

# Association between the Number of Unfamiliar Vegetables and Dietary Factors of Elementary School Children

Kyunghee Song<sup>1</sup> and Hongmie Lee<sup>2</sup>

<sup>1</sup>Department of Food and Nutrition, Myongji University, Gyeonggi 449-728, Korea

<sup>2</sup>Department of Food Science and Nutrition, Daejin University, Gyeonggi 487-711, Korea

**ABSTRACT:** Despite well established health benefits, today's children do not eat enough vegetables. The purpose of this study was to determine the association between the number of unfamiliar foods in the vegetable food group and the preference for these foods and dietary factors. Subjects were 1,072 children in 5th and 6th grades from elementary schools located in 4 cities in Gyeonggi-do, Korea. A two-page questionnaire consisted of questions asking about the subjects' preference and familiarity for 64 foods in the vegetable group, preferences for three fast foods, four types of vegetable dishes, and six tastes. Also included in the questionnaire were questions assessing subjects' adherence to national dietary guidelines. The subjects were divided into quintiles according to the number of unfamiliar vegetables; the 1st quintile (N=226) was children who had less than 14 unfamiliar vegetables and the 5th quintile (N=229) was more than 29. Compared to the children in the other quintiles, the children in the 5th quintile had a significantly lower adherence to national dietary guidelines regarding consumptions of vegetable and protein sources, regular exercise, awareness of desirable height and weight, and reading food labels, as well as total ( $P<0.05$ ). The preferences for bland tastes ( $P<0.05$ ), salads (saengchae,  $P<0.01$ ), stir-fried vegetables ( $P<0.01$ ), and several vegetable items ( $P<0.05$ ) were significantly lower in the 5th quintile compared to the other quintiles. This study proposes the potential benefits of teaching children names of a variety of vegetables to improve their dietary factors such as food preferences and dietary habits.

**Keywords:** food preference, vegetable, food habit, children, taste

## INTRODUCTION

Adequate intake of fruits and vegetables may reduce various types of chronic diseases (1,2). Despite the potential health benefits, today's people in most developed countries are known not to eat enough fruits and vegetables. Increasing the intake of vegetables is considered a bigger issue than fruits, because vegetables are liked much less than fruits. Moreover, nutritionists do not advise to increase fruit consumption to all people because of its high content of glucose and fructose, resulting in a higher caloric content, namely 50 kcal vs. 15 kcal per serving of fruits and vegetables, respectively (3). In Korea, seaweed and mushrooms are considered to be part of the vegetable food group because they contain similar nutrients as vegetables. According to a 2009 Korea National Health and Nutrition Examination Survey (4), 6-to-11-year-old boys and girls consumed 167.0 g and 157.9 g of vegetables, 10.9 g and 11.9 g of mushrooms, and 5.6 g and 5.4 g of seaweed, respectively,

which is far less than the recommended 4~5 daily servings (3).

One's eating behavior is influenced by genetic and environmental factors. Food preference for fruits and vegetables is one of the most powerful predictors of someone's food consumption (5,6) and can be a barrier to the dietary change (7). Availability and accessibility may also be important factors affecting one's consumption of vegetables. A positive relation between liking and eating vegetables was found only in children who had frequent opportunities to select these foods, but not in those with limited accessibility (8). Similarly, children with a lower preference for vegetables needed higher access to vegetables for adequate consumption (9).

Many past and present projects have aimed to increase children's vegetable consumption by increasing children's exposure to vegetables. For instance, gardening (10-13), distribution of free vegetable baskets to classrooms (14), and parental initiative to consume fruits and vegetables (15) improved the younger generation's

Received 19 April 2013; Accepted 25 November 2013

Correspondence to Hongmie Lee, Tel: +82-31-539-1862, E-mail: hmlee@daejin.ac.kr

Copyright © 2013 by The Korean Society of Food Science and Nutrition. All rights Reserved.

© This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

preference (10,12) and consumption of fruits and vegetables (11-15). These studies attributed the improvement to increased children's exposure to vegetables. Moreover, scientists even proposed that exposing children to new vegetables at least five to ten times is necessary to become familiar with, and eventually accept, the new food item (16,17).

Because many studies have been emphasizing the importance of exposure to vegetables for enhancing children's vegetable preference, we attempted to quantify the exposure to vegetables by using the number of unfamiliar foods in the vegetable group. Our hypothesis is whether the children who are unfamiliar with more items in the vegetable food group have lower preferences for items and dish types from this food group and also have more undesirable dietary habits and preferences for foods and tastes.

## SUBJECTS AND METHODS

### Subjects

A total of 1,403 children in 5th and 6th grade were recruited from 12 elementary schools located in 4 cities in Gyeonggi, Korea. After children who responded insincerely as well as those who recognized less than 5 vegetables as unfamiliar were excluded from the study, 1,072 children were the subjects of this study. Survey was done in November 2012. Ethical approval of this study was obtained from the Institutional Research Board of Daejin University.

