



## The Knowledge, Attitude, and Practices of Secondary High School Students Regarding Food Safety and Hygiene in Khorramdarreh, Iran

Aghdas Moghaddam<sup>a</sup> | Hassan Hassanzadazar<sup>a\*</sup> | Mohammad Masoud Vakili<sup>b</sup> | Fatemeh Jafari<sup>c</sup> | Majid Aminzare<sup>a</sup>

a. Department of Food Safety and Hygiene, School of Public Health, Zanjan University of Medical Sciences, Zanjan, Iran.

b. Department of Health Promotion and Education, School of Public Health, Zanjan University of Medical Sciences, Zanjan, Iran.

c. Department of Public Health, School of Public Health, Zanjan University of Medical Sciences, Zanjan, Iran.

\*Corresponding author: Department of Food Safety and Hygiene, School of Public Health, Zanjan University of Medical Sciences, Zanjan, Iran. Postal code: 4513956184.

E-mail address: hassanzadazar\_h@zums.ac.ir

### ARTICLE INFO

**Article type:**  
Original article

**Article history:**  
Received: 8 March 2020  
Revised: 25 April 2020  
Accepted: 21 May 2020

DOI: [10.29252/jhehp.6.2.3](https://doi.org/10.29252/jhehp.6.2.3)

**Keywords:**  
Attitude  
Food safety and hygiene  
Knowledge  
Practice  
Secondary high school students

### ABSTRACT

**Background:** The studies on children and adolescents provide the basic information for educational interventions such as the assessment of the knowledge of community health promotion. The present study aimed to evaluate the knowledge, attitude, and practices of secondary high school students regarding food safety and hygiene in Khorramdarreh, Zanjan, Iran.

**Methods:** This cross-sectional study was conducted on 640 secondary high school students during December 2014-December 2015. The participants were selected via cluster sampling, and data were collected using a researcher-made questionnaire after assessing its validity and reliability. Data analysis was performed in SPSS version 16.

**Results:** The mean scores of the knowledge, attitude, and practices of the students were  $36.6 \pm 6.96$  (moderate),  $57.95 \pm 6.88$  (favorable), and  $40.59 \pm 5.80$  (favorable), respectively. The lowest knowledge level of the students was observed in milk and egg hygiene (27%), meat hygiene (35%), effect of temperature on microorganisms (35%), and brucellosis-related aspects (7.33%).

**Conclusion:** Although the students had a positive attitude toward food safety, they had inadequate knowledge of the effects on their practices. Therefore, it seems that training is essential in the food safety and hygiene fields for students and their parents.

## 1. Introduction

Food safety and hygiene are important issues in the global community health care and are defined as taking the required measures for the production, processing, storage, and provision of high-quality foods for consumers [1]. With the global population growth, the importance of food quantity has been coupled with the considerations regarding the quality and preparation of safe and hygienic food. Most food contaminations occur due to recklessness in various stages of production, distribution, and sale,

which in turn causes foodborne diseases. The estimation of the incidence rate of foodborne diseases, whether infections or food poisoning, is rather challenging. According to reliable reports, 1.8 million individuals lose their lives each year due to diarrheal diseases, which are mainly caused by drinking water and food contamination [2,3]. Furthermore, statistics suggest that foodborne diseases cause 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths annually [4].

According to the literature, food spoilage and contamination could give rise to 250 diseases due to



negligence and adulterations, non-compliance with rules and regulations, lack of health care and nutritional knowledge, and inappropriate performance in food production processes. Foodborne diseases have been reported to be a major cause of illnesses in students due to the consumption of contaminated food at canteens and hostel kitchens, improper food storage, and poor hygiene of food producers and food handlers in schools [1,5]. Decision-making and performance in food safety and hygiene has also been reported to be rather poor due to the inadequate knowledge of a large proportion of the world's population regarding these issues, which has in turn led to the increasing prevalence of foodborne diseases in developed and developing countries [4,6]. The epidemiological investigations of foodborne diseases have indicated that in addition to inadequate knowledge, factors such as the inappropriate attitudes and practices of food consumers (e.g., consumption of raw and undercooked foods with poor health conditions) play a pivotal role in the epidemics of foodborne diseases [7].

