

Estimate of Vitamin B₆ Intake and Major Dietary Sources of Vitamin B₆ in Children Aged 7-12 Years in the Seoul Area*

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The dietary vitamin B₆ intake of 185 Korean children aged 7-12 years (y), who showed no health problems, in the Seoul area and its sources were estimated using a modified Korean vitamin B₆ database. The age and sex of each subject was classified according to the classifications in the Korean Recommended Dietary Allowance (RDA). Dietary vitamin B₆ intake and food sources were estimated using the three-day recall method with the help of a trained interviewer. Food portion sizes were estimated by using standard household measures and published average portion sizes. The average daily vitamin B₆ intake was 1.69 ± 0.50 mg/d in children aged 7-9 y, 1.86 ± 0.44 mg/d in male children aged 10-12 y and 1.77 ± 0.62 mg/d in female children aged 10-12 y. Less than 5% of the subjects consumed less than the Korean RDA of vitamin B₆. The average ratio of vitamin B₆ intake to daily protein intake was 0.028 ± 0.006 mg/g in children aged 7-9 y, 0.028 ± 0.004 mg/g in male children aged 10-12 y and 0.029 ± 0.007 mg/g in female children aged 10-12 y. The intake of vitamin B₆ was significantly ($p < .01$) positively correlated to the intake of all other nutrients. Foods from animal and plant sources provided 37% and 73%, respectively, of total vitamin B₆. Major dietary sources of vitamin B₆ in children in the Seoul area were rice, soybean sprouts, pork, beef, cereal, kimchi, milk, onions, and potatoes. As for major dietary sources of vitamin B₆, the top 20 foods provided nearly 73-75% of the total vitamin B₆ consumed by Korean children.

Key words : Vitamin B₆, Food sources, Dietary intake

INTRODUCTION

Because vitamin B₆ is involved in gluconeogenesis, niacin formation, lipid metabolism and hormone modulation and is found in nucleic acids and in the nervous and immune systems,¹⁾ the adequate intake of vitamin B₆ is essential for favorable health outcomes, especially in growing children. The Korean Nutrition Society began offering a Korean Recommended Dietary Allowance (RDA) for vitamin B₆ in 1995 and did so again in 2000. Since there was little information on vitamin B₆ status in Koreans, the Korean RDA had to be established on the basis of western data that was founded on western dietary habits and intakes. However, Korean dietary habits and intakes differ from those in the western world and nutrient requirements are affected by physio-cultural factors, including race. Because vitamin B₆ is frequently identified as a nutrient with a high prevalence of inadequate intakes even in western countries²⁻⁶⁾ there was a potential for inadequate dietary vitamin B₆ intake in Korea.

Thus, the purpose of this study was to estimate the dietary intake and major dietary sources of vitamin B₆ in

Korean children by using a modified Korean vitamin B₆ database⁷⁾ as a part of our continuing study of the vitamin B₆ status of Koreans.

SUBJECTS AND METHODS

1. Subjects

One hundred eighty five Korean children aged 7-12 years (y) who showed no health problems were interviewed in July 2002 and July 2003. Because of the difficulties of random sampling of the children, convenience sampling was used in this study. The subjects were students of 'W' elementary school in Seoul. The age and sex of each subject was classified according to the classifications of the Korean

Table 1. General characteristics of the subjects

	Both sexes, 7-9 y(n=72)	Male, 10-12y (n=57)	Female, 10-12y(n=42)
Age(years)	8.22±0.84 ²⁾	11.13±0.88	11.23±0.84
Height(cm)	128.09±6.85	144.86±7.25	146.04±7.74
Weight(kg)	27.85±6.45	39.62±7.75	38.74±6.55
Body mass index (BMI) ¹⁾	16.81±2.75	18.77±2.64	18.10±2.41

1) Body mass index(BMI)=Weight(kg)/Height(m)²

2) Values are mean ±SEM

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RDA. On the day of collection of dietary data, weights and heights were reported and body mass index (BMI) was calculated based on these measurements. Characteristics of the subjects are given in Table 1. The weights and heights of the subjects were distributed within the normal range of anthropometric reference values for Koreans.⁷⁾

