

## Assessment of Food Hygiene and Safety Knowledge, Attitudes, and Practice in Elementary School Students

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**ABSTRACT** The purpose of this study was to evaluate the elementary students' knowledge, attitudes, and practice for food hygiene and safety. A self-administered questionnaire was developed and offered to 375 elementary school students throughout the Seoul region. The results of the survey were as follows: First, the knowledge, attitudes, and practice were not at satisfactory level. The scores of children's knowledge, attitudes, and practice were 67.42%, 3.83, and 3.81 out of 5 point scale, respectively. Second, knowledge, attitudes and practice levels were significantly different according to demographic characteristics. The lower grade-students had significantly higher scores for knowledge ( $p < .05$ ), attitudes ( $p < .05$ ) and practice ( $p < .01$ ) than higher grade-students, suggesting that food hygiene and safety education is more effective in younger students or that repeated education is needed for higher grade-students. Third, knowledge, attitudes and practice levels were significantly correlated each other. These results suggest that the education programs for food hygiene and safety should be developed for, as well as implemented in, lower elementary school grades.

**KEYWORDS:** food hygiene, safety, elementary students, knowledge, attitudes, practice

### INTRODUCTION

Despite economic development and improvement in quality of life, the occurrence of foodborne illness has increased gradually; this can be attributed to increases in domestic and international food trading, eating-out frequently, and to our complex system of food production and distribution, which exposes our food to greater chances of contamination (Lee BH 2003).

The major route of foodborne illness appears to be foodservice establishments including school foodservice, where even elementary school students have become victims. In 1995, the average number of patients per foodborne outbreak was 28.8, however, it gradually increased to 58.6 in 2003 and 52.4 in 2005 (KFDA 2007). By the enforcement of School Foodservice Act, the ratio of school with foodservice in Korea has reached nearly 100%. However, the occurrence of foodborne illness in school foodservice has increased as well, and in 2006, one of Korea's largest foodborne outbreak occurred at a school foodservice where

almost 3,000 students became ill (KFDA 2007).

So far, the aims and activities on food safety improvement and outbreak prevention have concentrated on aspects pertaining to food suppliers, such as raw ingredients, as well as processed foods, food processing methods, and food storage and distribution. However, analyses of foodborne outbreak indicate that more outbreaks are caused by the improper handling or consumption of food by food handler and consumers, respectively, having no sound knowledge of food hygiene, than to contamination originating from the food production level (Kim WJ and Choi EH 2002).

Education on food hygiene and safety is very important in order for children to have the ability to choose safe foods and enjoy the offerings of school food service, as well as to attain the proper food hygiene and safety knowledge, attitudes and practice for everyday life. Because such behavior is not formed in a short period and since it is not easy to change behaviors once one has reached adulthood, proper education on food hygiene and safety should begin during childhood.

There have been several reports examining the food hygiene and safety knowledge and behaviors of housewives, parents, foodservice workers, consumers (Bahk GJ et al 2003, Kim WJ and Choi EH 2002, Kim JG 2004, Lee YH et al 2006, Park JY et al 2006, Kim H and Kim M 2003), but very little research has assessed groups of elementary

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students (Kim M and Kim H 2005a, 2005b, Yoon HJ and Yoon KS 2007). Furthermore, education programs designed for adults can not be used with children.

The food hygiene and safety knowledge and practice levels of consumers have been evaluated as low (Kim WJ and Choi EH 2002, Kim JG 2004); however, the demand and interest for information on foodborne illness is high, and consumers with low levels of education but high interests in foodborne illness demand more information (Kim H and Kim M 2003). A person's education level was found to be an influential factor for their perceptions on food safety; however knowledge and experience of foodborne illness were not influential factors toward behaviors for foodborne illness prevention (Bahk GJ et al 2003). Also the food safety practice levels of individuals are generally lower than their levels of knowledge or attitudes toward food safety; therefore, there seems to be a gap between the food hygiene and safety knowledge or attitude and practices of adults.