The recognition of the hazards associated with food hygiene during food preparation by adolescents and children (especially school children) is considered essential to their health and health of others. These community members may continue their acquired health behaviors in adulthood as supervisors of family or food staffs. After the development of habits and desire to maintain these habits for a long time, the habits become more difficult to change later, and childhood and adolescence are critical periods for the acquisition of knowledge, attitude, and practical skills regarding food hygiene [8,9]. Previous studies of Slovenian adults have indicated that most food preparation practices are learnt primarily from parents [10,11]. In addition, the study of children, adolescents, and young adults have shown that parents are the main source of information or the first to introduce food safety concepts to children [12].

A literature review of the studies regarding the knowledge, attitude, and practice (KAP) of various social groups regarding food safety and hygiene in Iran and other countries has indicated the knowledge level of individuals changes based on their demographic and academic status and increased age. On the other hand, food preparation practices in females have been reported to be more effective compared to males, while the knowledge level in this regard has been shown to be equal in both genders [13,14]. Furthermore, the evaluation of knowledge in adolescents regarding food safety and hygiene has been considerable at the two levels of learning skills and catering/food preparation responsibilities in the future [8]. Evidence suggests that children contribute to food preparation at home with their parents or alone [15,16]. Education is considered to be the most effective approach to acquiring knowledge and the institutionalization of positive practices in food safety and hygiene [17]. Research on children and adolescents has determined basic information as the stepping stone for educational interventions [8]. However, educational health promotion strategies are only successful if they are programed in accordance with the knowledge, attitudes, and practices of the community [18].

Food hygienic and food safety must be emphasized for students. To date, only few studies have been conducted in this regard on students, and there is a lack of regular

educational programs in the schools of Iran. The present study aimed to evaluate the KAP of secondary high school students regarding food safety and hygiene in Khorramdareh city in Zanjan province, Iran as an introduction to the implementation of organized educational programs in these schools in the future.

## 2. Materials and Methods

### 2.1. Participants and Procedure

This descriptive study was conducted during November 2014-March 2015. Data were collected using a researcher-made questionnaire, which was distributed among the male and female students of the secondary high schools of Khorramdarreh, which is the second largest city in Zanjan province. After obtaining the required permit from the Office of Education for the study, all the secondary high school students in the city were considered as the sample population, including 1,455 students, with 649 male (44.6%) and 806 female students (55.4%) from 11 secondary high schools. Considering 95% confidence level, 5% error, and 1.5 design effect index, the sample size was estimated at 680 students using multistage cluster sampling and the following formula:

$$N = Z^2 pq / d^2$$

$n$  = sample size,  $z$  = level of confidence according to the standard normal distribution (for a level of confidence of 95%,  $z = 1.96$ , for a level of confidence of 99%,  $z = 2.575$ ),  $P$  = estimated proportion of the population that presents the characteristic (when unknown we use  $P = 0.5$ ),  $d$  = tolerated margin of error.

In total, 680 students agreed to participate in the study, and 40 uncompleted questionnaires were excluded from the analysis. Finally, 355 female (55.4%) and 285 male students (44.5%) completed the questionnaire. After the coding of the questionnaires, data analysis was performed.

### 2.2. Questionnaire Design

Data were collected using a self-administered questionnaire designed by the authors, which was divided into four sections of demographic information, knowledge, attitude, and practice. The items in the questionnaire were determined based on the latest scientific resources and measures identified by the World Health Organization (WHO) as the crucial measures for food safety and hygiene, including keeping clean, separation of raw and cooked foods, thorough cooking, keeping food at safe temperatures, using safe raw materials, diagnosis of food spoilage, food hazards, and the necessary measures for the prevention of foodborne diseases [2,5,10,12,19].

#### 2.2.1. Quantification of Content Validity

The viewpoints of 15 academic experts were applied to determine the content validity of the questionnaire. In addition, the preliminary qualitative scientific validation of the questionnaire was performed, and the clarity, suitability of wording, and average time needed for completion were evaluated via an invitation sent by e-mail to 15 academician experts in food safety and hygiene from various universities in Iran and a pilot study on 20 students of high schools as the target group.