2. Dietary intake

The three-day recall method was used to record the standard dietary intake of the subjects: Two days during the week, one day on the weekend. Subjects reported their dietary intakes with the help of the trained interviewer. Food portion sizes were estimated by using standard household measures and published average portion sizes.⁸⁾ Recorded food intakes were converted into vitamin B₆ and nutrient intakes by using a computerized dietary analysis program⁹⁾ which was developed based on the food nutrient database of the Korean Nutrition Society. When information was unavailable for a particular food, a value was assigned based on the values of similar foods. The methods used for the determination of the quantitative contribution of various foods to daily vitamin B₆ intake of the subjects followed the method of Block *et al.*¹⁰⁾

3. Statistical analysis

The statistical analysis was carried out using the statistical analysis system (SAS). Pearson's correlation coefficient was used to determine possible relationships between

vitamin B₆ intake and that of other nutrients.

RESULTS

Table 2 shows the nutrient intake expressed as a percentage of Korean RDA. The nutrient intakes were 69-211% of Korean RDA for the respective nutrients in children aged 7-9 y, 61-168% in male children aged 10-12 y, and 58-160% in female children aged 10-12 y. The subjects' intakes of most nutrients were at levels close to or above Korean RDA levels,⁷⁾ except for calcium and iron, which were similar to the dietary intake levels listed in the National Health and Nutrition Survey of Korea.¹¹⁾ Although the protein intake of children aged 7-9 y was 60.57 g and 151% of Korean RDA, this intake was also similar to the dietary intake listed in the National Health and Nutrition Survey of Korea.¹¹⁾ Thus, the nutrient intakes for these subjects were similar to those for the average Korean. Table 3 shows the mean and percentiles for usual intake of vitamin B₆. The mean intake of vitamin B₆ was 1.69 ± 0.50 mg/d in children aged 7-9 y, 1.86 ± 0.44 mg/d in male children aged 10-12 y and 1.77 ± 0.62 mg/d in female children aged 10-12 y. Ninety-five percent of the subjects aged 7-9 y consumed 1.09 mg/d which is more than the Korean RDA of 0.8 mg/d. Ninety five percent of the male subjects aged 10-12 y consumed 1.24 mg/d. The figures were 1.10 mg/d for female children aged 10-12 y,

Table 2. Daily nutrient intake of the subjects

Nutrient	Both sexes, 7-9 y		Male, 10-12 y		Female, 10-12 y	
	intake ¹⁾	% of Korean RDA ²⁾	intake	% of Korean RDA	intake	% of Korean RDA
Energy (kcal)	1571.84±282.25	87.32	1607.07±261.25	73.05	1553.78±324.68	77.69
Carbohydrate (g)	236.34±45.10		231.05±49.59		231.05±49.59	
Protein (g)	60.57±12.37	151.43	65.16±11.02	93.09	61.76±16.19	112.29
Animal protein	31.42±8.52		35.61±8.65		33.46±11.11	
Plant protein	29.16±7.78		29.55±6.35		28.30±7.75	
Fat (g)	43.26±11.37		47.07±12.93		43.23±13.13	
Animal fat	24.61±9.22		27.71±9.90		25.65±10.16	
Plant fat	18.65±6.38		19.37±6.91		17.58±8.30	
Cholesterol (mg)	279.10±97.08		326.30±122.39		308.91±120.71	
Calcium (mg)	483.71±158.37	69.10	490.38±173.03	61.30	462.50±199.37	57.81
Phosphorus (mg)	893.69±210.26	127.67	947.29±198.63	118.41	897.11±258.50	112.14
Iron (mg)	11.24±3.76	112.41	12.20±3.87	101.69	11.38±3.62	71.12
Sodium (mg)	3143.49±845.01		3134.44±786.12		3120.78±1143.34	
Potassium (mg)	2012.63±508.13		2194.16±485.05		2014.92±649.33	
Vitamin A (RE)	612.90±301.94	122.58	727.63±303.62	121.27	633.09±303.08	105.52
Vitamin B ₁ (mg)	1.04±0.34	114.96	1.03±0.31	93.90	0.98±0.34	97.79
Vitamin B ₂ (mg)	1.11±0.65	101.14	1.12±0.56	86.16	0.99±0.31	82.68
Vitamin B ₆ (mg)	1.69±0.50	211.36	1.86±0.44	168.67	1.77±0.62	160.93
Niacin (NE)	13.08±4.09	108.97	13.83±3.59	92.19	13.09±4.47	100.70
Vitamin C (mg)	62.05±30.15	103.42	71.57±33.76	102.24	61.58±39.24	87.97

