

A study on nutrition knowledge and dietary behavior of elementary school children in Seoul

Eun-Suil Choi¹, Na-Ri Shin², Eun-Im Jung², Hae-Ryun Park², Hong-Mie Lee³ and Kyung-Hee Song^{2§}

¹Department of Nutrition Education, Myong-ji University, Namgajwa 2-dong, Seodaemun-gu, Seoul 120-728, Korea

²Department of Food and Nutrition, Myong-ji University, San 38-2, Nam-Dong, Yongin, Gyeonggi 449-726, Korea

³Department of Food Science and Nutrition, Daejin University, San 38-2, Nam-Dong, Yongin, Gyeonggi 487-711, Korea

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Abstract

The purpose of this study was to investigate the nutrition and diet related knowledge, attitude, and behavior of elementary school children in Seoul. The subjects included were 439 (male 236, female 203) elementary school children in the 4th to the 6th grades. The statistical analysis was conducted using SPSS 12.0 program. The average obesity index (OI) was 104.98 and 99.82 for male and female subjects, respectively. The average percentage of underweight, normal, overweight and obese of subjects was 33.7%, 32.8%, 12.3%, and 19.4%, respectively. The percentage of the underweight group of female subjects was higher than that of the male subjects. The percentage of the obese group of male subjects was higher than that of the female subjects. The average score of nutrition knowledge, nutrition attitude and dietary behavior was 6.8, 7.44, and 7.34, respectively. Dietary behavior of male subjects was positively correlated with parents' education levels, monthly household income and nutrition attitude. Dietary behavior of female subjects was positively correlated with monthly household income, nutrition knowledge and nutrition attitude. Dietary behavior of female subjects was positively correlated with obesity index (OI). Proper nutrition education and intervention are required for the improvement of elementary school children's nutrition knowledge, nutrition attitudes and dietary behaviors.

Key Words: Nutrition knowledge, nutrition attitude, dietary behavior, elementary school children

Introduction

School age is a period of rapid growth in human development when nutritional demand is increased and dietary habit is established. Also, emotional development is seen such as self-consciousness and one's values are established in addition to physical development (Chang & Kim, 2006). Hertzler (1983) reported that the growth rate is slightly slowed down but dietary habit is formed and fixed during the school age, which is thus greatly affected by stimuli through school life and peer groups. Nutrition of school age children has not only direct and short-term influence on physical and mental growth during that period but also indirect and long-term influence on the continuing growth and health of the adolescence and the health during the lifetime, and thus the importance of nutrition in school age children has been emphasized because malnutrition during this period can decrease not only physical and mental developments but also the learning ability of children (Lee, 2002).

As the frequency of eating with the family is decreased and the number of children eating alone, or preparing meal by themselves, is increased due to socioeconomic changes, it has been reported that the quality of the meal is lower when children

eat alone than when eating with the family, the rate of skipping meals is increased in children eating alone, and the establishment of proper dietary habit is interfered by eating alone (Adachi 1998; Adachi *et al.*, 2000). School age children are insufficient of general knowledge on their own health and nutrition and are not aware of the importance of health, and thus select foods on the basis of preference without proper judgement to aggravate unbalanced diets (Chung *et al.*, 2004). Such dietary habits increase the intake of calorie nutrients and thus increase the incidence of overweight, obesity, and juvenile diabetes, and on the other hand, some nutrients such as calcium, vitamin A, thiamine, and riboflavin are deficient because of unbalanced diet, eating out, and overflowing processed foods, to result in the state of nutritional imbalance with over-nutrition and nutrition deficiency at the same time (Jung, 2002).

Studies on students of upper elementary grades have revealed changes in the positive and negative aspects of nutritional status of children in this life cycle. There has been some nutritional improvements due to increased national income through rapid economic growth, stable food supply, and increased interests in nutrition, but negative changes in dietary lifestyle such as dietary imbalance, irregular meals, and improper snacks are pointed out

§ Corresponding Author: Kyung-Hee Song, Tel. 82-31-330-6206, Fax. 82-31-335-7248, Email. khsong@mju.ac.kr

(Lee *et al.*, 1998).

It has been reported in a study performed in the country that proper diet in children ideally improved their health, growth, and intellectual development (Han *et al.*, 1999) and Crook (1983) reported that malnutrition, unbalanced diet, and skipping breakfast caused by poor dietary habits could potentially lower children's behavioral development, ability for coping with stimuli, memory, and learning ability (Sung *et al.*, 2001). Dietary habits of children not only affect the health in childhood but also greatly influence dietary habits and health in adulthood. Dietary habit is more than just understanding meals in terms of nutrients or calories and includes all methods and contents of dietary lifestyles of an individual. It is not established in a short period of time but affected through a long period of education at home, school, and in society since weaning and by various factors such as culture, religion, education level, family members, and socioeconomic level. Also, because once-established dietary habits decide dietary habits in adulthood and are difficult to change, nutritional guidance in childhood for the establishment of proper dietary habit is very important (Chung *et al.*, 2004).