### Grouping by number of unfamiliar vegetables

The subjects were divided into quintiles according to the number of unfamiliar vegetables; the 1st quintile (Q1) was children who had less than 14 unfamiliar vegetables, the 2nd quintile (Q2) was 14~18, the 3rd quintile (Q3) with 19~23, the 4th quintile (Q4) was 24~29, and the 5th quintile (Q5) was more than 29 (Table 1). Therefore, 226 (21.1%) belonged to Q1, 207 (18.9%) to Q2, 203 (19.3%) to Q3, 207 (19.3%) to Q4, and 229 (21.4%) to Q5. Q1 was composed of more 6th graders (57.5% vs. 42.5%), while Q5 was composed of more 5th

graders (56.3% vs. 43.7%) than their counterparts ( $P<0.007$ ). Genders were equally distributed into all quintiles (Table 1).

### Questionnaire development

A 2-page questionnaire was developed consisting of questions that asked general information, preferences for 64 vegetables, 3 most popular fast foods, 4 types of vegetable dishes and 6 tastes (sweet, hot, salty, sour, bland, and rich), and dietary habits. Measurements had been validated in previous studies on similar groups (18,19). The reliability of the measurements was examined by Chronbach  $\alpha$ , and was found to be acceptable (0.689~0.929). The vegetables, mushrooms, and seaweeds that were asked in the questionnaire were less common items selected from the Korea National Health and Nutrition Examination Survey questionnaire (4).

The preferences for vegetables, foods, and tastes were determined by asking subjects to respond "dislike a lot", "tend to dislike", "average", "tend to like", "like a lot" and "unfamiliar", which were encoded as 1, 2, 3, 4, and 5, respectively, except for "unfamiliar". The dietary habits were determined by asking subjects to respond to the 18 dietary action guides for Korean children established by the Korean Ministry of Health and Welfare (20). The subjects were asked to indicate how frequently they practice the dietary habits from the following choices: "never (0 day/week)", "seldom (1~2 days/week)", "sometimes (3~4 days/week)", "often (5~6 days/week)", and "always (7 days/week)", which were encoded as 1, 2, 3, 4, and 5, respectively. The undesirable dietary guideline was reversely encoded.

### Statistical analysis

The data were processed and examined for significant associations using SPSS Statistics 21.0 for Windows (SPSS Inc., Chicago, IL, USA). The preferences for vegetables, foods, and tastes, and the adherences to each dietary action guides were reported as the mean $\pm$ SD. After the analysis of variance, the significances of the differences among 5 quintiles were tested using Duncan's multiple range tests at  $P<0.05$ .

**Table 1.** General characteristics of the subjects across quintiles of the number of unfamiliar vegetables

		Q1	Q2	Q3	Q4	Q5	Total	$\chi^2$ value
Grade	Fifth	96 (42.5)	101 (48.8)	88 (43.3)	113 (54.6)	129 (56.3)	527 (49.2)	13.945**
	Sixth	130 (57.5)	106 (51.2)	115 (56.7)	94 (45.4)	100 (43.7)	545 (50.8)	
Gender	Boys	107 (47.3)	92 (44.4)	99 (48.8)	95 (45.9)	119 (52.0)	512 (47.8)	2.922
	Girls	119 (52.7)	115 (55.6)	104 (51.2)	112 (54.1)	110 (48.0)	560 (52.2)	
Total		226	207	203	207	229	1,072	

N (%).

Q, Quintiles for the number of unfamiliar vegetables; Q1 (<14), Q2 (14~18), Q3 (19~23), Q4 (24~29), and Q5 (>29).

\*\* $P<0.01$  by  $\chi^2$  test.

## RESULTS

### Ranking of vegetables that are unfamiliar to children

Table 2 lists the number of children who responded being unfamiliar with each vegetable item asked in the questionnaire. The items that were unfamiliar to more than 70% of children were *myeongilyeop* (79.4%), *bireum* (79.3%), kale (75.7%), *sebalnamul* (74.8%), cilantro (71.0%), asparagus (77.3%), *meoui* (80.1%), *cheonggak* (83.9%), *mojaban* (76.4%), and *tot* (71.5%). The items that were unfamiliar to less than 10% of children were *minari* (9.4%), *buchu* (6.5%), iceberg lettuce (1.4%), cabbage (0.9%), *putgochu* (4.8%), *aehobak* (2.7%), broccoli (2.1%), eggplant (1.7%), *cheongyanggochu* (1.6%), paprika (1.3%), pimento (0.5%), *danhobak* (0.3%), rotus root (7.6%), *deodeok* (6.7%), *yeolmu* (4.2%), *doraji* (3.2%), *saesongi beoseot* (king oyster mushrooms, 9.6%), *neutari beoseot* (oyster mushrooms, 9.3%), *pyogo beoseot* (shitake mushrooms, 6.3%), *yangsongi beoseot* (button mushrooms, 5.3%), *paengi beoseot* (enoki mushrooms, 3.5%), *songi beoseot* (pine mushrooms, 2.1%), *dasima* (2.0%), and *myeok* (0.7%).