The quantitative validation of the questionnaire was carried out through the measurement of the content validity ratio (CVR), validity index, impact source, and Cronbach's alpha coefficient to confirm the reliability [20]. To determine the CVR, the academician experts are asked to grade each items of the questionnaire within the range of 1-3 based on a three-point scale (Not Necessary, Useful but Not Necessary, Necessary). The CVR was estimated within the range of 1—1, and the higher grades indicated the further consensus of the invited experts on the necessity of an item in the designed questionnaire. The CVR formula is as follows:

$$\text{CVR} = (N_e - N/2) / (N/2)$$

where  $N_e$  is the number of the experts agreeing upon the necessity of an item, and  $N$  represents the total number of the experts.

Lawshe Table was used to determine the numeric value of CVR. Accordingly, higher CVR value than 0.7 for each item was defined as the necessity of the item to be saved in the questionnaire ( $P < 0.05$ ).

To determine the Content Validity Index (CVI), the experts were requested to rate the items of the questionnaire in terms of clarity and relevancy to the research subject based on a four-point ordinal scale (1=Not Relevant, 2=Partly Relevant, 3=Quite Relevant, 4=Highly Relevant) [20]. In this regard, the items with the rating of three or four by calculating the item level and scale level based on the viewpoints of the experts were selected for the questionnaire.

The impact source of each item in the designed questionnaire was inferred from the viewpoints of the target group (20 high school students) and the experts, who were requested to determine the items that seemed most important in their opinion and score the importance based on a five-point Likert scale (Very Important, Important, Relatively Important, Slightly Important, and Unimportant). To calculate the impact score of each item, the percentage of the experts and students who scored the importance of an item four or five was calculated (frequency), and the mean significance score of the item (importance) and impact score of the items were calculated using the following formula:

$$\text{Item Impact Score} = \text{Frequency} \times \text{Importance}$$

If the impact score of an item was  $\geq 1.5$ , the item would remain in the questionnaire; otherwise, it would be eliminated [20].

The reliability of the questionnaire was determined using the Cronbach's alpha. Initially, the questionnaire was completed by 20 students (10 males and 10 females), and after 10 days, the questionnaire was completed again by the same individuals to determine the Cronbach's alpha coefficient ( $\alpha = 0.7$ ). Before the distribution of the questionnaires, the items were reviewed again.

The initial questionnaire contained 50, 30, and 30 items on the parameters of knowledge, attitude, and practice, which were reduced to 24, 15, and 15 items, respectively after the validation process. The qualitative rating of the scores as favorable, moderate, and poor regarding the KAP of the students was determined based on the minimum and maximum scores that could be obtained by each respondent in the questionnaire, as well as the determination of the three equal intervals and prior experience of the research team.

### 2.2.2. Statistical Analysis

Data analysis was performed in SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) using descriptive statistics (mean, percentage, standard deviation, and frequency) for all the variables. The study protocol was approved by the Ethics Committee of Zanjan University of Medical Sciences (No. ZUMS.REC.1393.220).

## 3. Results and Discussion

The present study aimed to evaluate the knowledge, attitudes, and behaviors of high school students in Khorramdarreh and detect the educational priorities regarding food health and safety. Several studies in Iran have been focused on the KAP of university students, adults, and other groups in terms of food safety and hygiene, while this was the first research to be implemented on the secondary high school students in Iran. Since students are the next generation of food consumers and food suppliers, the improvement of their knowledge in this regard is paramount. Attitude and practices of students and other individuals could affect their knowledge level.

### 3.1. Profile of the Respondents

Analyzable data were obtained from 640 upper secondary school students of the schools in Khorramdarreh city. Table 1 shows the demographic characteristics of the students. According to the findings, the fathers (45.3%) and mothers of the majority of the students (86.9%) were self-employed and housewives, respectively, and their education level was primary high school (28%) and elementary school (34.5%), respectively. In addition, the majority of the students (94.2%) lived in urban areas (Table 1).