Lee *et al.* (1996) reported that proper dietary guidance for children, and the establishment of desirable dietary habits, are essential not only for healthy physical status in adulthood but also for the maintenance of a healthy mental status.

Nutrition education is clearly required for the establishment of desirable dietary lifestyles in school age children, and the purpose of nutrition education is not to convey simple nutrition knowledge but to actually apply nutrition knowledge to everyday life to maintain more reasonable dietary lifestyle (Lee *et al.*, 1998). Contento (1990) reported that increased knowledge and behavioral changes in general were not matched and, on the contrary, no behavioral change for choosing healthy meals was observed, suggesting that nutrition education should focus on behavioral changes, not on knowledge increase. Only the supply of knowledge is not sufficient to change multi-dimensional behaviors such as dietary behavior. Elementary school children are sensitive by nature and thus this period is effective for educating basic knowledge including nutrition knowledge on general dietary lifestyle, food selection, dietary habits, and table manners with organized educational contents. Dietary habits are more difficult to change as the age of children increases and thus it is important to provide nutrition education to eat various foods with balance and with moderate amounts by correcting one-sided dietary habits in the school age children (Lee & Pang, 1996).

Since nutritional problems are directly and indirectly related to dietary environment factors and the behavior of an individual is decided by one's values, attitudes, and knowledge, nutritional problems can be fundamentally solved after investigating and analyzing actual conditions for such factors (Moon & Kim, 1992).

Many preceding studies have been performed for dietary lifestyle of elementary students so far, but few studies were performed on the relationship among nutrition knowledge, nutrition attitude, and dietary behavior. In addition, it is considered that basic

research, in which several variables involved in the dietary lifestyle of children including eating environment are examined in various aspects of socioeconomic changes, is needed for nutritional guidance for the establishment of proper dietary habits, and the investment should be made for a reasonable period of time because the results of investment for health and nutrition appear as a healthy and happy human being over a long period of time (Kim, 2005). Thus, it is necessary to study factors influencing nutrition knowledge, nutrition attitude, and dietary behavior and the relationship among nutrition knowledge-nutrition attitude-dietary behavior-degree of food preference (Jung, 2002).

Therefore, this study was performed to investigate anthropometric measurements, nutrition knowledge, nutrition attitude, and dietary behavior in elementary school children of the upper grades in the Seoul area to understand their general condition of dietary lifestyle, and to study the relationship among variables such as nutrition knowledge, nutrition attitude, and dietary behavior, and to provide basic data for effective nutrition education in the elementary school.

Subjects and Methods

Subjects and survey period

This survey was performed on 450 (240 males, 210 females) elementary students in the 4th through the 6th grades in five elementary schools located in Seoul between August and September of 2007. The purpose of the study was explained to dietitians and related teachers of each school and then data were collected using a survey questionnaire, with their cooperation, and 439 (236 males, 203 females) questionnaires, except those with incomplete answers, were used for the analytical data of this study.

Survey contents and methods

The survey questionnaire was composed of 15 question items on general environment of the subjects, 10 items on nutrition knowledge, 10 items on nutrition attitude, and 12 items on dietary habits.

1) General characteristics

The height and body weights of the subjects were from physical examination records obtained at the beginning of the semester through physical examination and then the obesity index of the subjects was calculated. Also, parents' educational level, mother's employment status, residence type, rising time and bedtime, family size, and monthly household income were included.

The Obesity Index was decided by Kanawati method (Kanawati, 1976) with the assumption that the ideal weight was 50% of the percentile of weight for height by the Korean Growth standard (Korean Pediatric Society 2005) and classified as underweight

for below 90, normal weight for 90~110, overweight for 110~120, and obesity for over 120.

2) Nutrition knowledge

Question items for nutrition knowledge were composed of a total of 10 items including the functions of 5 major nutrients (5 items) and foods source (2 items) and general knowledge on nutrition (3 items), based on the survey questionnaire designed by investigators of previous studies. Answers were either 'yes', 'no', or 'don't know' and 1 point was assigned to each question item to make a total of 10 points, and higher scores were evaluated as the more nutrition knowledge a subject had. Recognized knowledge was the ratio for the number of question items answered 'yes' or 'no' out of all items, and the rate of right answer was the ratio of right answers among all items.

3) Nutrition attitude

Questionnaire for nutrition attitude was composed of 10 items by modifying and complementing questions used in the studies of Lee (2000), Lee *et al.* (1997), and Kim *et al.* (2000) and used a 5-point Likert-type scale.

For positive nutrition attitude, 5 points was given to 'very good', 4 points to 'good', 3 points to 'fair', 2 points to 'poor', and 1 point to 'very poor'. Total score was calculated out of full scores of 55 points and then converted to new scores out of full scores of 10 points, and higher scores were regarded as desirable nutrition attitude.