### Dietary habits according to the number of unfamiliar vegetables

Table 3 summarizes the adherence to the eighteen dietary guidelines for Korean children. Compared to the children in the other quintiles, the children in the highest quintile had a significantly lower adherence to national dietary guidelines regarding consumption of vegetable ( $P<0.05$ ) and protein sources ( $P<0.01$ ), regular exercise ( $P<0.01$ ), awareness of desirable height and weight ( $P<0.01$ ), and reading food labels ( $P<0.05$ ) as well as overall ( $P<0.01$ ).

### Preferences for fast foods, vegetable dishes and tastes according to number of unfamiliar vegetables

The preferences for fast foods, vegetable dishes and tastes are shown in Table 4. Among preferences for all these fast foods, *namul* (blanched vegetables with seasoning), and kimchi were not different across quintiles. The preferences for *saengchae* (raw vegetables with seasoning) and *bokkeum* (stir-fried) vegetables were significantly lower in the 5th quintile compared to the other

**Table 2.** The ranking of vegetables that are unfamiliar to children

	N (%)		N (%)
Leaf vegetables		Stem and root vegetables	
<i>Myeongilyeop</i>	851 (79.4)	<i>Meoui</i>	859 (80.1)
<i>Bireum</i>	850 (79.3)	<i>Torandae</i>	652 (60.8)
Kale	812 (75.7)	<i>Sseumbaqui</i>	469 (43.8)
<i>Sebalnamul</i>	802 (74.8)	<i>Dalae</i>	460 (42.9)
Cilantro	761 (71.0)	Turnip	349 (32.6)
<i>Bangpunnamul</i>	740 (69.0)	<i>Naengi</i>	338 (31.5)
<i>Cheogyeongchu</i>	720 (67.2)	<i>Maneuljjong</i>	288 (26.9)
<i>Chui</i>	681 (63.5)	Celery	179 (16.7)
Red mustard	651 (60.7)	<i>Gogumajulgi</i>	177 (16.5)
<i>Auk</i>	631 (58.9)	<i>Ueong</i>	120 (11.2)
<i>Yuchae</i>	581 (54.2)	Lotus root	81 (7.6)
<i>Gat</i>	597 (55.7)	<i>Deodeok</i>	72 (6.7)
Mustard	576 (53.7)	<i>Yeolmu</i>	45 (4.2)
<i>Gomchui</i>	549 (51.2)	<i>Doraji</i>	34 (3.2)
<i>Ssukgat</i>	364 (34.0)	Mushrooms	
<i>Hobakip</i>	250 (23.3)	<i>Seoki beoseot</i>	368 (34.3)
<i>Chamnamul</i>	180 (16.8)	<i>Moki beoseot</i>	292 (27.2)
<i>Minari</i>	101 (9.4)	<i>Saesongi beoseot</i>	103 (9.6)
<i>Buchu</i>	70 (6.5)	<i>Neutari beoseot</i>	100 (9.3)
Iceberg lettuce	15 (1.4)	<i>Pyogo beoseot</i>	68 (6.3)
Cabbage	10 (0.9)	<i>Yangsongi beoseot</i>	57 (5.3)
Fruit vegetables and other vegetables		<i>Paengi beoseot</i>	38 (3.5)
Asparagus	829 (77.3)	<i>Songi beoseot</i>	23 (2.1)
<i>Dureup</i>	597 (55.7)	Seaweeds	
<i>Joseonhobak</i>	547 (51.0)	<i>Cheonggak</i>	899 (83.9)
Bamboo shoot	377 (35.2)	<i>Mojaban</i>	819 (76.4)
<i>Kkwari pepper</i>	304 (28.4)	<i>Tot</i>	767 (71.5)
<i>Putgochu</i>	51 (4.8)	<i>Maesangi</i>	558 (52.1)
<i>Aehobak</i>	29 (2.7)	<i>Parae</i>	370 (34.5)
Broccoli	22 (2.1)	<i>Dasima</i>	21 (2.0)
Eggplant	18 (1.7)	<i>Myeok</i>	8 (0.7)
<i>Cheongyanggochu</i>	17 (1.6)		
Paprika	14 (1.3)		
Pimento	5 (0.5)		
<i>Danhobak</i>	3 (0.3)		

N (%), Number of children who recognized each vegetable as unfamiliar.