**Table 1:** Demographic Characteristics of Secondary High School Students of Khorramdarreh City in Zanjan, Iran (2014-2015)

Variable		%	
Gender	Girl	55.5	
	Boy	44.5	
Age	14-16 y	56.7	
	17-19 y	43.3	
Course study	Experimental	34.8	
	Humanities	16.9	
	Mathematics	12.7	
	Practical	19.1	
	Technical	16.6	
Course grade	Second	43.1	
	Third	39.2	
	Pre-University	17.7	
Father's job	Free	45.3	
	Employee	22.2	
	Others	35.5	
Mother's job	Housewife	86.9	
	Employee	13.1	
Settlement area	Urban	94.2	
	Rural	5.8	
Parent's education	Illiterate	Father	4.4
		Mother	8.4
	Elementary	Father	26.9
		Mother	4.5
	Secondary	Father	28
		Mother	2.7
	Diploma	Father	20.6
		Mother	7.8
	Collegiate	Father	17.8
		Mother	16.2
Without parents	Father	2.3	
	Mother	0.3	

The food safety and hygiene knowledge of the students was assessed in the first section of the questionnaire by 24 items responded with True/False options, which were divided into nine categories, including food spoilage signs, food contaminants, food preservation methods and prevention of cross contamination, milk, meat, and egg hygiene, food poisoning symptoms and brucellosis, role of food handlers in food contamination, hand hygiene, heat treatment and temperature control, and food safety responsibility after purchase (Table 2).

The second section of the questionnaire was designated to evaluate the attitude of the students by 15 items, which were scored based on a five-point scale (Strongly Disagree, Disagree, No Idea, Agree, and Strongly Agree), including food safety basics, personal hygiene, disinfection of fruits and vegetables, traditional ice cream, egg preservation, and hygienic food purchasing (Table 3).

In the third section of the questionnaire, the food safety and hygiene practices of the students were investigated, which was composed of 10 previously described measures scored based on a five-point scale (Never, Sometimes, Usually, Often, and Always), including food purchasing practices, food spoilage detection, personal hygiene, and washing fruits before use (Table 4).

### 3.2. Knowledge

The results of the present study indicated a significant difference between the knowledge of the students and parental education level. Accordingly, the students whose parents had academic education had a higher knowledge level in this regard compared to the other groups. However, the paired comparison of the groups indicated differences only between the students whose parents had academic and primary education ( $P < 0.01$ ). Accordingly, the increased maternal education level was associated with the higher mean score of knowledge in the students (illiterate < primary < primary high school < high school diploma < university). Furthermore, a significant difference was observed between the knowledge of the students and parental occupation status ( $P < 0.05$ ).

According to the results of the present study, the lowest knowledge level of the students was regarding milk and egg hygiene (27%), brucellosis (7.3%), meat hygiene (35%), and effect of temperature on microorganisms (35%) (Figure 1). The mean score of the knowledge of the students was  $36.6 \pm 6.96$ , and the knowledge level was observed to be favorable, moderate, and poor in 12.2%, 84.7%, and 3.1% of the students, respectively (Table 5). However, no significant difference was denoted in the knowledge of the students in terms of gender ( $P < 0.81$ ) and education grade ( $P < 0.05$ ), while significant differences were observed between various courses and the knowledge of the students ( $P \leq 0.001$ ). The mean score of the knowledge of the students in the mathematics and experimental sciences disciplines was higher compared to those in the humanities and technical courses.

According to the findings of the current research, the knowledge of the students was moderate overall, and 12.2%, 84.7%, and 3.1% of the students had favorable, moderate, and poor knowledge, respectively. Since no similar studies have been performed in Iran, our findings were compared

with the similar studies conducted in other countries, such as the studies by Norazmir in Malaysia [5] and Almansour in Saudi Arabia or the studies that have been conducted on university students [21]. Accordingly, the KAP of the students in Malaysia and Saudi Arabia was higher and lower than Iranian students, respectively. This discrepancy could be due to the type of the questions in the applied questionnaires, as well as the methods of the educational systems in different countries. According to the comparison of the university students in Iran (Tehran, Kermanshah, and Ilam medical university) with the students of other countries (USA and Greece), the knowledge of university students is higher than non-academic students [6,7,15,22,23]. This could be due to the differences in demographic characteristics, such as age, education level, high use of multimedia systems (TV, magazines), and possibly taking the courses related to food safety and hygiene at the university.