Elementary school students have also shown desires to learn about unsanitary food, foodborne illness, food selection and storage method, and personal hygiene (Yoon HJ and Yoon KS 2007). In a study of elementary school students in the Youngnam area, food hygiene and safety knowledge and behavior levels were low, but unlike adults, a significant relationship was observed between the knowledge and behavior levels of the children (Kim M and Kim H 2005b).

Food safety issues are becoming increasingly important. And as implies above, more studies are needed to diagnose the current status of elementary school students relative to aspects of food hygiene and safety. Therefore, this study evaluated the food hygiene and safety knowledge, attitudes, and practice levels of elementary school students in order to assess their current status and to provide basic data for the development of food hygiene and safety education programs at the elementary school level.

## MATERIALS AND METHODS

### Subjects and period

Elementary school students in 4th to 6th grades in Seoul area were subjected for a survey by using a self-administered questionnaire. Before the survey, a pre-test was conducted in a class of 4th grade students to adjust for levels of understanding and difficulty. The survey was conducted from March 6 to March 15, 2007, and total 375 questionnaires returned out of 381 questionnaires with a return rate of 95.2%, were used for analysis.

### Questionnaire

The questionnaire was designed to evaluate the subjects' knowledge, attitudes and practice levels. It consisted of 9 questions assessing the general characteristics of the subjects, 20 questions assessing knowledge, 10 questions assessing attitude, and 10 questions related to the food

hygiene and safty practice levels of the children. Questions within each of the above categories focused on 3 areas: personal hygiene, food safety, and food handing hygiene. The questions on personal hygiene examined hand washing, interest and food safety related practices. The questions on food safety were related to drinking water, foodborne illness, spoiled food, expiration date, food additives, etc. And the questions on food handling hygiene pertained to the handling of cooking utensils, refrigerators, cross contamination, food washing, and proper food preparation.

For the questions examining knowledge, all correct answers were given '1' point and then the total points gained and the rate of correct answers were calculated. For the questions examining attitude and food hygiene and safety practice, a 5 point Likert scale was used: where 1 point was 'never' or 'the least' and 5 points was 'very much' or 'very likely', therefore, higher score given by the students implied better attitudes or practices.

### Data analyses

Total 375 questionnaires were used for analysis by excluding those with insufficient answers. SPSS/Windows 12.0 was used to perform statistical analysis including frequency analysis, means with standard deviation for the demographic data, t-test and analysis of variance (ANOVA) to determine the statistical difference between or among groups. Pearson's correlation analysis to assess the relationship between groups.

## RESULTS AND DISCUSSION

### General characteristics of the subjects

Table 1 presents the general characteristics of the subjects. Overall, 50.1% of the student's were 11 years old (5th grade), 44% were 10 years old, and 5.9% were 12 years old; the numbers of female and male students were the same, Over 60% of the students had families composed of 4 members, and more than half had two working parents. For 83.2% of the student's, their mother was the person in charge of family meals. The majority of the children answered that their family income and individual scholastic achievement were both average.

Over 40% of the subjects answered they had not received food hygiene and safety education at home or school. These results were similar to those of previous reports (Kim M and Kim H 2005b, Yoon HJ and Yoon KS 2007) and revealed a lack of proper food hygiene and safety education for the children.

### Food hygiene and safety knowledge levels of elementary school children

The knowledge levels of the students were measured according to the rate of correct answer in the 3 categories of personal hygiene, food safety, and food handling hygiene.