**Table 3.** The dietary habits of children across quintiles of the number of unfamiliar vegetables

	Q1	Q2	Q3	Q4	Q5	F-value
	N=226	N=207	N=203	N=207	N=229	
Eat only what I like	3.55±1.08	3.49±1.03	3.41±1.02	3.46±1.00	3.30±1.13	1.894
Eat a variety of vegetables each day	3.50±1.12 <sup>a</sup>	3.37±1.04 <sup>a</sup>	3.40±1.11 <sup>a</sup>	3.40±0.98 <sup>a</sup>	3.17±0.10 <sup>b</sup>	3.193*
Eat meat, fish, or eggs each day	3.90±1.01 <sup>a</sup>	3.81±1.03 <sup>a</sup>	3.84±1.05 <sup>a</sup>	3.82±1.03 <sup>a</sup>	3.51±1.23 <sup>b</sup>	4.711**
Exercise at least 1 hour a day	3.55±1.12 <sup>a</sup>	3.45±1.19 <sup>ab</sup>	3.67±1.11 <sup>a</sup>	3.29±1.16 <sup>b</sup>	3.29±1.28 <sup>b</sup>	4.187**
Know desirable height and weight for age	3.43±1.20 <sup>ab</sup>	3.41±1.21 <sup>ab</sup>	3.46±1.19 <sup>a</sup>	3.20±1.18 <sup>bc</sup>	3.06±1.26 <sup>c</sup>	4.585**
Spend less than 2 hours for TV/computer	2.47±1.40	2.43±1.23	2.47±1.33	2.56±1.28	2.45±1.37	0.279
Overeat meals and snacks	3.72±1.08	3.80±1.01	3.93±0.91	3.73±0.98	3.75±1.05	1.567
Eat breakfast	4.02±1.30	4.13±1.19	3.87±1.37	3.99±1.28	4.05±1.26	1.125
Chew foods thoroughly	3.55±1.09	3.42±1.14	3.37±1.01	3.41±1.08	3.46±1.07	0.840
Eat salty, sweet, and greasy foods	3.19±1.08	3.31±1.01	3.19±0.96	3.06±0.92	3.08±1.06	2.132
Have fruits or milk for snack	3.49±1.17	3.51±1.10	3.49±1.06	3.41±1.11	3.30±1.21	1.337
Eat cookies, soda, or fast foods	3.21±1.01	3.26±0.97	3.20±0.97	3.05±0.92	3.05±0.93	2.163
Eat street foods	3.76±1.11	3.86±0.98	3.84±1.06	3.95±0.10	3.88±1.04	0.903
Check food label and expiration date	3.68±1.17 <sup>a</sup>	3.67±1.26 <sup>a</sup>	3.54±1.28 <sup>ab</sup>	3.58±1.16 <sup>a</sup>	3.31±1.27 <sup>b</sup>	3.285*
Have meals with family	4.00±1.13	4.12±1.08	4.22±0.96	4.17±0.97	4.02±1.05	1.772
Wash hands before eating	4.09±0.95	4.05±0.94	4.04±0.93	3.94±0.97	3.94±0.98	1.092
Have good table manner	3.58±1.01	3.58±1.04	3.55±0.99	3.53±1.02	3.46±1.06	0.502
Leave plate waste	3.55±1.16	3.55±1.15	3.40±1.11	3.47±1.13	3.43±1.09	0.749
Total	3.57±0.46 <sup>a</sup>	3.57±0.42 <sup>a</sup>	3.55±0.41 <sup>a</sup>	3.50±0.43 <sup>a</sup>	3.42±0.46 <sup>b</sup>	4.906**

Mean±SD.

Q, Quintiles for the number of unfamiliar vegetables; Q1 (&lt;14), Q2 (14~18), Q3 (19~23), Q4 (24~29), and Q5 (&gt;29).

\* $P<0.05$ , \*\* $P<0.01$  by analysis of variance.<sup>a-c</sup>Means with the same superscripts in a row are not significantly different at  $P<0.05$  by Duncan's multiple range test.**Table 4.** The preferences for fast foods, vegetable dishes and tastes of children according to the number of unfamiliar vegetables