The results of the present study demonstrated no significant difference in the knowledge of the students in terms of gender, which is consistent with the studies conducted by Dargahi *et al.* (2016) in Kermanshah [22], Noorimotlagh *et al.* (2015) in Ilam [6], and Hassan *et al.* (2014) in Libanon [2]. In terms of the studied disciplines in the current research, the mean score of the knowledge of the students in the experimental sciences and mathematics disciplines was higher than the other courses, which could be due to the higher involvement of the experimental sciences students with health-related curriculum compared to the other disciplines; this is consistent with the previous findings in this regard. In a survey on Lebanese students, the mean scores of the knowledge and attitude of students of health-related courses were higher compared to other courses [2]. Furthermore, the studies performed in the north of Jordan and Tehran University of Medical Sciences (Iran) indicated that the knowledge of medical students in the field of food safety is higher compared to non-medical students [7,24].

According to the results of the present study, knowledge was directly correlated with the parental education level and occupation status of the students as the knowledge level of the students whose parents had higher education levels or official jobs was higher compared to the other groups ( $P < 0.001$ ). Highly educated parents had more knowledge compared to the non-educated or low-educated parents. Therefore, the improvement of parental knowledge in this regard could enhance the knowledge of students since parents are the foremost information source for students. On the other hand, the lack of knowledge or acquisition of misconceptions from the parents and others regarding this issue could lead to the transfer of false information to the future generations. According to the literature, training and increasing knowledge plays a pivotal role in the nutritional status of individuals [7]. The human knowledge of food safety and hygiene could prevent numerous diseases, as well as the contamination of food and the environment.

The most common causes of the transmission of epidemic foodborne diseases are the poor storage conditions of food (temperature/time), contamination of the equipment in food processing, use of unsafe raw materials for food preparation, poor personal hygiene, and inadequate cooking [25].

**Table 2:** Knowledge Questions and Responses of Students

Questions	Multiple-choice responses	Correct responses (%)	Incorrect responses (%)	Not sure(%)
1- Food Hygiene and safety is included all principles relating to the manufacture, storage, distribution and sale of food	-	72.3	4.1	23.6
2- HOW do you detect food spoiling?	Looking	59.2	21.2	19.5
	Smelling	84.1	8.3	7.7
	Touching	41.1	30.8	28.1
	Tasting	30.5	55.9	13.6
3- Which one is food contaminant?	Microbs	90.3	3.8	5.9
	Chemical agents (Pb,Cd,Hg,...)	66.4	14.1	19.5
	Physical agents (Glass, sand, insects, ...)	63.4	13	23.6
4- Raw and cooked foods can be kept adjacent to each other in the refrigerator		51.6	25.8	22.7
5- We can keep pasteurized milk 24 hours at room temperature.		34.2	33.8	32
6- Ultra-pasteurized milk (quite heated milk) does not require refrigeration.		11.4	60.9	27.7
7- Children and elderly can consumpt undercooked eggs		35.8	36.9	27.3
8- A common cutting board can be used for meat slicing and vegetables cutting.		58.9	20.6	20.5
9- Frozen meat should be left at room temperature for defrosting.		23.3	58.6	18.1
10- Minced meat is spoiled faster.		37.3	15.9	46.8
11- Sticky or slimy surface of raw meat is a sign of corruption.		28.8	24.5	46.7
12- Microbial pathogens are destroyed in:	Freezer temp. (0 - -18°C)	15.6	40.6	43.8
	Refrigerator temp. (2-8°C)	35.2	13.3	51.6
	Room temp. (15-25°C)	39.8	12.3	47.8
	Close to boiling temp. (75-100°C )	55	8.4	36.6
13- When we must wash our hands for preventing diseases transmission.	Before food preparing	89.5	5.6	4.8
	Before food eating	84.5	10.2	5.3
	After handling raw meat and eggs	42.5	35.9	21.6
	After touching of dusty things	62.5	20.2	17.3
14- Which one of these diseases can cause food contamination by food handlers?	Acne or purulent wounds on the body	52.2	20.5	27.3
	Respiratory infection (Tuberculosis)	63.9	14.7	21.4
	Intestinal diseases such as dysentery, typhoid and intestinal parasites	39.1	27.3	33.6
	AIDS and Hepatitis B	22.5	49.4	28.1
15-Brucellosis can be transmitted through:	Milk consumption	67.8	5.5	26.7
	Cheese consumption	55.5	12.5	32
	Yoghurt consumption	15.5	50.2	34.4
	Dried whey (Curd) consumption	35.3	19.5	45.2
	Ice cream consumption	26.6	25	48.4
16- Which one of this behaviors causing food contamination?	Licking fingers and spoon	77.2	7.5	15.3
	Sneezing and coughing on food	89.2	5.9	4.8
	Finger dipping in the ear and nose	85.5	5.9	8.6
	Blowing in plastic bag	59.5	16.2	24.2
	Count the money by hand	70.8	13	16.2
	smoking	67	13.3	19.7
17- Food Poisoning symptom is:	Diarrhea	80	7.5	12.5
	Vomitting	87	6.4	6.6
	Abdominal pains	76.1	10.3	13.6
	Fever	31.9	34.5	33.6
18- Before serving, Fresh local cheese should be in salt water for:	Immediately is consumable	48.3	16.1	35.6
	1-2 months	13.9	34.2	51.9
	3-4 months	14.8	23.9	61.2
19- Consumption of high-fried or roasted foods (such as grilled meat, toasted bread and ...) is OK.		71.2	14.8	13.9
20- Milk of animals with moldy foods diet is harmful to human health		43.4	22.5	34.1
21- Why fruits were peeled before consumption?	Presence of chemicals on fruit peel	60.9	18.3	20.8
	Presence of microbial agents on fruit Peel	15.3	66.6	18.1