**Table 1.** General characteristics of the subjects

Factors	Classification	Frequency	%
Age	10	165	44.0
	11	188	50.1
	12	22	5.9
Gender	Male	190	50.7
	Female	185	49.3
Family member	≤3	35	9.3
	4	228	60.8
	5	70	18.7
	6	27	7.2
	7≤	15	4.0
Both parents working	Yes	210	56.0
	No	165	44.0
Person in charge of family meals	Mother	312	83.2
	Father	16	4.3
	Grandmother	36	9.6
	Maid	2	.5
	Others	9	2.4
Family income level	upper	38	10.1
	average	318	84.8
	lower	19	5.1
Scholastic achievement	upper	59	15.7
	average	272	72.5
	lower	44	11.7
Education experience on food hygiene and safety at home	very often	21	5.6
	often	49	13.1
	a few	155	41.3
	few	90	24.0
	never	60	16.0
Education experience on food hygiene and safety at school	very often	11	2.9
	often	17	4.5
	a few	181	48.3
	few	109	29.1
	never	57	15.2

The average rate of correct answers was 67.42%, which was deemed an unacceptable level. Among the scores or knowledge, questions related to personal hygiene received the highest number of correct answers with 83.56% correct, followed by food safety, with 65.93%, and food handling hygiene with only 52.38% answered correctly. Table 2 shows the knowledge scores for food hygiene and safety when analyzed according to the demographic characteristics of the students.

Age, gender, number of family members, and scholastic achievement level were the significant factors affecting the students' knowledge levels ( $p < 0.05$ ). When reviewed according to student age, food hygiene and safety knowledge was generally high and in the order of 10, 11 and 12 years old; The students' knowledge on food handling hygiene was significantly different by age ( $p < 0.05$ ), indicating that the younger elementary school students had a better food safety

knowledge. This result suggests that being in a higher grade does not mean a student has higher food safety knowledge, and it also implies the lack of food hygiene and safety education in the upper levels of elementary school curricula. Yoon HJ and Yoon KS (2007) observed a similar trend where 4th graders showed significantly better behavior toward food safety.

The female students showed significantly higher scores with regard to food safety ( $p < 0.05$ ) and food handling hygiene ( $p < 0.01$ ) than male students. This could be attributed to the female students acquiring knowledge from their mothers as role models at home.

The number of members in a student's family was an influential factor for food hygiene and safety knowledge. In general, as the number of family members in a student's family increased, their knowledge levels for food safety ( $p < 0.05$ ) and food handling hygiene ( $p < 0.01$ ) also increased. Finally, a student's scholastic achievement level also had an effect on their knowledge of food safety ( $p < 0.01$ ) and food handling hygiene ( $p < 0.01$ ), which was similar to a previous report (Kim M and Kim H 2005a).

Other demographic factors such as whether or not both parents worked, the person in charge of family meal preparation, and family income level, did not have any significant effects on the knowledge levels of the students. Also previous food hygiene and safety educational experiences at home or school were not factors affecting the knowledge level of the students. Based on this result, one could assume that the children had not received proper food hygiene and safety education at home or at school, suggesting the necessity for education.

#### Attitudes on food hygiene and safety

The mean student score for attitudes toward food hygiene and safety was 3.83 out of 5 points, which is slightly above average. The average scores in 3 categories of personal hygiene, food safety, and food handling hygiene were 4.05, 3.34, and 4.11, respectively, indicating that the lowest score in food safety category.

Statistical analyses using t-test and ANOVA indicated that demographic factors, including student age, gender, scholastic achievement level, and experience with food hygiene and safety education at home or at school, were influential factors affecting student attitudes toward food hygiene and safety (Table 3).

As students age increased, attitudes score for personal hygiene decreased ( $p < 0.05$ ). This trend was very similar to that for personal hygiene knowledge. The result that the younger students had better attitudes toward food hygiene and safety suggests a lack of proper food hygiene and safety education or continuity of education. The female students generally had higher attitude scores, and showed significantly higher score for food handling hygiene ( $p < 0.05$ ). This trend was very similar to that for food handling knowledge.