	Q1	Q2	Q3	Q4	Q5	F-value
	N=226	N=207	N=203	N=207	N=229	
Fried chicken	3.87±1.11	4.00±1.01	4.09±0.95	4.01±0.94	4.07±0.97	0.380
Pizza	3.93±1.09	4.00±1.01	3.96±1.02	3.91±1.05	4.00±1.10	0.294
Hamburger	3.87±1.11	3.94±1.07	3.99±1.03	3.86±1.17	3.90±1.13	0.480
<i>Namul</i> (blanched vegetables with seasoning)	3.83±1.08	3.78±1.08	3.65±1.09	3.73±1.04	3.61±1.11	1.582
<i>Saengchae</i> (raw vegetables with seasoning)	3.57±1.24 <sup>a</sup>	3.49±1.20 <sup>a</sup>	3.44±1.25 <sup>a</sup>	3.47±1.23 <sup>a</sup>	3.14±1.13 <sup>b</sup>	4.346**
<i>Bokkeum</i> (stir-fried vegetables)	3.47±1.35 <sup>a</sup>	3.38±1.27 <sup>a</sup>	3.34±1.29 <sup>a</sup>	3.37±1.22 <sup>a</sup>	3.06±1.23 <sup>b</sup>	3.375**
Kimchi	4.17±0.98	4.08±1.03	4.08±0.94	4.04±0.99	4.03±1.01	0.705
Sweet taste	3.81±1.15	4.00±1.00	3.94±0.98	4.05±0.97	4.03±0.95	1.964
Hot taste	3.97±1.10	3.91±1.10	3.88±1.11	4.02±0.98	3.83±1.12	1.096
Salty taste	3.41±1.11	3.55±1.14	3.41±1.13	3.59±1.13	3.46±1.12	1.096
Sour taste	3.59±1.16	3.53±1.21	3.59±1.12	3.66±1.11	3.48±1.16	0.742
Bland taste	2.84±1.25 <sup>a</sup>	2.69±1.14 <sup>ab</sup>	2.59±1.11 <sup>b</sup>	2.75±1.12 <sup>ab</sup>	2.54±1.07 <sup>b</sup>	2.533*
Rich taste	3.87±1.10	3.96±1.03	3.89±1.11	4.00±0.10	3.94±0.94	0.540

Mean±SD.

Q, Quintiles for the number of unfamiliar vegetables; Q1 (&lt;14), Q2 (14~18), Q3 (19~23), Q4 (24~29), and Q5 (&gt;29).

\* $P<0.05$ , \*\* $P<0.01$  by analysis of variance.<sup>a,b</sup>Means with the same superscripts in a row are not significantly different at  $P<0.05$  by Duncan's multiple range test.

quintiles (3.14 vs. 3.44~3.57 for *saengchae*, respectively,  $P<0.01$ ; 3.06 vs. 3.34~3.47 for *bokkeum* vegetables, respectively,  $P<0.01$ ). Children in the 1st quintile had significantly higher preferences for bland taste compared to those in the 3rd quintile and 5th quintiles (2.84 vs. 2.59 and 2.54, respectively,  $P<0.05$ ).

#### Preferences for vegetables according to number of unfamiliar vegetables

Table 5 shows the children's preferences for relatively popular vegetables, namely for the vegetables which only less than 10% of the children recognized as unfamiliar.

The children in the 5th quintile had significantly lower preferences for *putgochu* (2.25 vs. 2.73 and 2.58, respectively,  $P<0.01$ ) and pimento (2.24 vs. 2.60 and 2.57, respectively,  $P<0.05$ ) than the 1st and 2nd quintiles, for *deodeok* (2.23 vs. 2.56~2.63, respectively,  $P<0.05$ ) than 1st~3rd quintiles and for paprika (2.39 vs. 2.73~2.78, respectively,  $P<0.01$ ) and for *dasima* (2.86 vs. 3.15~3.26, respectively,  $P<0.05$ ) than the other 4 quintiles. Also the preference for *cheongyanggochu* was significantly lower in the 4th and 5th quintiles than the 1st quintile (1.99 and 1.94 vs. 2.26, respectively,  $P<0.05$ ). The children in 4th quintile had significantly lower preferences for *paengi beo-*