**Table 2:** Knowledge Questions and Responses of Students (continue)

Questions	Multiple-choice responses	Correct responses	Incorrect responses (%)	Not sure(%)
		(%)		
22- Cans should be boiled in water for:	At least 20 minutes	44.4	19.8	35.8
	At least 15 minutes	32	32.5	35.5
23- Which one of canned food need to boiling before consumption?	Canned vegetables, such as spinach, peas and beans	39.8	28.3	31.9
	Canned Meat	60.5	14.8	24.7
	Canned tuna	86.4	5.8	7.8
24- Which food is not allowed in schools?	Sausage	89.4	7.2	3.4
	Olivier salad	32.7	51.4	15.9
	Donuts and Burger	69.4	17	13.6
	Bread and cheese	94.8	0.9	4.2
	Ice cream, candies, pastille	56.6	28.3	15.2
	Milk	94.8	1.6	3.6
	Chips and snacks	89.2	5.5	5.3
	Tamarind	85	9.8	5.2

According to the results of the present study, 65.8% and 88.6% of the students had no knowledge of the proper maintenance of pasteurized and sterilized milk, respectively, and only 44.4% had sufficient knowledge regarding the necessary boiling time of cans before consumption despite the extensive training on this subject. Moreover, the students had no knowledge about some unsafe foods (e.g., Olivier salad, sausage and burgers, ice cream, candies, pastille, chips, snacks, tamarind, and carbonated soft drinks) and their microbial and chemical risks and nutritional aspects for the consumers [26].

### 3.3. Attitude and Practice

According to the findings of the current research, the mean scores of attitude and practice in the students were  $57.95 \pm 6.88$  (favorable) and  $40.59 \pm 5.80$  (favorable),

respectively. The attitude of the students was considered favorable, moderate, and poor in 70.2%, 29.8%, and 0%, respectively. In addition, the practice level was considered favorable, moderate, and poor in 62%, 37.7%, and 0.3% of the students, respectively (Table 5).