**Table 2.** Elementary school students' food hygiene and safety knowledge levels according to the demographic factors (unit: % score)

Demographic factors	Category	Personal Hygiene	Food Safety	Food Handling Hygiene
Age	10	86.06±24.43	65.90±20.11	55.63±18.81
	11	81.38±29.69	68.08±19.78	52.02±17.49
	12	79.54±29.51	63.63±22.79	45.00±24.05
	<i>f</i> value	1.494	.816	3.970
	<i>p</i> value	.226	.443	.020*
Gender	Male	85.78±25.88	64.67±20.39	50.36±19.22
	Female	80.81±28.96	69.12±19.59	56.10±17.63
	<i>t</i> value	1.756	-2.154	-3.011
	<i>p</i> value	.080	.032*	.003**
Family Members	≤3	80.00±34.72	60.35±22.98	48.00±18.27
	4	82.23±27.41	67.21±19.69	52.85±19.26
	5	87.85±24.72	69.64±16.83	58.14±16.26
	6	81.48±28.24	60.18±24.27	45.55±18.87
	≥7	90.00±20.70	75.83±20.30	61.33±11.25
	<i>f</i> value	.941	2.814	3.891
	<i>p</i> value	.440	.025*	.004**
Scholastic Achievement	High	88.98±22.87	75.84±16.22	58.93±17.68
	Average	81.61±29.01	66.26±20.22	53.60±17.50
	Low	86.36±22.52	58.52±19.95	42.95±22.78
	<i>f</i> value	2.049	10.285	9.992
	<i>p</i> value	.130	.000**	.000**

\* $p < .05$ , \*\* $p < .01$ 

Furthermore, the students with higher scholastic achievement levels also had better attitude scores, particularly for personal hygiene ( $p < 0.05$ ) and food handling hygiene ( $p < 0.01$ ).

In contrast to the knowledge results, the attitudes scores of students were improved according to the extent of education experiences at home in the categories of personal hygiene ( $p < 0.01$ ) and food handling hygiene ( $p < 0.05$ ). Also, attitude scores increased as the extent of personal hygiene ( $p < 0.05$ ) and food handling hygiene ( $p < 0.01$ ) education at school increased. These results suggest that education at home or school can improve student attitudes toward food hygiene and safety. Finally, the other demographic factors such as family members, whether both parents worked, and family income level did not affect the scores.

### Food hygiene and safety practice levels

The average food hygiene and safety practice score was 3.81 out of 5-point Likert scale, which was similar to that for attitude. The average scores for the personal hygiene, food safety, and food handling hygiene were 3.82, 3.64, and 3.99, respectively; thus, the students answered that their best food safety practices pertained to food handling hygiene.

Based on the statistical analyses, the demographic factors influencing the practice levels were age, the person in charge of family meal preparation, family income level, and

food hygiene and safety education experience at home (Table 4).

The younger students showed a superior food hygiene and safety practice score, and scores within the personal hygiene category were significantly different ( $p < 0.05$ ). That is, the 4th-grade students appeared to have better food hygiene and safety practices which was a similar trend to those for knowledge and attitude.

The person in charge of family meal preparation was also a significant factor affecting the food hygiene and safety practice levels of students, especially in the categories of personal hygiene ( $p < 0.01$ ) and food safety ( $p < 0.05$ ). The students with grandmothers in charge of meal preparation had the highest food hygiene and safety practice scores, followed by mother, father, others (ant, brother or sister), or maid ( $p < 0.01$ ) were the primaty meal preparers. Based on this data, one might infer that grandmothers take extra care of their grandchildren especially on personal hygiene and food safety.

According to the family income level, there were significant differences in the scores of practice in every category of food hygiene and safety. The higher the family income of the students was, the higher the scores of practice were in personal hygiene ( $p < .05$ ), food safety ( $p < .05$ ) and food handling hygiene ( $p < .05$ ) of the students.