**Table 5.** The preferences for vegetables of children according to number of unfamiliar vegetables

	Q1	Q2	Q3	Q4	Q5	F-value
	N=226	N=207	N=203	N=207	N=229	
<i>Minari</i>	3.00±1.32 (223) <sup>1)</sup>	3.07±1.26 (200)	2.87±1.14 (190)	2.97±1.15 (190)	2.83±1.12 (168)	1.196
<i>Buchu</i>	3.46±1.27 (225)	3.60±1.24 (204)	3.47±1.13 (192)	3.44±1.19 (193)	3.33±1.12 (188)	1.258
Iceburg lettuce	3.48±1.25 (224)	3.72±1.15 (206)	3.53±1.21 (200)	3.59±1.21 (206)	3.39±1.17 (221)	2.281
Cabbage	3.46±1.30 (224)	3.64±1.21 (207)	3.48±1.26 (201)	3.49±1.26 (207)	3.35±1.17 (223)	1.427
<i>Putgochu</i>	2.73±1.37 (224) <sup>a</sup>	2.58±1.33 (206) <sup>a</sup>	2.47±1.30 (200) <sup>ab</sup>	2.47±1.24 (201) <sup>ab</sup>	2.25±1.10 (190) <sup>b</sup>	3.915**
<i>Aehobak</i>	3.18±1.28 (225)	3.22±1.21 (206)	3.22±1.23 (201)	3.05±1.26 (203)	3.08±1.18 (207)	0.919
Broccoli	3.30±1.41 (226)	3.33±1.44 (205)	3.15±1.45 (196)	3.27±1.41 (201)	3.05±1.34 (222)	1.453
Eggplant	2.62±1.21 (223)	2.6±1.17 (205)	2.45±1.40 (201)	2.56±1.18 (206)	2.34±1.08 (219)	2.195
<i>Cheongyanggochu</i>	2.26±1.27 (223) <sup>a</sup>	2.18±1.16 (207) <sup>ab</sup>	2.05±1.11 (201) <sup>ab</sup>	1.99±1.04 (206) <sup>b</sup>	1.94±1.01 (218) <sup>b</sup>	2.922*
Paprika	2.76±1.37 (225) <sup>a</sup>	2.78±1.36 (205) <sup>a</sup>	2.73±1.34 (201) <sup>a</sup>	2.77±1.40 (204) <sup>a</sup>	2.39±1.27 (223) <sup>b</sup>	3.447**
Pimento	2.60±1.35 (226) <sup>a</sup>	2.57±1.27 (207) <sup>a</sup>	2.47±1.21 (202) <sup>ab</sup>	2.41±1.27 (207) <sup>ab</sup>	2.24±1.15 (225) <sup>b</sup>	2.898*
<i>Danhobak</i>	3.65±1.27 (226)	3.50±1.30 (207)	3.53±1.22 (202)	3.53±1.21 (206)	3.40±1.23 (228)	1.133
Lotus root	3.14±1.44 (223)	3.12±1.36 (200)	2.99±1.42 (193)	2.85±1.42 (193)	2.94±1.42 (182)	1.482
<i>Deodeok</i>	2.63±1.36 (226) <sup>a</sup>	2.59±1.24 (205) <sup>a</sup>	2.56±1.28 (200) <sup>a</sup>	2.46±1.28 (192) <sup>ab</sup>	2.23±1.20 (177) <sup>b</sup>	2.956*
<i>Yeolmu</i>	3.53±1.18 (225)	3.62±1.20 (202)	3.59±1.22 (199)	3.56±1.20 (201)	3.51±1.06 (200)	0.296
<i>Doraji</i>	2.65±1.36 (226)	2.60±1.31 (207)	2.47±1.25 (199)	2.42±1.32 (203)	2.42±1.32 (203)	1.380
<i>Saesongi beoseot</i>	3.57±1.38 (224)	3.68±1.32 (200)	3.61±1.31 (191)	3.43±1.40 (193)	3.55±1.25 (161)	0.917
<i>Neutari beoseot</i>	3.54±1.42 (220)	3.55±1.33 (202)	3.48±1.34 (194)	3.24±1.39 (191)	3.48±1.26 (165)	1.702
<i>Pyogo beoseot</i>	3.45±1.49 (225) <sup>ab</sup>	3.63±1.40 (207) <sup>a</sup>	3.50±1.38 (197) <sup>a</sup>	3.18±1.41 (193) <sup>b</sup>	3.38±1.36 (182) <sup>ab</sup>	2.706*
<i>Yangsongi beoseot</i>	3.74±1.36 (225) <sup>a</sup>	3.89±1.29 (205) <sup>a</sup>	3.68±1.30 (197) <sup>ab</sup>	3.43±1.39 (198) <sup>b</sup>	3.64±1.30 (190) <sup>ab</sup>	3.166*
<i>Paengi beoseot</i>	3.79±1.34 (224) <sup>a</sup>	4.00±1.19 (206) <sup>a</sup>	3.86±1.26 (201) <sup>a</sup>	3.53±1.38 (200) <sup>b</sup>	3.75±1.25 (203) <sup>ab</sup>	3.592**
<i>Songi beoseot</i>	3.84±1.28 (224) <sup>a</sup>	3.92±1.29 (207) <sup>a</sup>	3.84±1.26 (200) <sup>a</sup>	3.54±1.37 (207) <sup>b</sup>	3.78±1.24 (211) <sup>ab</sup>	2.648*
<i>Dasima</i>	3.26±1.29 (225) <sup>a</sup>	3.20±1.33 (206) <sup>a</sup>	3.16±1.37 (203) <sup>a</sup>	3.15±1.25 (205) <sup>a</sup>	2.86±1.24 (212) <sup>b</sup>	2.978*
<i>Miyeok</i>	3.84±1.15 (226)	3.93±1.15 (207)	3.91±1.19 (201)	3.82±1.13 (206)	3.84±1.08 (224)	0.387

Mean±SD.

<sup>1)</sup>Number of subjects who answered not to be unfamiliar with each vegetable.

Q, Quintiles for the number of unfamiliar vegetables; Q1 (&lt;14), Q2 (14~18), Q3 (19~23), Q4 (24~29), and Q5 (&gt;29).

\* $P<0.05$ , \*\* $P<0.01$  by analysis of variance.<sup>a,b</sup>Means with the same superscripts in a row are not significantly different at  $P<0.05$  by Duncan's multiple range test.