1) Values are mean ± SEM

2) Recommended Dietary Allowances for Koreans, 7th Revision, 2000

Table 3. Mean and percentiles for usual intake of vitamin B₆(mg/d)

Sex and age, y	Number of estimated person	Mean ±SEM	Selected percentiles								
			5th	10th	15th	25th	50th	75th	85th	90th	95th
Both sexes, 7-9y	72	1.691	2.846	2.553	2.316	2.062	1.770	1.496	1.269	1.192	1.086
		±0.500	±0.115	±0.130	±0.082	±0.108	±0.101	±0.103	±0.035	±0.039	±0.021
Male, 10-12y	57	1.855	2.812	2.496	2.346	2.175	2.006	1.690	1.424	1.306	1.243
		±0.440	±0.159	±0.069	±0.049	±0.052	±0.068	±0.114	±0.082	±0.006	±0.041
Female, 10-12y	42	1.770	3.561	2.690	2.373	2.126	1.876	1.494	1.208	1.119	1.096
		±0.620	±0.814	±0.297	±0.101	±0.054	±0.157	±0.088	±0.071	±0.024	±0.008

which was also more than the Korean RDA, and 1.1 mg/d for male and female children aged 10-12 y. Table 4 lists the total daily vitamin B₆, mg vitamin B₆/1000 Kcal, mg vitamin B₆/g dietary protein intake and percentage of Korean RDA of vitamin B₆ for the subjects. The daily vitamin B₆ intake from plant and animal sources for the subjects expressed as a percentage of the total is also shown in Table 4. The average ratio of vitamin B₆ intake to daily protein intake was 0.028±0.006 mg/g in children aged 7-9 y, 0.028±0.004 mg/g in male children aged 10-12 y and 0.029±0.007 mg/g in female children aged 10-12 y. Foods from animal and plant sources provided approximately 27% and 73%, respectively, of total vitamin B₆ intake in children regardless of age and sex.

Table 4. Dietary vitamin B₆ intake of the subjects¹⁾

	Both sexes, 7-9 y	Male, 10-12 y	Female, 10-12 y
Vitamin B ₆ per day (mg/d)	1.69±0.50	1.86±0.44	1.77±0.62
Vitamin B ₆ per 1000kcal (mg/1000 kcal)	1.07±0.24	1.15±0.03	1.13±0.26
Vitamin B ₆ per g protein (mg/g protein)	0.028±0.006	0.028±0.004	0.029±0.007
Vitamin B ₆ from plant foods(%)	73.12±0.09	73.83±0.08	72.91±0.08
Vitamin B ₆ from animal foods(%)	26.88±0.08	26.17±0.07	27.09±0.11

1) Values are mean ± SEM

There were significant correlations between vitamin B₆ intake and nutrient intake (Table 5). As expected, vitamin B₆ intake had a positive correlation with all other nutrients. Major dietary sources of vitamin B₆ for children are shown in Table 6. The 50 major food sources of vitamin B₆ in the diet provided 91-92% of the total daily vitamin intake and the top 20 foods provided 73-75% of total vitamin B₆ in both sex and age groups. Rice was the top contributor with 16-18% of the daily intake of vitamin B₆ in both sex and age groups. Major dietary sources of vitamin B₆ in Korean children were rice, soybean sprouts, pork, beef, cereal, kimchi, onions, milk and potatoes. Table 7 lists the 15 foods reported by the subjects with the highest vitamin