4) Dietary behavior

Questionnaire for dietary behavior was composed of 12 items by modifying and complementing questions used in the studies of Lee *et al.* (1980) and Choi & Jung (2006), in which evaluation was made for the degree of food intake balance in a week. For each question item, subjects were instructed to answer the number of relevant days in a week as 0-2 days, 3-5 days, or 6-7 days, and 1, 2, and 3 points were given to each question.

Statistical analysis

Statistical analysis for collected data was performed by using SPSS (ver. 12.0) and frequency analysis for general characteristics

and socioeconomic characteristics by gender and grade was performed. Frequency analysis and differences among groups for nutrition knowledge, nutrition attitude, and dietary behavior were performed using Student's t-test and one-way ANOVA, and Duncan multiple range test was performed if significance was present after significance testing among groups. Pearson's correlation coefficient was calculated for correlation among variables in boys and girls.

Results

General characteristics

1) Individual characteristics

Table 1 presents anthropometric measurements of the subjects by gender and grade. The results of analysis showed statistically significant differences for body weight, obesity index, and Rohrer index ($p < 0.05$), which were higher in boys.

Table 2 shows the results of physique evaluation by measuring the degree of obesity of the subjects. For different genders, underweight was 33.7% in the total, 30.1% in boys and 37.9% in girls; normal weight was 32.8% in the total, 35.2% in boys and 34.0% in girls. Also, overweight was 12.3% in the total, 12.7% in boys and 11.8% in girls; obesity was 19.4% in the total, 22.0% in boys and 16.3% in girls.

For different grades, underweight was 40.0% in the 4th grade, 30.1% in the 5th grade, and 31.2% in the 6th grade; normal weight was 36.6% in the 4th grade, 33.3% in the 5th grade, and 34.1% in the 6th grade. Also, overweight was 8.3% in the 4th grade, 15.4% in the 5th grade, and 13.0% in the 6th grade;

Table 2. Distribution of the subjects by obesity index¹⁾

		Underweight	Normal	Overweight	Obese	Total
Gender	Boys	71 (30.1) ²⁾	83 (35.2)	30 (12.7)	52 (22.0)	236 (100.0)
	Girls	77 (37.9)	69 (34.0)	24 (11.8)	33 (16.3)	203 (100.0)
Grade	4th	58 (40.0)	53 (36.6)	12 (8.3)	22 (15.2)	145 (100.0)
	5th	47 (30.1)	52 (33.3)	24 (15.4)	33 (21.2)	156 (100.0)
	6th	43 (31.2)	47 (34.1)	18 (13.0)	30 (21.7)	138 (100.0)
	Total	148 (33.7)	152 (32.8)	54 (12.3)	85 (19.4)	439 (100.0)

¹⁾ <90: Underweight, 90~110: Normal; 110~120: Overweight; ≥120: Obese

²⁾ N (%)

Table 1. Anthropometric indices of the subjects according to gender and grade

		N (%)	Height (cm)	Weight (kg)	Obesity Index (%) ²⁾
Gender	Boys	236 (53.8)	145.31 ± 8.874 ¹⁾	41.97 ± 11.104	104.98 ± 23.33
	Girls	203 (46.2)	145.75 ± 8.720	39.17 ± 9.398	99.82 ± 20.78
	t-value (p-value)		0.271 (0.603)	7.973 (0.005)**	9.983 (0.002)**
Grade	4th	132 (30.1)	138.54 ± 6.416	33.29 ± 7.092	96.92 ± 19.45
	5th	154 (35.1)	145.00 ± 6.853	41.52 ± 9.046	104.84 ± 22.84
	6th	153 (34.1)	152.04 ± 7.399	46.19 ± 10.453	105.23 ± 23.30
	F-value (p-value)		135.517 (0.000)** ²⁾	72.980 (0.000)**	10.044 (0.000)**

¹⁾ Mean ± SD

²⁾ Obesity Index: {Current weight (kg)/Ideal weight (kg)} × 100

³⁾ *, **, ***: Significantly different between groups at $p < 0.05$, $p < 0.01$ and $p < 0.001$, respectively.

obesity was 15.2% in the 4th grade, 21.2% in the 5th grade, and 21.7% in the 6th grade.

2) Socioeconomic characteristics

Table 3 is the result of analyzing sociodemographic characteristics of the subjects. Father's age showed 27.1% of under 40 years, 69.0% of 41-50 years, and 3.9% of over 51 years, and mother's age showed 56.0% of under 40 years, 41.9% of 41-50 years, and 2.1% of over 51 years.

Father's education level included 36.4% of high school graduate and below, 46.9% of college graduates, and 16.6% of graduate school, and mother's education level included 45.8% of high school graduate and below, 42.1% of college graduates, and 12.1% of graduate school.