*seot* (3.53 vs. 3.79~4.00, respectively,  $P<0.01$ ) and *songi beoseot* (3.54 vs. 3.84~3.92, respectively,  $P<0.05$ ) than the 1st, 2nd, and 3rd quintiles, for *pyogo beoseot* than the 2nd and 3rd quintiles (3.18 vs. 3.45~3.63, respectively,  $P<0.05$ ), and for *yangsongi beoseot* than the 1st and 2nd quintiles (3.53 vs. 3.74 and 3.89, respectively,  $P<0.05$ ).

## DISCUSSION

Because preference is the most important predictor of children's food intake, developing effective strategies are needed to increase children's preferences for vegetables. The results of this study suggest possible benefits of teaching children the names of various vegetables, not only for higher preferences for such vegetables, but also for more desirable dietary factors including dietary habits and taste preference.

The children who were the least familiar with the items in the vegetable food group had significantly lower adherence to the guidelines regarding eating vegetables and protein sources, exercising, knowing the desirable height and weight, and reading food labels; the adherence to these 4 guidelines may be important especially for lowering the risks of being overweight. Greater preference for fruits and vegetables has been positively asso-

ciated with less risks of being overweight by previous studies (21). Children who reported a very low preference for fruits and vegetables were 5.5 times more likely to be categorized as at risk of being overweight than were those who had a high preference for those foods, resulting in a significantly negative association between fruits and vegetable preference and body mass index for age percentile.

The mean score of the adherence to national dietary guidelines in 5th to 6th graders from our study was 3.52, higher than 3.23 in middle school students of Gwangju, which used the same Likert 5-point scale as ours to measure adherence to dietary guidelines (22). The Korean government announced the National dietary guideline for Koreans in 2002 and revised it in 2009 to prevent chronic diseases and the resulting costs. The revised guideline for children consists of five tenets and each tenet consists of 3~4 specific action guides and has become useful to measure the overall dietary habits of children. The study on nutrient intake of children in Gwangju city reported the association between greater adherences to the Korean national dietary guidelines with higher levels of nutrient intake (22). Moreover, the fiber intake from vegetables was higher in youths with higher adherence to national guidelines compared to those with fewer adherences, while fiber intake through

cereal did not differ according to adherence to guidelines, although cereal contributed more fiber than vegetables (23). The authors suggested that children who consumed fiber through vegetables may have healthier dietary habits.

Children's preference for foods and how they taste play a central role in food choices and consumption. The results of this study showed no significant difference in preference for salty taste or hot taste according to number of unfamiliar vegetables but a significantly higher preference for bland taste among children who were the most familiar to items in the vegetable group, which seems to be desirable considering the previous studies (24,25). Children who liked spiciness ate significantly more calories than other groups, according to the study on anthropometric measurements and nutrient intake of 3rd graders in Gwangju city (24). Moreover, university female students who liked saltiness ate significantly faster and in significantly larger quantities than those who disliked saltiness (25).

This study used the number of unfamiliar foods to quantify how much they were exposed to the foods. The important role of knowing vegetable names in children's liking for vegetables has been emphasized in a recently reported study (26). Elementary students ate twice the amount of carrots when the carrots were attractively named as "X-ray Vision Carrots", than when the carrots were unnamed or generically named as the "Food of the Day". Moreover, they were also 16% more likely to persistently choose more hot vegetable dishes when they were given fun or attractive names. The study further reported that attaching more appealing names to vegetables led to a sustained increase in their consumption in schools.

We admit that there are some limitations of this study, which relied on self-reported dietary habits, preferences for foods and tastes, and recognition of unfamiliar vegetables. Furthermore, whether being unfamiliar with more vegetables is the direct cause or the effect of less desirable dietary habits or food preferences is unclear. Nevertheless, this meaningful study is the first attempt to quantify the exposure to vegetables by using the number of vegetable names which the children recognized as unfamiliar and suggested their association with vegetable preferences.

Although the results of this study suggest that children who knew the names of more vegetables may have a lot of beneficial dietary factors, simply knowing the names without being exposed directly to the vegetables has been found insufficient for increasing vegetable intake (27). Since children's eating behaviors do not necessarily change to coincide with the newly acquired knowledge, teaching the names of vegetables should be implemented together with getting the children to try foods.

## AUTHOR DISCLOSURE STATEMENT

The authors declare no conflict of interest.