Table 5. Correlation among the indices of vitamin B₆ status and nutrient intake per day of the subjects

Nutrients	Vitamin B ₆ intake (mg)		
	Both sexes, 7-9 y	Male, 10-12 y	Female, 10-12 y
Energy (kcal)	0.66208*** ¹⁾	0.74080***	0.73544***
Total protein (g)	0.64827***	0.76011***	0.78801***
Animal protein (g)	0.44220***	0.64172***	0.63431***
Plant protein (g)	0.54191***	0.44595***	0.73785***
Total fat (g)	0.43878***	0.66305***	0.54354**
Animal (g)	0.35257**	0.51171***	0.39717**
Plant fat (g)	0.27273**	0.50705***	0.37400**
Carbohydrate (g)	0.64027***	0.59117***	0.60760***
Ca (mg)	0.44103***	0.58813***	0.76293***
P (mg)	0.68921***	0.78493***	0.86133***
Fe (mg)	0.52780***	0.56855***	0.79224***
Na (mg)	0.60740***	0.67364***	0.70300***
K (mg)	0.69219***	0.79569***	0.83950***
Vitamin A (RE)	0.62109***	0.60731***	0.77042***
Vitamin B ₁ (mg)	0.79660***	0.74930***	0.87268***
Vitamin B ₂ (mg)	0.36472**	0.25933**	0.75982***
Niacin (NE)	0.84165***	0.75279***	0.83599***
Vitamin C (mg)	0.72854***	0.61564***	0.82399***
Cholesterol (mg)	0.44672***	0.50036***	0.61880***

1) p-value, **: significant at p<0.01, ***: significant at p<0.001

B₆ content expressed per serving and per 100g of food. A comparison of Table 6 and 7 reveals that of the top 10 foods in each of the two tables, only three foods appeared in both. Six of the top 10 foods, namely rice, pork, beef, kimchi, onions and milk were not present in Table 7.

DISCUSSION

This study provides data for the evaluation of dietary vitamin B₆ intake and major food sources of vitamin B₆ in Korean children. The average vitamin B₆ intake of Korean children aged 7-9 years was 1.69 mg/d, which was higher than the 1.53 mg/d for children aged 4-8 years in the CSFII¹²⁾ and the 1.63 mg/d for children aged 6-9 years