Mother's employment status showed 48.5% of employed mothers and 51.5% of unemployed mothers, and residence types included 57.9% of apartment, 31.0% of tenement house (villa, studio), 8.2% of house, and 3.0% of other types.

The rising time in the morning was distributed as 66.7% at 7-8 o'clock, which was the highest, and then 25.7% at 6-7 o'clock, 4.8% at 8-9 o'clock, and 2.7% at before 6 o'clock. The bedtime was distributed as 45.8% at 10-11 o'clock, which was the highest, and then 35.3% at 11-12 o'clock, 10.5% at after

12 o'clock, and 8.4% at before 10 o'clock.

Family size was the highest as 74.3% with 4-5 family members, and 11.6% with 2-3 members, 10.7% with 5-6 members, and 3.4% with more than 7 members. Monthly household income showed 5.9% of less than 1 million won, 15.3% of 1-2 million won, 31.0% of 2-3 million won, 29.2% of 3-5 million won, and 18.7% of over 5 million won.

The person to prepare meals was mother as 86.3%, which was the highest, and grandmother or grandfather as 8.0%, father as 2.1%, siblings or relatives as 1.1%.

Nutrition knowledge, attitude, and behavior by socioeconomic characteristics

1) Nutrition knowledge

Table 4 shows the degree of recognition for nutrition knowledge of the subjects and the rate of right answers of the subjects.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on gender showed that the degree of recognition was slightly higher in boys with 8.11 points than in girls with 7.92 points, but the difference was not statistically significant. On the other hand, the rate of right answers was slightly higher in girls with 6.82 points than in boys with 6.79 points, but the difference was not statistically significant. For nutrition knowledge, girls recognized knowledge relatively accurately compared to boys who had more inaccurate parts in recognized knowledge compared to girls.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on grade showed that the degree of recognition was relatively higher in the 4th grade (8.07 points) and the 6th grade (8.06 points), but the difference was not statistically significant, and the rate of right answers was higher in the 6th grade (6.86 point) and the 4th grade (6.80 points) but the difference was not statistically significant either. That is, students in the 4th grade showed slightly higher degree of recognition for nutrition knowledge but had more inaccurate parts in recognized knowledge compared to students in the 6th grade, and students in the 5th grade showed slightly lower degree of recognition and rate of right answers compared to those in other grades.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on mother's employment status showed no significant differences in both the degree of recognition and the rate of right answers by mother's employment status.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on father's education level showed statistically significant difference in the degree of recognition ($p < 0.05$).

Also, the analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on mother's education level showed statistically significant differences in both the degree of recognition and the rate of right answers ($p < 0.05$),

Table 3. Socioeconomic characteristics of the subjects

Variables	N	%	
Father's age (year)	≤ 40	119	27.1
	41 - 50	303	69.0
	≥ 51	17	3.9
Mother's age (year)	≤ 40	246	56.0
	41 - 50	184	41.9
	≥ 51	9	2.1
Father's education	≤ High school	160	36.4
	College	206	46.9
	≥ Graduate school	73	16.6
Mother's education	≤ High school	201	45.8
	College	185	42.1
	≥ Graduate school	53	12.1
Mother's employment status	Employed	213	48.5
	Unemployed	226	51.5
Residence type	Apartment	254	57.9
	House	36	8.2
	Tenement house (villa, studio)	136	31.0
	Others	13	3.0
Family size	2 - 3	51	11.6
	4 - 5	326	74.3
	6 - 7	47	10.7
	> 8	15	3.4
	< 1	26	5.9
Monthly household income (million won)	1 - 2	67	15.3
	2 - 3	136	31.0
	3 - 4	128	29.2
	> 4	82	18.7

and both tended to be higher as mother's education level increased.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on residence type showed statistically significant difference in the degree of recognition for nutrition knowledge ($p < 0.05$), and relatively higher degree of recognition when residing in apartments or houses.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on family size showed no statistically significant differences in both variables.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on monthly

household income showed statistically significant differences both in the degree of recognition and in the rate of right answers ($p < 0.05$), and showed relatively higher degree of recognition as monthly income increased and similarly, the highest rate of right answers as the income increased to over 5 million won.

2) Nutrition attitude and behavior

Table 5 shows the results of analyzing nutrition attitudes and dietary behaviors of the subjects.

