecting consumer rights and ensure proper functioning of the food safety system. Although food safety is handled by the government, food industry and consumers, the government has the primary responsible with its power to lay down food-oriented rules and directives³⁸. Governments are responsible for providing an environment that ensures peace and developing appropriate policies, in addition to ensuring social, political and economic stability and justice. Seeing the subject in a global perspective, governments should actively cooperate with each other as well as with United Nations bodies, financial organizations, international organizations and non-governmental organizations in order to ensure food safety for everyone. The first step towards determining the measures to be taken and conducting a risk analysis on food safety should be to educate consumers on food safety.

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