Table 6. Major dietary sources of vitamin B₆ for subjects

▷Both sexes, 7-9 yr

Rank	Description	Percent of total vitamin B ₆	Cumulative percent of vitamin B ₆	Percent of population
1	Rice products, paddy rice, cooked rice, well milled	18.03	18.03	100.00
2	Pork, loin, raw	6.93	24.96	86.11
3	Soybean sprout, raw	6.44	31.40	77.78
4	Cereal, corn flakes, Kellog	5.40	36.80	19.44
5	Beef, imported cattle, frank, raw	4.70	41.50	95.83
6	Hair tail, raw	4.53	46.03	88.89
7	Water melon	4.43	50.46	56.94
8	Kimchi, korean cabbage	3.77	54.22	95.83
9	Cow's milk, ordinary liquid milk	3.08	57.31	76.39
10	Onion, raw, domestic	2.51	59.82	100.00
11	Mungbean, sprout, raw	2.32	62.13	45.83
12	Garlic, bulb, raw	1.91	64.04	100.00
13	Chicken's egg whole egg, fresh	1.82	65.86	97.22
14	Ko Ch'u Jang(fermented 5% red pepper soybean paste)	1.60	67.46	81.94
15	Yellow croaker, raw	1.36	68.81	36.11
16	Anchovy boiled-dried	1.28	70.09	90.28
17	Banana, fresh	1.18	71.27	16.67
18	Carrot, raw	1.16	72.43	93.06
19	Sugar, white sugar	1.11	73.54	98.61
20	Fast food, Pizza	1.09	74.63	16.67
21	Red pepper powder	1.07	75.70	94.44
22	Udong, boiled	1.01	76.71	13.89
23	Spanish mackerel, raw	0.83	77.54	23.61
24	Chicken, meat and skin, raw	0.80	78.34	31.94
25	Soybean, black soybeans	0.79	79.13	87.50
26	Mackerel, raw	0.75	79.88	2.78
27	Small red bean, dried	0.75	80.63	51.39
28	Pepper, green pepper, native	0.74	81.37	95.83
29	Orange	0.74	82.12	26.39
30	Spinach, raw cultivation	0.72	82.82	58.33
31	Ice cream, vanilla	0.71	83.53	45.83
32	Yogurt	0.70	84.23	26.39
33	Loaf bread, loaf bread	0.66	84.90	29.17
34	Fish paste, fried	0.59	85.48	33.33
35	Radish, Korean radish, root	0.58	86.06	86.11
36	Starch syrup	0.51	86.57	69.44
37	Soybean. Black soybeans	0.50	87.07	26.39
38	Soybean curd, pressed	0.48	87.55	80.56
39	Soy sauce, jinsoysauce	0.47	88.02	100.00
40	Glutinous millet	0.43	88.45	51.39
41	Welsh onion, medium type	0.41	88.86	100.00
42	Sorghum, milled grain	0.39	89.25	50.00
43	Plum, raw	0.37	89.62	20.83
44	Ra Myon, instant	0.36	89.98	18.06
45	Chard, raw	0.35	90.33	29.17
46	Cucumber, improved	0.33	90.66	68.06
47	Laver, toasted	0.32	90.98	58.33
48	Sweet potatoes, raw	0.31	91.29	2.78
49	Lettuce, native	0.29	91.58	30.56
50	Pumpkin, immature, raw	0.29	91.87	65.28

Table 6. Continue

▷Male, 10-12

Rank	Description	Percent of total vitamin B ₆	Cumulative percent of vitamin B ₆	Percent of population
1	Rice products, paddy rice, cooked rice, well milled	15.56	15.56	100.00
2	Soybean sprout, raw	8.99	24.55	91.23
3	Beef, imported cattle, frank, raw	5.97	30.52	94.74
4	Pork, loin, raw	4.91	35.43	87.72
5	Kimchi, korean cabbage	4.22	39.65	98.25
6	Mungbean, sprout, raw	4.19	43.84	78.95
7	Water melon	4.08	47.91	66.67
8	Potatoes, raw	3.16	51.08	73.68
9	Onion, raw, domestic	2.83	53.90	96.49
10	Cow's milk, ordinary liquid milk	2.52	56.42	70.18
11	Garlic, bulb, raw	2.26	58.68	98.25
12	Cereal, corn flakes, Kellog	2.17	60.86	8.77
13	Chicken's egg whole egg, fresh	2.12	62.97	98.25
14	Ko Ch'u Jang (fermented 5% red pepper soybean paste)	1.93	64.90	96.49
15	Chicken, meat and skin, raw	1.92	66.82	29.82
16	Udong, boiled	1.85	68.67	22.81
17	Hair tail, raw	1.55	70.22	52.63
18	Red pepper powder	1.53	71.75	94.74
19	Sugar, white sugar	1.48	73.23	98.25
20	Carrot, raw	1.19	74.42	94.74
21	Anchovy boiled-dried	1.10	75.51	89.47
22	Spaghetti, retort pouched	0.91	76.43	31.58
23	Pepper, green pepper, native	0.89	77.32	96.49
24	Yellow croaker, raw	0.89	78.20	24.56
25	Spinach, raw cultivation	0.88	79.08	66.67
26	Ice cream, vanilla	0.77	79.86	56.14
27	Soybean paste	0.76	80.62	77.19
28	Spanish mackerel, raw	0.76	81.37	24.56
29	Small red bean, dried	0.65	82.02	47.37
30	Fish paste, fried	0.61	82.63	31.58
31	Soybean, black soybeans	0.59	83.21	26.32
32	Soy sauce, jinsoysauce	0.58	83.80	96.49
33	Orange	0.48	84.27	22.81
34	Ra Myon, instant	0.48	84.75	17.54
35	Bracken, raw	0.47	85.22	82.46
36	Welsh onion	0.47	85.69	100.00
37	Starch syrup	0.46	86.15	57.89
38	Chard, raw	0.45	86.60	40.35
39	Plum, raw	0.44	87.04	31.58
40	Soybean curd, pressed	0.44	87.48	70.18
41	Mackerel, raw	0.40	87.88	5.26
42	Radish, Korean radish, root	0.39	88.27	91.23
43	Yogurt	0.39	88.66	19.30
44	Loaf bread, loaf bread	0.38	89.03	26.32
45	Glutinous millet	0.34	89.37	49.12
46	Tomato, raw	0.34	89.70	15.79
47	Sorghum, milled grain	0.33	90.03	49.12
48	Stem of taro, wet form, raw	0.32	90.35	77.19
49	Laver, toasted	0.32	90.67	57.89
50	Tcha Jang, Black noodle sauce pasta	0.31	90.98	17.54