The analysis for nutrition attitude and dietary behavior depending on gender showed that nutrition attitude was slightly higher in girls with 7.59 points than in boys with 7.31 points, which showed statistically significant difference ($p < 0.05$), and

Table 4. Nutrition knowledge score according to socioeconomic characteristics

		Recognition	Right answer
Gender	Boys	8.11 ± 2.24 ¹⁾	6.79 ± 1.95
	Girls	7.92 ± 1.81	6.82 ± 1.57
	t-value (p)	0.88 (0.34)	0.03 (0.86)
Grade	4th	8.07 ± 1.87	6.80 ± 1.67
	5th	7.94 ± 2.22	6.75 ± 1.85
	6th	8.06 ± 2.04	6.86 ± 1.82
	F-value (p)	0.175 (0.84)	0.16 (0.85)
Mother's employment status	Employed	7.92 ± 2.09	6.72 ± 1.821
	Unemployed	8.12 ± 2.01	6.88 ± 1.75
	t-value (p)	0.98 (0.32)	0.80 (0.37)
Father's education	High school	7.66 ± 2.12 ²⁾	6.62 ± 1.79
	College	8.17 ± 1.94 ^{ab}	6.89 ± 1.76
	≥ Graduate school	8.41 ± 2.12 ^b	6.96 ± 1.82
	F-value (p)	4.40* (0.01)	1.36 (0.25)
Mother's education	High school	7.67 ± 2.15 ^a	6.57 ± 1.83 ^a
	College	8.20 ± 2.02 ^{ab}	6.91 ± 1.82 ^{ab}
	≥ Graduate school	8.74 ± 1.44 ^b	7.30 ± 1.32 ^b
	F-value (p)	7.08 (0.001) ^{**3)}	4.22 (0.01)*
Residence type	Apartment	8.22 ± 1.99 ^b	6.91 ± 1.75
	House	8.08 ± 1.79 ^{ab}	6.78 ± 1.60
	Tenement (villa, studio)	7.71 ± 2.23 ^{ab}	6.66 ± 1.91
	Others	7.08 ± 1.38 ^a	6.15 ± 1.46
	F-value (p)	2.80 (.03)*	1.18 (.31)
Family size (person)	2-3	7.67 ± 2.43	6.63 ± 2.04
	4-5	8.11 ± 1.93	6.90 ± 1.69
	6-7	7.94 ± 2.52	6.43 ± 2.15
	>8	7.60 ± 1.54	6.53 ± 1.40
	F-value (p)	0.93 (0.42)	1.27 (0.28)
Monthly household income (million won)	> 1	7.62 ± 2.33 ^{ab}	6.42 ± 1.96 ^a
	1 - 2	8.21 ± 1.84 ^{bc}	7.13 ± 1.71 ^b
	2 - 3	7.35 ± 2.14 ^a	6.33 ± 1.83 ^a
	3 - 4	8.29 ± 2.08 ^{bc}	6.97 ± 1.78 ^{ab}
	≥ 4	8.68 ± 1.57 ^c	7.17 ± 1.56 ^b
	F-value (p)	7.02 (0.000)**	4.52 (0.001)**
Total		8.02 ± 2.05	6.80 ± 1.78

¹⁾ Mean ± SD

²⁾ Means with different superscript are significantly different by Duncan's multiple range test at $p < 0.05$.

³⁾ *, **: Significantly different at $p < 0.05$ and $p < 0.01$, respectively.

Table 5. Nutrition attitude and behavior by socioeconomic characteristics

		Nutrition Attitude	Dietary habit
Gender	Boys	7.31 ± 1.334 ¹⁾	7.12 ± 1.392
	Girls	7.59 ± 1.243	7.63 ± 1.258
	t-value (p)	5.344 (0.021) ^{**2)}	9.519 (0.002)**
Grade	4th	7(0.77 ± 1.215 ⁵³⁾	7.45 ± 1.432
	5th	7.35 ± 1.396 ^a	7.36 ± 1.371
	6th	7.24 ± 1.220 ^a	7.44 ± 1.243
	F-value (p)	6.462 (0.002)**	0.210 (0.811)
Mother's employment status	Employed	7.48 ± 1.310	7.29 ± 1.397
	Unemployed	7.40 ± 1.291	7.53 ± 1.284
	t-value (p)	0.367 (0.545)	3.645 (0.057)
Father's education	High school	7.27 ± 1.315 ^a	7.22 ± 1.337 ^a
	College	7.42 ± 1.269 ^a	7.42 ± 1.359 ^a
	≥ Graduate school	7.87 ± 1.268 ^b	7.83 ± 1.246 ^b
	F-value (p)	5.677 (0.004)**	5.209 (0.006)**
Mother's education	High school	7.30 ± 1.364 ^a	7.18 ± 1.371 ^a
	College	7.43 ± 1.201 ^a	7.57 ± 1.279 ^b
	≥ Graduate school	7.98 ± 1.255 ^b	7.75 ± 1.340 ^b
	F-value (p)	5.975 (0.003)**	6.010 (0.003)**
Residence type	Apartment	7.46 ± 1.315	7.56 ± 1.349 ^b
	House	7.51 ± 1.275	7.60 ± 1.219 ^b
	Tenement (villa, studio)	7.38 ± 1.319	7.11 ± 1.355 ^a
	Others	7.35 ± .865	7.35 ± 1.005 ^{ab}
	F-value (p)	0.177 (0.912)	3.674 (0.012)*
Family size	2 - 3	7.27 ± 1.420	7.81 ± 1.185 ^{ab}
	4 - 5	7.43 ± 1.271	7.35 ± 1.367 ^a
	5 - 6	7.59 ± 1.378	7.26 ± 1.287 ^a
	≥ 7	7.61 ± 1.295	8.07 ± 1.217 ^b
	F-value (p)	0.580 (0.629)	3.167 (0.024)*
Monthly household income (million won)	< 1	7.56 ± 1.431	6.73 ± 1.520 ^a
	1 - 2	7.48 ± 1.421	7.29 ± 1.203 ^b
	2 - 3	7.30 ± 1.160	7.33 ± 1.284 ^b
	3 - 4	7.45 ± 1.319	7.41 ± 1.390 ^b
	≥ 5	7.56 ± 1.351	7.88 ± 1.306 ^c
	F-value (p)	0.635 (0.638)	4.584 (0.001)**
Total		7.44 ± 1.299	7.42 ± 1.344