**Table 3.** Attitudes of elementary school students toward food hygiene and safety according to demographic factors

Demographic factors	Category	Personal Hygiene	Food Safety	Food Handling Hygiene
Age	10	4.09±0.70	3.31±0.83	4.10±0.81
	11	4.06±0.71	3.33±0.78	4.16±0.74
	12	3.69±0.73	3.54±0.55	3.83±0.92
	<i>f</i> value	3.123	.820	1.829
	<i>p</i> value	.045*	.441	.162
Gender	Male	4.03±0.74	3.28±0.79	4.02±0.83
	Female	4.07±0.68	3.39±0.79	4.21±0.72
	<i>t</i> value	-.617	-1.244	-2.276
	<i>p</i> value	.538	.214	.023*
Scholastic Achievement	High	4.23±0.72	3.54±0.80	4.23±0.83
	Average	4.05±0.71	3.32±0.79	4.15±0.72
	Low	3.82±0.84	3.18±0.76	3.75±1.00
	<i>f</i> value	4.167	2.979	5.625
	<i>p</i> value	.016*	.052	.004**
Education Experience at home	very often	4.44±0.60	3.58±0.72	4.33±0.78
	often	4.21±0.59	3.35±0.89	4.31±0.76
	a few	4.08±0.66	3.32±0.77	4.16±0.71
	few	3.94±0.72	3.28±0.77	4.01±0.72
	never	3.87±0.86	3.36±0.83	3.90±1.02
	<i>f</i> value	3.731	.641	2.773
	<i>p</i> value	.005**	.634	.027*
Education Experience at school	very often	4.45±0.60	3.61±0.63	4.30±0.78
	often	4.41±0.64	3.45±0.64	4.31±0.74
	a few	4.09±0.64	3.30±0.81	4.19±0.70
	few	3.93±0.72	3.30±0.81	4.13±0.73
	never	3.95±0.86	3.41±0.77	3.76±1.05
	<i>f</i> value	3.113	.654	3.683
	<i>p</i> value	.015*	.625	.006**

\* $p < .05$ , \*\* $p < .01$ 

In general, the students who had received greater food hygiene and safety education at home had, higher practice scores, which were statistically significant in the category of food safety ( $p < 0.05$ ). In contrast, gender, number of family members, scholastic achievement level, education experience at school were not influential factors for the food hygiene and safety practice of students.

#### Correlation among the food hygiene and safety knowledge, attitudes, and practice of students

Table 5 presents the results of Pearson's correlation analysis, showing the relationships among food hygiene and safety knowledge, attitude, and practice for the students. Overall, there were significant positive relationships between knowledge and attitude ( $r = .299$ ,  $p < .05$ ), knowledge and practice ( $r = .275$ ,  $p < .05$ ), and attitudes and practice ( $r = .483$ ,  $p < .01$ ), which offered the highest correlation coefficient.

These results imply that elementary school students with greater knowledge have better attitudes toward food hygiene and safety, and students with improved attitudes have better food hygiene and safety practices.

The correlation coefficients of personal hygiene, food safety, and food handling hygiene within each category were statistically significant in general. That is, if a student's knowledge is high in personal hygiene, he or she would have high scores in knowledge of food safety and food handling hygiene. The highest correlation coefficient observed in knowledge was 0.513 between the food safety and food handling hygiene ( $p < 0.01$ ). In the attitudes of the students, a high correlation ( $r = 0.479$ ) was observed between personal hygiene and food handling hygiene. In the practice category, significant relationships were observed among personal hygiene, food safety, and food handling hygiene ( $p < 0.01$ ).