Table 6. Continue

▷Female, 10-12

Rank	Description	Percent of total vitamin B ₆	Cumulative percent of vitamin B ₆	Percent of population
1	Rice products, paddy rice, cooked rice, well milled	16.58	16.58	97.62
2	Pork, loin, raw	8.38	24.96	90.48
3	Beef, imported cattle, frank, raw	6.11	29.10	100.00
4	Soybean sprout, raw	5.51	34.61	80.95
5	Mungbean, sprout, raw	4.81	39.42	76.19
6	Kimchi, korean cabbage	4.25	43.67	100.00
7	Cereal, corn flakes, Kellog	2.82	46.49	11.90
8	Potatoes, raw	2.81	49.30	78.57
9	Onion, raw, domestic	2.72	52.02	100.00
10	Water melon	2.69	54.71	64.29
11	Garlic, bulb, raw	2.35	57.06	100.00
12	Cow's milk, ordinary liquid milk	2.25	59.31	64.29
13	Chicken's egg whole egg, fresh	1.92	63.21	100.00
14	Sugar, white sugar	1.63	64.83	92.86
15	Hair tail, raw	1.60	66.43	52.38
16	Candy, nougat	1.53	67.96	14.29
17	Red pepper powder	1.45	69.41	92.86
18	Ko Ch'u Jang (fermented 5% red pepper soybean paste)	1.41	70.81	76.19
19	Snack cakes	1.28	72.09	16.67
20	Chicken, meat and skin, raw	1.24	73.33	28.57
21	Sweet potatoes raw	1.12	74.45	4.76
22	Carrot, raw	1.05	75.50	92.86
23	Banana, fresh	1.00	76.50	7.14
24	Udong, boiled	0.93	77.43	7.14
25	Ice cream, vanilla	0.87	78.30	57.14
26	Anchovy boiled-dried	0.79	79.09	92.86
27	Soybean paste	0.77	79.86	83.33
28	Pepper, green pepper, native	0.67	80.52	95.24
29	Orange	0.65	81.17	19.05
30	Barley, naked barley, milled	0.64	81.80	26.19
31	Small red bean, dried	0.58	82.39	38.10
32	Soybean, black soybeans	0.57	82.96	26.19
33	Spinach, raw cultivation	0.56	83.52	61.90
34	Chard, raw	0.55	84.07	45.24
35	Spanish mackerel, raw	0.55	84.62	21.43
36	Soy sauce, jinsoysauce	0.54	85.16	97.62
37	Ra Myon, instant	0.52	85.68	21.43
38	Buckwheat noodle, wet form, raw	0.51	86.19	16.67
39	Soybean curd, pressed	0.51	86.70	73.81
40	Welsh onion	0.47	87.17	73.81
41	Loaf bread	0.45	87.62	33.33
42	Yogurt	0.43	88.04	21.43
43	Lettuce, native	0.42	88.46	35.71
44	Rice, glutinous rice, milled	0.40	88.86	7.14
45	Radish, Korean radish, root	0.40	89.27	88.10
46	Bracken, raw	0.40	89.66	78.57
47	Pumpkin, immature, raw	0.37	90.03	59.52
48	Stem of taro, wet form, raw	0.36	90.40	73.81
49	Fast food, Pizza	0.32	90.72	9.52
50	Alaska pollack, raw	0.31	91.03	16.67