¹⁾ Mean ± SD

²⁾ *, **: Significantly different at $p < 0.05$ and $p < 0.01$, respectively.

³⁾ Means with different superscript are significantly different by Duncan's multiple range test at $p < 0.05$.

girls seemed to have better nutrition attitude than boys.

Dietary behavior was slightly higher in girls with 7.63 points than in boys with 7.12 points, which had statistically significant difference ($p < 0.05$).

The analysis for nutrition attitude and dietary behavior depending on grade showed that nutrition attitude was high in the order of 4th grade (7.77 points), 5th grade (7.35 points), and 6th grade (7.24 points) with statistically significant differences ($p < 0.05$), and students in lower grades generally showed better nutrition attitude. Dietary behavior was higher in the 6th grade (7.44 points) and the 4th grade (7.45 points) compared to the 5th grade (7.36 points), with statistically significant difference ($p < 0.05$).

The analysis for nutrition attitude and dietary behavior depending on mother's employment status showed no statistically significant differences in both variables by mother's employment status.

The analysis for nutrition attitude and dietary behavior depending on father's education level showed statistically significant differences in both variables ($p < 0.05$), and higher education level showed relatively higher nutrition attitude and dietary behavior.

The analysis for nutrition attitude and dietary behavior depending on mother's education level showed statistically significant differences in both variables ($p < 0.05$), and higher education level

showed relatively higher nutrition attitude and dietary behavior.

The analysis for nutrition attitude and dietary behavior depending on residence type showed statistically significant differences in dietary behavior ($p < 0.05$), and relatively higher dietary behavior was observed when residing in apartments or houses.

The analysis for nutrition attitude and dietary behavior depending on family size showed that the difference was not statistically significant in nutrition attitude, but significant in dietary behavior ($p < 0.05$).

The analysis for nutrition attitude and dietary behavior depending on monthly household income showed statistically significant differences in dietary behavior ($p < 0.05$), and relatively higher dietary behavior was observed as monthly income was higher.

Correlation among variables

1) Correlation among variables in boys

The correlation among variables in boys is shown in Table 6. The results showed that father's education level and nutrition attitude ($r = 0.183$), father's education level and dietary behavior ($r = 0.153$), mother's education level and monthly income ($r = 0.237$), mother's education level and nutrition knowledge ($r = 0.191$),

Table 6. Pearson's correlation coefficients between variables for boys

	Height	Weight	Father's age	Mother's age	Father's education	Mother's education	Mother's employment status	Monthly household income	OI	Nutrition knowledge	Nutrition attitude
Weight	0.731**	1									
Father's age	0.059	0.086	1								
Mother's age	0.033	0.068	0.432**	1							
Father's education	-0.068	-0.131*	0.006	-0.024	1						
Mother's education	-0.042	-0.049	0.061	0.093	0.684**	1					
Mother's employment status	0.082	0.054	-0.034	0.014	-0.107	-0.040	1				
Monthly household income	0.117	0.035	0.151*	0.151*	0.276**	0.237**	-0.043	1			
OI	0.366**	0.895**	0.070	0.066	-0.141*	-0.039	0.036	-0.017	1		
Nutrition knowledge	0.071	0.040	0.126	0.109	0.089	0.191**	-0.035	0.069	0.029	1	
Nutrition attitude	-0.077	-0.034	0.004	-0.015	0.183**	0.246**	0.086	-0.005	0.018	0.082	1
Dietary behavior	0.136*	0.089	-0.064	-0.005	0.153*	0.198**	-0.127	0.170**	0.042	0.011	0.261**