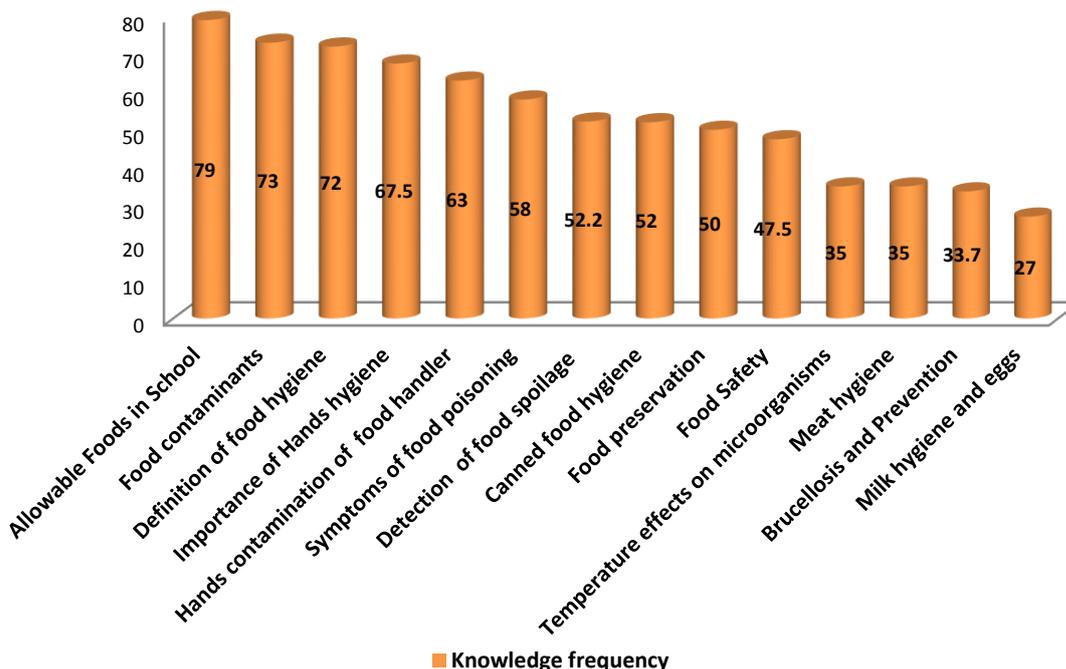
The results of the present study indicated that the attitude and practice of the students were favorable, which is consistent with the similar studies conducted in Saudi Arabia and Malaysia on secondary high school students, as well as the findings of Jahed *et al.* (2012) in university students [5,7,21,25]. The difference in the attitude and practice of the students in the current research with the other studies could be due to the differences in the applied questionnaires and the demographic and psychological characteristics of the samples. In our study, the items of the questionnaire regarding the practice of the students were designated for the selected target group and were easier compared to the similar studies.

**Table 3:** Attitude Questions and Responses of Students

No	Attitude questions	Responses (%)				
		Strongly agree	Agree	No idea	Disagree	Strongly disagree
1	In my opinion, food safety and hygiene is an important factor in maintaining human health.	60.3	32.3	2.7	1.1	3.6
2	I would like to learn more information about food safety and hygiene	48.1	31.1	12.3	3.3	5.2
3	I think food poisoning, disease is not dangerous.	4.4	15	21.7	35.8	23.1
4	I think, hands should be washing with soap and water prior to eating.	70.6	20.9	4.4	1.6	2.5
5	I think hands should be washed after going to the toilet with soap and water.	78	15	3.8	1.4	1.9
6	In my opinion fruits and vegetables, should be washed with disinfectants prior to eating.	36.2	28.3	21.1	9.8	4.5
7	I can eat unwashed fruit and grapes in the garden and farm.	30.2	30	21.6	12.7	5.6
8	I think buying ice cream of sidewalk ice cream maker devices is okay.	11.6	23.4	31.7	14.7	18.6
9	I think eating traditional ice cream is okay.	22.7	40.8	25.6	4.5	6.4
10	I think food should be bought from hygienic places.	55.3	30.3	9.7	2	2.7
11	In my opinion food vendors must wear clean caps and covers.	3.6	33.1	26.1	3.9	5.3
12	I think manufacture and expire date on lables to buy food is very important.	70.9	19.7	5.5	1.9	2
13	I refuse to buy food without labels.	48.8	25.3	14.5	6.2	5
14	It's okay to buy food without packaging.	4.1	6.6	15.3	22	52
15	Raw eggs must be washed before placing to refrigerator.	20.6	17.8	33.9	13.1	14.5

**Table 4:** Practice Questions and Responses of Students

No	Practice questions	Responses (%)				
		Never	Sometimes	Usually	Often	Always
1	I pay attention to label of food package (eg. Manufacture and expiration date before buying	3.4	10.5	13.3	21.9	50.9
2	I buy food without label of manufacture and expiration date.	60.6	21.6	7.7	6.6	3.6
3	I buy food of street vendors (such as fava beans and ...)	36.7	30.6	15	11.9	5.8
4	I buy foodstuffs placed in front of the store under the sun.	57.5	24.8	8.3	6.1	3.3
5	I wash fruits prior to eating.	1.7	4.1	4.8	11.9	77.5
6	I don't consume foodstuff, if their color and appearance changed	12.2	6.2	5.8	12.5	63.3
7	I taste food To determine their safety	31.1	19.5	20.2	15.6	13.6
8	I used personal mug to drink water at the School.	27.5	15.2	9.8	12.8	34.7
9	I wash my hands with soap and water.prior to eating	2.0	6.9	10.3	16.9	63.9
10	I Wash my hands with soap and water after going to the toilet.	3.8	3.0	2.8	6.9	83.6