Table 7. Vitamin B₆ content of foods reported by the subjects

	Rank	Description	Vitamin B ₆ mg/serving	Vitamin B ₆ mg/100g
Both sexes, 7-9 y	1	Mustard, leaf	0.840	1.20
	2	Mungbean, sprout, raw	0.672	0.96
	3	Soybean sprout, raw	0.672	0.96
	4	Garlic, pickled garlic	0.480	0.96
	5	Cereal, corn flakes, Kellog	0.390	1.30
	6	Potatoes, raw	0.351	0.27
	7	Fast food, Pizza	0.330	0.22
	8	Celery	0.301	0.43
	9	Water melon	0.275	0.11
	10	Sweet potatoes raw	0.270	0.27
	11	O Mi Ja tea	0.270	0.27
	12	Tcha Jang, Black noodle sauce pasta type	0.264	0.22
	13	Common octopus, raw	0.252	0.36
	14	Starch syrup	0.245	0.72
	15	File fish, fillet, dried	0.243	1.62
	Rank	Description	Vitamin B ₆ mg/serving	Vitamin B ₆ mg/100 g
Male, 10-12 y	1	Mungbean, sprout, raw	0.672	0.96
	2	Soybean sprout, raw	0.672	0.96
	3	Cereal, corn flakes, Kellog	0.390	1.30
	4	Potatoes, raw	0.351	0.27
	5	Fast food, Pizza	0.330	0.22
	6	Common sea bass, raw	0.280	0.40
	7	Water melon	0.275	0.11
	8	Sweet potatoes raw	0.270	0.27
	9	O Mi Ja Tea	0.270	0.27
	10	Tcha Jang, Black noodle sauce pasta type	0.264	0.22
	11	Starch syrup	0.245	0.72
	12	File fish, fillet dried	0.243	1.62
	13	Sea bream, blanguillo	0.230	0.46
	14	Pork, loin, raw	0.228	0.57
	15	Pacific saury, raw	0.225	0.45
	Rank	Description	Vitamin B ₆ mg/serving	Vitamin B ₆ mg/100g
Female, 10-12 y	1	Mustard, leaf	0.840	1.20
	2	Mungbean, sprout, raw	0.672	0.96
	3	Soybean sprout, raw	0.672	0.96
	4	Cereal, corn flakes, Kellog	0.390	1.30
	5	Potatoes, raw	0.351	0.27
	6	Fast food, Pizza	0.330	0.22
	7	Water melon	0.275	0.11
	8	Sweet potatoes raw	0.270	0.27
	9	Tcha Jang, Black noodle sauce pasta type	0.264	0.22
	10	Common octopus, raw	0.252	0.36
	11	Starch syrup	0.245	0.72
	12	Pork, loin, raw	0.228	0.57
	13	Sandwich, Ham subway	0.210	0.14
	14	Ko Ch'u Jang(Fermented 5% red pepper soybean paste)	0.206	1.03
	15	Spanish mackerel, raw	0.200	0.40

in the NHANES III.¹³⁾ The average vitamin B₆ intake of Korean male children aged 10-12 years was 1.86 mg/d which was lower than the 2.04 mg/d in the CSFII¹²⁾ and was similar to the 1.81 mg/d in the NHANES III¹³⁾ for male children aged 9-13 years. The average vitamin B₆