* $p < 0.05$, ** $p < 0.01$,

Table 7. Pearson's correlation coefficients between variables for girls

	Height	Weight	Father's age	Mother's age	Father's education	Mother's education	Mother's employment status	Monthly household income	OI	Nutrition knowledge	Nutrition attitude
Weight	0.767**	1									
Father's age	0.149*	0.156*	1								
Mother's age	0.141*	0.150*	0.419**	1							
Father's education	-0.103	-0.117	0.065	-0.117	1						
Mother's education	-0.165*	-0.166*	0.050	-0.017	0.659**	1					
Mother's employment status	0.113	0.103	-0.069	-0.016	0.039	0.098	1				
Monthly household income	-0.019	-0.109	0.069	-0.115	0.242**	0.221**	0.046	1			
OI	0.411**	0.895**	0.115	0.113	-0.091	-0.123	0.077	-0.141*	1		
Nutrition knowledge	0.071	0.044	0.080	0.178*	0.052	0.057	-0.055	0.123	0.002	1	
Nutrition attitude	-0.122	-0.040	-0.106	-0.183**	0.121	0.040	-0.045	0.064	0.027	0.067	1
Dietary behavior	-0.002	-0.028	-0.051	-0.081	0.183**	0.145*	-0.062	0.222**	-0.032	0.279**	0.374**

* $p < 0.05$, ** $p < 0.01$,

mother's education level and nutrition attitude ($r=0.246$), mother's education level and dietary behavior ($r=0.198$), monthly income and dietary behavior ($r=0.170$), and nutrition attitude and dietary behavior ($r=0.261$) showed statistically significant positive (+) correlation ($p<0.05$), and weight and father's education level ($r=-0.131$), father's education level and OI ($r=-0.141$) showed statistically significant negative (-) correlation ($p<0.05$).

2) Correlation among variables in girls

The correlation among variables in girls is shown in Table 7. The results showed that mother's education level and dietary behavior ($r=0.145$), monthly income and dietary behavior ($r=0.222$), nutrition knowledge and dietary behavior ($r=0.279$), and nutrition attitude and dietary behavior ($r=0.374$) showed statistically significant positive (+) correlation ($p<0.05$).

Discussion

This study was performed to investigate nutrition knowledge, nutrition attitude, and dietary behavior in elementary school children of the upper grades in the Seoul area and to understand their general conditions of dietary lifestyle, to study the relationship among variables such as nutrition knowledge, nutrition attitude, and dietary behavior, and further to provide basic data for effective nutrition education in the elementary school. Thus, the survey was performed in 493 elementary school students of the upper grades in the Seoul area.

Nutrition knowledge, attitude, and behavior by socioeconomic characteristics

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on gender showed that girls recognized knowledge relatively accurately compared to boys who had more inaccurate parts in recognized knowledge compared to girls. These results were similar to those reported in the study on elementary school students in the Chuncheon area by Lee *et al.* (1997) in which girls (7.00 points) had higher points than boys (6.73 points), and also similar to those in the studies on elementary school students in the Seoul and Daejeon areas by Kim (2005) and Jung (2002), respectively. On the other hand, in the study by Lee *et al.* (2000), boys (60.0 points) showed significantly higher scores on nutrition knowledge than girls (55.0 points), which is different from the results of this study.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on mother's employment status showed no significant differences in both the degree of recognition and the rate of right answers by mother's employment status. That is, both mother's employment and unemployment had similar effects on the degree of recognition for nutrition knowledge and the rate of right answers in children, which was similar to the results from the study by Jung (2002) in which

unemployed housewives (7.42 points) had higher scores than employed housewives (7.34 points) but difference was not significant, and from the study by Lee *et al.* (2000) in which unemployed housewives (58.8 points) had higher scores than employed housewives (56.6 points) but difference was not significant.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on father's education level showed relatively higher degree of recognition as the education level increased, which was consistent with the result from the study on elementary school students in the Seoul area by Yoon *et al.* (2000).

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on mother's education level showed that both tended to be higher as mother's education level increased, which was consistent with the results from the studies by Kim (1995) and Chung *et al.* (1995) in which nutrition knowledge score was higher as parents' education levels increased, but different from the study by Kim *et al.* (2000) in which nutrition knowledge score was not significantly different depending on parents' educational levels.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on residence type showed statistically significant difference in the degree of recognition for nutrition knowledge ($p<0.05$), and the analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on monthly household income showed statistically significant differences both in the degree of recognition and in the rate of right answers ($p<0.05$) and showed relatively higher degree of recognition as monthly income increased.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on family size showed no statistically significant differences in both variables. That is, the number of family members living together did not affect the degree of recognition for nutrition knowledge and the rate of right answers, and similar levels of the degree of recognition for nutrition knowledge and the rate of right answers could be achieved regardless of family size.

The analysis for the degree of recognition for nutrition knowledge and the rate of right answers depending on monthly household income showed relatively higher degree of recognition as monthly income increased and similarly the highest rate of right answers as the income increased to over 5 million won. These results were similar to those reported in the study on middle school students by Kim & Kang (1997) in which nutrition knowledge was higher as total household income increased.