**Table 4.** Elementary school students' food hygiene and safety practice levels according to demographic factors

Demographic factors	Category	Personal Hygiene	Food Safety	Food Handling Hygiene
Age	10	3.93±0.77	3.68±0.73	4.01±0.63
	11	3.78±0.78	3.63±0.76	4.00±0.67
	12	3.33±0.86	3.45±0.57	3.73±0.73
	<i>f</i> value	5.84	.842	1.606
	<i>p</i> value	.003**	.432	.202
Person in charge of Family Meal	mother	3.78±0.81	3.62±0.72	3.99±0.67
	father	3.75±0.49	3.70±0.72	4.17±0.40
	grandma	4.29±0.64	3.90±0.76	3.95±0.65
	maid	3.50±0.23	3.50±0.70	4.75±0.00
	others	3.66±0.74	3.07±0.93	3.66±0.62
	<i>f</i> value	3.560	2.511	1.523
	<i>p</i> value	.007**	.042*	.195
Family Income Level	High	4.12±0.77	3.93±0.67	4.24±0.69
	Average	3.79±0.78	3.62±0.73	3.96±0.65
	Low	3.74±0.92	3.45±0.86	3.95±0.69
	<i>f</i> value	3.084	3.780	3.052
	<i>p</i> value	.047*	.024*	.048*
Education Experience at home	very often	4.05±0.89	3.79±0.60	4.20±0.64
	often	3.95±0.72	3.76±0.76	3.91±0.66
	a few	3.85±0.72	3.73±0.68	4.07±0.64
	few	3.73±0.85	3.53±0.78	3.91±0.69
	never	3.69±0.88	3.41±0.81	3.88±0.64
	<i>f</i> value	1.502	2.959	2.017
	<i>p</i> value	.201	.020*	.091

\**p*<.05, \*\**p*<.01

**Table 5.** Correlation coefficients between the the food hygiene and safety knowledge, attitudes, and practice levels of elementary school students

		Knowledge (K)				Attitudes (A)				Practice (P)			
		PH	FS	FH	Total	PH	FS	FH	Total	PH	FS	FH	Total
K	PH	1.000											
	FS	.232**	1.000										
	FH	.305**	.513**	1.000									
	Total	-	-	-	1.000								
A	PH	.070	.132*	.123*	-	1.000							
	FS	.097	.209**	.264**	-	.090	1.000						
	FH	.170**	.166**	.198**	-	.479**	.086	1.000					
	Total	-	-	-	.299**	-	-	-	1.000				
P	PH	.137**	.038	.164**	-	.428**	-.013	.345**	-	1.000			
	FS	.108**	.114*	.177**	-	.379**	.136**	.404**	-	.374**	1.000		
	FH	.207**	.179**	.200**	-	.222**	.136**	.312**	-	.203**	.286**	1.000	
	Total	-	-	-	.275**	-	-	-	.483**	-	-	-	1.000

\**p*<.05 \*\**p*<.01

PH, personal hygiene; FS, food safety ; FH, food handling hygiene

In conclusion, the elementary school students' food hygiene and safety scores were not at satisfactory level: 67.42% in knowledge, 3.83/5.00 in attitudes, and 3.81/5.00 for practice. Among the several demographic factors affecting a student's food hygiene and safety knowledge, attitude, and practice, a special attention should be given to the age. The fact that younger students showed significantly higher scores than older students for knowledge ( $p < 0.05$ ), attitudes ( $p < 0.05$ ), and practice ( $p < 0.01$ ), has allowed us to recognize that younger students tend to take action on what they are taught because they generally like to please their elders. However, without proper education at the upper level, no further knowledge or attitudes changes can be gained, and therefore, the knowledge, attitudes, and practice levels of students can not be developed further and would eventually deteriorate. This reflects the current status of our elementary school curriculum, which needs to be revised so that children can have food safety skills for life.

The significant relationships between the children's food hygiene and safety practice and knowledge ( $r = .275, p < .05$ ), attitudes ( $r = .483, p < .01$ ) on food hygiene and safety showed us a possibility that unlike previous results on adults which showed no relationship between them (Bahk GJ et al 2003, Kim WJ and Choi EH 2002, Kim JG 2004), elementary school children could develop desirable level of knowledge, attitudes, and eventually practice on food hygiene and safety by school education.

The above results indicate there is a need for proper food hygiene and safety education in elementary school. Because the education on food in the 7th national curriculum in Korea is rather focused on food preparation itself in Practical Arts subject which is being taught only in 5th and 6th grades, education on food safety aspect has been limited (Kim JW 2005), and it should be included in the curriculum such as the 'Fight Bac!' program in the U.S. which has been reflected in the elementary curriculum of 38 states among 50 (Oh CH et al 2006). Finally, as indicated by this study, food safety education should begin in the earlier elementary school grades, and school foodservices potentially be utilized for food safety education class.

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