intake of Korean female children aged 10-12 years was 1.77 mg/d, which was higher than the 1.58 mg/d in CSFII¹²⁾ and the 1.65 mg/d in NHANES III¹³⁾ for female children aged 9-13 years. Thus, the intake status of vitamin B₆ in the children in this study was better than that for the

children in the NHANES III. The adequacy of reported vitamin B₆ intake for meeting requirements is influenced by the bioavailability of the vitamin from different food sources. The bioavailability of vitamin B₆ from food varies because the bioavailability of vitamin B₆ is incomplete when it is conjugated with glucosides.¹⁴⁾ Thus, when considering the bioavailability of vitamin B₆, the available vitamin B₆ in Korean children could not be more than that of young women in the NHANES III because Korean children in this study obtained 73% of their vitamin B₆ intake from plant sources, whereas in the NHANES III approximately one-half of dietary vitamin B₆ intake was reported to have come from meat and one-half from plant-based foods.

The vitamin B₆ intake of Korean children was 211% of the Korean RDA in children aged 7-9 years and 169% of the Korean RDA for male children aged 10-12 years and 161% of the Korean RDA for female children aged 10-12 years. If the average intake of a healthy subject is the amount needed to keep healthy status, it is concluded that either Korean children in this study consumed sufficient amounts of vitamin B₆ or the Korean RDA for vitamin B₆ for this age was established at a level that is lower than required. The vitamin B₆ requirement is affected by the level of dietary protein intake, with the requirement growing with increasing protein consumption.^{15,16)} For comparative purposes, the requirement was also estimated assuming that there is a direct relationship between protein intake and the B₆ requirement. Hence, the adequacy of dietary intakes of the vitamin is frequently evaluated in terms of mg vitamin B₆/g protein consumed.¹⁷⁾ Korean RDA for vitamin B₆ is based on the ratio of 0.02 mg/g dietary protein. In this study, the average ratios of vitamin B₆ intake to daily protein intake were 0.028-0.029 mg/g. Thus, the application of average ratios of vitamin B₆ intake to daily protein intake to establish RDA for vitamin B₆ in this study was judged to be unreasonably high. As with the children, there is no compelling evidence to suggest that requirements for protein intake within any of these age groups should be adjusted.

As expected, there were positive correlations between vitamin B₆ intake and intakes of all other nutrients in this study. Foods that are good sources of vitamin B₆ are animal-derived foods such as fish, pork, chicken, eggs, and animal organs.⁷⁾ Thus, the nutrients that originated from animal-derived foods might have shown relatively stronger positive correlations with vitamin B₆ than the nutrients that originate from plant-derived foods. In considering the substantial contribution (16-18%) of rice to daily vitamin B₆ intake in the Korean diet and that other major food sources are also plant sources, it is important to note that the bioavailability of vitamin B₆ from plant sources is known to be less than that from animal sources.¹⁸⁾ As for major dietary sources of vitamin B₆, the top 20 foods provided 73-75% of total vitamin B₆, whereas the top 10

foods provided nearly 76% of total vitamin B₆ in Korean men¹⁹⁾ and the top 20 foods provided nearly 70% of total vitamin B₆ in Korean women.²⁰⁾ Thus, it can be concluded that the dietary sources of vitamin B₆ for children are more varied than those for adults in Korea. Although the vitamin B₆ content of rice is 0.11 mg/100 g, it was the top contributor to total intake because rice is consumed frequently and in quantity. Also, kimchi, a Korean-style pickled vegetable, is not a good food source of vitamin B₆, with vitamin B₆ content of only 0.105 mg/serving, but it provided 6.75% of the total daily vitamin intake because of the frequency of its consumption and the amounts usually consumed. Therefore, it is concluded that Korean children consume sufficient amounts of vitamin B₆. However, considering the major food sources of vitamin B₆, it is suggested that the supply of vitamin B₆ for Korean children should be based not only on sufficient amounts but also on varied food sources.

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