The analysis for nutrition attitude depending on gender showed that girls seemed to have better nutrition attitude than boys, which was different from the results in the study on elementary school students by Park *et al.* (2000) and the study on middle school students by Lee *et al.* (2000) and Ko (1990), in which nutrition attitude was not significantly different depending on gender.

Dietary behavior was slightly higher in girls than in boys,

which had statistically significant difference ($p < 0.05$). This result is consistent with the study by Kim (2005) and Lee *et al.* (2000) in which dietary behavior score by gender showed higher scores in girls than in boys, but different from the results from studies by Moon *et al.* (1987) and Moon and Kim (1992) in which no gender difference was observed.

The analysis for nutrition attitude and dietary behavior depending on mother's employment status showed no statistically significant differences in both variables by mother's employment status, which was consistent with the results from studies by Ko (1990), Moon *et al.* (1987), Lee *et al.* (2000) and Jung (2002) in which dietary behavior was not greatly affected by mother's employment status.

The analysis for nutrition attitudes and dietary behaviors depending on parents' education levels showed relatively higher nutrition attitudes and dietary behaviors as parents' education levels increased, which was slightly different from the studies by Jung (2002) and Kim *et al.* (2000) in which father's education level did not affect nutrition attitude and dietary behavior of children. However, it was consistent with the result reported by Kim *et al.* (1976) in which nutrition attitude and dietary behavior were high as mother's education level increased.

The analysis for nutrition attitude and dietary behavior depending on family size showed that the difference was not statistically significant in nutrition attitude ($p > 0.05$), but significant in dietary behavior ($p < 0.05$). That is, the number of family members living together did not affect nutrition attitude but affected dietary behavior.

The analysis for nutrition attitude and dietary behavior depending on monthly household income showed statistically significant differences in dietary behavior ($p < 0.05$), and relatively higher dietary behavior was observed as monthly income was higher. Moon & Kim (1992) reported higher scores for dietary behavior as economic level increased, and Kim *et al.* (1998) also reported significantly higher scores for dietary behavior in students with upper and middle economic level than those with lower economic level. It is considered that the level of purchasing foods is increased as economic level increases, and thus the number of dishes prepared for a meal becomes different.

Correlation among variables

For the correlation among variables in boys, father's education level and nutrition attitude ($p < 0.01$), dietary behavior ($p < 0.05$), and mother's education level and nutrition knowledge ($p < 0.01$), nutrition attitude ($p < 0.01$), dietary behavior ($p < 0.01$), and monthly income and dietary behavior ($p < 0.01$), and nutrition attitude and dietary behavior ($p < 0.01$) showed statistically significant positive (+) correlation.

In case of boys, weight, OI, and proper dietary behavior were increased as height increased, and OI was increased as weight increased. Also, proper nutrition attitude and dietary behavior were observed as father's education level or mother's education

level increased, and proper dietary behavior was observed as monthly income increased. Dietary behavior is directly influenced by sociodemographic characteristics including family size, parents' education levels, economic level, and mother's employment status (Kim & Yoo, 1999), and also dietary behavior is closely related to school, home, and social environment (Yperman & Vermeersch, 1979). In addition, boys with proper nutrition attitude behavior had proper dietary behavior.

For the correlation among variables in girls, mother's education level and dietary behavior ($p < 0.05$), monthly income and dietary behavior ($p < 0.01$), nutrition knowledge and dietary behavior ($p < 0.01$), and nutrition attitude and dietary behavior ($p < 0.01$) showed statistically significant positive (+) correlation. This is consistent with the result from the study on nutrition knowledge, nutrition attitude, and dietary behavior of elementary school students in the Busan area (Jung, 2002) that nutrition knowledge affected dietary behavior and that better nutrition attitude induced better dietary behavior, and the influence of nutrition knowledge on dietary behavior was greater than that on nutrition attitude. In case of girls, weight and OI were increased as height increased, and OI was increased as weight increased. Also, height and weight were increased as father's age or mother's age was higher, but decreased as mother's education level was higher. Girls had proper dietary behavior as father's education level or mother's education level was higher, which is consistent with the result from the study by Jung (2002) in which nutrition attitude score was increased as mother's education level was higher than high school graduate.

Girls with higher nutrition knowledge or with proper nutrition attitude seemed to have proper dietary behavior. Positive correlation between nutrition knowledge and dietary behavior was reported in many domestic and foreign studies, and nutrition knowledge induced the level of meals and dietary behaviors emphasizing nutrition (Seo, 2000; Yoon *et al.*, 2000).

It is considered that nutrition education programs for children and parents is required not only to get correct nutrition knowledge but also to promote positive dietary behavior and the willpower to practice nutritionally balanced meals and to induce changes in dietary behavior for those improvements, because nutrition knowledge, nutrition attitude, and dietary behavior are related to one another.

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