## REFERENCES

1. Steinmetz KA, Potter JD. 1996. Vegetables, fruit, and cancer prevention: A review. *J Am Diet Assoc* 96: 1027-1039.
2. Key TJ, Thorogood M, Appleby PN, Burr ML. 1996. Dietary habits and mortality in 11,000 vegetarians and health conscious people: Results of a 17-year follow-up. *BMJ* 313: 775-779.
3. KNS. 2010. *Dietary recommended intake for Koreans*. 1st revision. The Korea Nutrition Society, Seoul, Korea. p 527-535.
4. KHIDI. 2012. Report of Korea National Health and Nutrition Examination Survey. Korea Health Industry Development Institute. <http://info.khidi.or.kr/kpublish/inv01list.do?mode=view&no=709&menuCd=21010010&tab=09&cpage=1&searchItem=0&searchKey=&searchYear=0> (accessed Jan 2013).
5. Balanchette L, Burg J. 2005. Determinants of fruit and vegetable consumption among 6-12-year-old children and effective interventions to increase consumption. *J Hum Nutr Diet* 18: 431-443.
6. Domel SB, Thompson WO, Davis HC, Baranowski T, Leonard SB, Baranowski J. 1996. Psychosocial predictors of fruit and vegetable consumption among elementary school children. *Health Educ Res* 11: 299-308.
7. Harneck L, Block G, Lane S. 1997. Influence of selected environmental and personal factors on dietary behavior for chronic disease prevention. *J Nutr Edu* 29: 306-312.
8. Newmark-Sztainer D, Wall M, Perry C, Story M. 2003. Correlates of fruit and vegetable intake among adolescents: Findings from Project EAT. *Prev Med* 37: 198-208.
9. Cullen KW, Baranowski T, Owens E, Marsh T, Ritenberry L, de Moor C. 2003. Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Educ Behav* 30: 615-626.
10. Heim S, Stang J, Ireland M. 2009. A garden pilot project enhances fruit and vegetable consumption among children. *J Am Diet Assoc* 109: 1220-1226.
11. Hermann JR, Parker SP, Brown BJ, Sieve YJ, Denny BA, Walker SJ. 2006. After-school gardening improves children's reported vegetable intake and physical activity. *J Nutr Edu Behav* 38: 201-202.
12. Morris JL, Zidenberg-Cherr S. 2002. Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge of nutrition and preferences for some vegetables. *J Am Diet Assoc* 102: 91-93.
13. McAleese JD, Rankin LL. 2007. Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents. *J Am Diet Assoc* 107: 662-665.
14. Davis EM, Cullen KW, Watson KB, Konarik M, Radcliffe JA. 2009. A fresh fruit and vegetable program improves high school students' consumption of fresh produce. *J Am Diet Assoc* 109: 1227-1231.
15. Wardle J, Carnell S, Cooke L. 2005. Parental control over feeding and children's fruit and vegetable intake: how are they related? *J Am Diet Assoc* 105: 227-232.
16. Birch LL, McPhee L, Shoba BC, Pirok E, Steinberg L. 1987. What kind of exposure reduces children's food neophobia? Looking vs. tasting. *Appetite* 9: 171-178.
17. Sullivan SA, Birch LL. 1990. Pass the sugar, pass the salt: Experience dictates preference. *Dev Psychol* 26: 546-551.

18. Kim HM, Han SN, Song KH, Lee HM. 2011. Lifestyle, dietary habits and consumption pattern of male university students according to the frequency of commercial beverage consumptions. *Nutr Res Pract* 5: 124-131.
19. Kwun HY, Kim JH, Lee HM. 2011. Beneficiaries' satisfaction, menu preference, and dietary habits of lunch-box program provided to low-income families. *Korean J Food Nutr* 24: 320-328.
20. MOHW. 2009. The Dietary Guidelines for Korean Children. Ministry of Health and Welfare. [http://www.mw.go.kr/front\\_new/al/sal0301vw.jsp?PAR\\_MENU\\_ID=04&MENU\\_ID=0403&CONT\\_SEQ=223072&page=1](http://www.mw.go.kr/front_new/al/sal0301vw.jsp?PAR_MENU_ID=04&MENU_ID=0403&CONT_SEQ=223072&page=1) (accessed Jan 2013).
21. Lakkakula AP, Zanovec M, Silverman L, Murphy E, Tuuri G. 2008. Black children with high preferences for fruits and vegetables are at less risk of being at risk of overweight or overweight. *J Am Diet Assoc* 108: 1912-1915.
22. Kim BH, Sung MY, Lee YN. 2011. Comparison of the nutrient intakes by the score of dietary action guides for Korean children among the elementary school students in Gwangju city. *Korean J Community Nutr* 16: 411-425.
23. Park SM, Na WR, Kim MS, Kim ES, Sohn CM. 2012. Correlation between intake of dietary fiber and adherence to the Korean national dietary guidelines in adolescents from Jeonju. *Prev Nutr Food Sci* 17: 254-260.
24. Lee SS. 2001. The effect of taste preferences on anthropometric measurements and nutrient intakes in children. *Korean J Community Nutr* 6: 130-138.
25. Cho HK, Kim MH. 2010. Dietary behavior and nutrient intake in university students according to taste preferences. *J Korean Diet Assoc* 16: 110-115.
26. Wansink B, Just DR, Payne CR, Klinger MZ. 2012. Attractive names sustain increased vegetable intake in schools. *Prev Med* 55: 330-332.
27. Schindler JM, Corbett D, Forestell CA. 2013. Assessing the effect of food exposure on children's identification and acceptance of fruit and vegetables. *Eat Behav* 14: 53-56.