**Figure 1:** Frequency of Knowledge of Students about Food Safety and Hygiene

If such questionnaires are designed with specific questions for other populations (e.g., housewives, food handlers or university students), the final results will be consistent with our findings. Our findings also showed that the mean scores of attitude and practice were higher in the female students compared to the male students with a significant difference in this regard, which is consistent with the study by Hassan *et al.* [2]. The differences in the attitude and practice of the male and female students could be attributed to their psychological characteristics [27]. It seems that girls are more sensitive than boys to food choice and hygiene. In contrast, the findings of Norazmir in Malaysia indicated no significant differences in the attitude and practice between the male and female students due to the increased knowledge of the males [5], while Yoon and Yoon reported a significant correlation between increased knowledge and improved practice in this regard [28]. Therefore, it could be concluded that increased knowledge results in better practice regarding food safety and hygiene.

In general, the majority of the students in the present

study had favorable practice regarding food safety and hygiene. Considering the target population in the present study, most of the items on food safety and hygiene practices were not added to the questionnaire. Undoubtedly, our findings could not be obtained if the practice section of the questionnaire had been designed with items regarding meat and egg hygiene, food preservation methods, food spoilage detection, and food purchasing.

Several studies have confirmed the positive, significant correlation between the attitude and practice of students, which reflects the impact of a proper attitude toward hygienic practices [5,7,20,24]. Therefore, the most important issue is to consider the systematic education and training of students within the first years of life in order to raise awareness and foster the proper attitude, which in turn enhances the practice of individuals in this regard. Since parents are the main source of information for children and affect their knowledge, such education should be extended to all the groups of the society.

**Table 5:** Frequency Distribution of Scores of Knowledge, Attitude, and Practice of Secondary High School Students of Khorramdarreh City in Zanjan, Iran (2014-2015)

	Knowledge score		Attitude score		Practice score	
	Score	(%)	Score	(%)	Score	(%)
Poor	(0-22)	3.1	(15-35)	-	(10-20)	0.3
Intermediate	(23-44)	84.7	(36-55)	29.8	(21-39)	37.7
Good	(45-66)	12.2	(56-75)	70.2	(40-50)	62
Mean score (Mean ± SD)	36.60 ± 6.96		57.95 ± 6.88		40.59 ± 5.80	
Minimum	10		36		16	
Maximum	55		73		50	

#### 4. Conclusion

According to results, the attitude of the students was better than their knowledge regarding food safety, indicating that although the students had a positive attitude toward food safety, they did not have the adequate knowledge in this respect. Given the moderate and poor knowledge of the students about food safety and hygiene (especially in the students of the humanities discipline and practical and technical courses and those with low parental education level), proper training on food safety and hygiene seems essential, with focus on personal hygiene, food storage duration and conditions, perishable foods, food packaging, identification and attention to various food labels, and disadvantages of the foods that are not allowed for consumption.

The results of this study help the officials of health organizations and ministry of education to plan specific educational programs and increase the knowledge students regarding food safety and hygiene. Furthermore, it is recommended that food safety and hygiene issues be incorporated into the curricula of schools and health educators with relevant education permanently attend schools (or at least three days per week). Such training could be implemented for one hour per week and regularly allocated to basic hygiene education. The operators and food suppliers of school buffets should also be trained in this regard.

#### Authors' Contributions

H.H.A., and A.M., designed the manuscript; A.M., and M. A., managed the analyses of the literature search; A.M., and M.M.V., managed data acquisition; A.M., and F.J., performed the statistical analysis; H.H.A., and A.M., drafted the manuscript.

#### Conflict of Interest

The Authors declare that there is no conflict of interest.

#### Acknowledgments

Hereby, we extend our gratitude to the Deputy of Research of Zanjan University of Medical Sciences for the financial support of this study (Project No. A-11-940-1). We would also like to thank Mr. Sajad Moghaddam and Mr. Abulfazl Moghaddam at the Office of Education of Khorramdarreh city for their cooperation in this research project.

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