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Gender Differences in Physical Activity, Dietary Habit and Nutrient Intake of Upper Grade Students in Elementary School

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Abstract

This study was conducted to find gender differences in physical activity, dietary habit and nutrient intake in 4~6th grade students in elementary school. Physical activity assessment showed that males significantly engaged in more vigorous activity with longer duration than females. It was found that females skipped their breakfast more often and had more snack than males. On the other hand, males were more indulged in peaky eating, despite their good practice of drinking milk. Twenty-four hour dietary recall revealed that energy intakes in both males and females were not sufficient. Furthermore, subjects, regardless of gender, consumed marginal intakes of Ca and Fe. Special attention should be given to marginal intakes of Ca in the subjects. Due to low Fe intake in females, more caution should be taken to include a meal which can enhance iron absorption. It might be suggested that effective intervention strategies need to be developed and implemented to choose nutrient dense foods and activities that lead to better health.

Key words: gender differences, physical activity, dietary habit, nutrient intake

INTRODUCTION

Early adolescence includes the onset of puberty and usually takes place by the age of 10 to 12 years in girls and 11 to 13 years in boys (1). During puberty young females usually mature earlier and become taller because of their growth spurt than males (2). Thus, in later part of elementary school, female children have increased height and weight more distinctly than male children (3). Furthermore, their body composition was different from males' (2).

During the growing years, good nutrition is important to support children's growth. Without adequate energy and other nutrients, children's growth cannot proceed normally. Childhood during upper grades of elementary school is highly formative for the development of health promoting and damaging habits and behaviors (4). They need to establish good food habits and physical activity patterns which may last into the adulthood.

Some studies showed that most children at this age were not satisfied with their body weight even though their weights were in normal range (3,5,6). Especially young girls were preoccupied with weight and size than boys (3,7). Their wrong perception about body image might lead into inappropriate health damaging behaviors, which influence their nutrient intake and dietary quality.

Despite the importance of adequate nutrition for children, the research to assess their dietary habit, nutrient intake and physical activity pattern has not been extensively done. In this study, children's nutrient intake and dietary habit and quality were investigated. Furthermore, children's physical activity pattern will be investigated to understand their activity patterns so that vulnerable groups can be identified and appropriate intervention programs will be designed and developed for weight control program in children.

Since the differences in physical maturity are prominent between genders, during this period, the study was done to compare the dietary habit, nutrient intake and physical activity patterns between two genders. The results from this study will give you some basic data for developing nutrition education program in the community.

MATERIALS AND METHODS

Subjects and experimental design

Subjects were 487 male and 481 female students of the 4th, 5th and 6th grade of elementary school in Gwangju. Subjects were asked to fill out questionnaires on dietary habit with the help of parents.

Nutrient intake analysis

Dietary data were obtained by a 24 hour dietary recall for determining typical food consumption pattern. Nutri-

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ent intake analysis was done with the CAN program developed by Korean Nutrition Society and compared with 7th Korean Recommended Daily Dietary Allowances (RDA) (7).

Dietary quality evaluation

To evaluate dietary quality, index of nutritional quality (INQ), nutrient adequacy ratio (NAR), mean nutrient adequacy ratio (MAR) were calculated. These indices were calculated using the following formulas.

$$INQ = \frac{\text{amount of nutrient in 1000 kcal of food}}{\text{allowance of nutrient per 1000 kcal of food}}$$

$$NAR = \frac{\text{individual's nutrient intake of specific nutrient}}{\text{RDA of specific nutrient}}$$

$$MAR = \frac{\text{sum of NARs for specific nutrients}}{\text{number of specific nutrients}}$$

Physical activity assessment

To estimate physical activity pattern, children were required to fill out their daily activity pattern in detail with the help of parents. Three activity levels determined by intensity of activity were (8,9):

① light activity ② moderate activity
③ vigorous activity

Five levels of duration determined by time participated in activity were:

① none ② 1/2～1 hr ③ 1 hr～2 hrs ④ 2 hr～3 hrs
⑤ more than 3 hrs

Statistical analysis

Statistical Analysis System (SAS) procedures were used to compute mean, frequency, standard deviation. T-test, x^2-test were used to find the statistical significance between two groups. A probability value of 0.05 was chosen as the level of statistical significance.

RESULTS AND DISCUSSION

Physical activity pattern

In this study more than half of subjects were engaged in light physical activity for 30 minutes to 1 hour (Table 1). 20.4% of subjects spent 1～2 hours on light activity. However, there was no significant difference in light activity pattern between male and female children.

Table 2 shows moderate activity pattern of subjects. 42.5% of subjects did not engage in moderate activity at all but 42.4% of subjects engaged in moderate activity for 30 minutes to 1 hour. Duration of moderate activity in females was significantly longer than that of males ($p<0.01$). Thus, female children spent more hours on moderate activity than males.

Table 3 shows vigorous activity pattern of subjects. 17.7% of subjects did not engage in vigorous physical activity at all but 44.4% of subjects engaged in vigorous physical activity for 30 minutes to 1 hour. More females participated in vigorous activity for a short time (30 minutes to 1 hour) than males. However, males engaged in vigorous physical activity longer than females. Thus, males significantly engaged in more strenuous activity with longer duration than females. This result in the study suggests that males use more bodily movement by skeletal muscles and spend more energy expenditure. More study should be done to find the potential de-

Table 1. Light activity pattern of subjects by gender N (%)

	None	1/2～1 h	1～2 hrs	2～3 hrs	More than 3 hrs	Total	x^2
Male	92 (10.9)	211 (25.0)	97 (11.5)	18 (2.1)	8 (1.0)	426 (50.5)	
Female	76 (9.02)	233 (24.6)	75 (8.90)	27 (3.2)	6 (0.7)	417 (49.5)	7.418
Total	168 (19.9)	444 (52.7)	712 (20.4)	45 (5.3)	14 (1.7)	843 (100.0)	

Table 2. Moderate activity pattern of subjects by gender N (%)

	None	1/2～1 h	1～2 hrs	2～3 hrs	More than 3 hrs	Total	x^2
Male	215 (25.5)	163 (19.3)	42 (5.0)	6 (0.7)	0 (0.0)	426 (50.5)	
Female	143 (17.0)	194 (23.0)	57 (6.8)	21 (2.5)	2 (0.2)	417 (49.5)	29.686**
Total	358 (42.5)	357 (42.4)	99 (11.8)	27 (3.2)	2 (0.2)	843 (100.0)	

**$p<0.01$.

Table 3. Vigorous activity pattern of subjects by gender N (%)

	None	1/2～1 h	1～2 hrs	2～3 hrs	More than 3 hrs	Total	x^2
Male	42 (5.0)	169 (20.1)	122 (14.5)	64 (7.6)	29 (3.4)	426 (50.5)	
Female	107 (12.7)	205 (24.3)	69 (8.2)	27 (3.2)	9 (1.1)	417 (49.5)	72.010**
Total	149 (17.7)	374 (44.4)	191 (22.7)	91 (10.8)	38 (4.5)	343 (100.0)	

**$p<0.01$.

terminants of physical activity patterns among children associated with environmental and social factors.

Dietary habit

Table 4 shows dietary habits of the subjects. Most subjects, regardless of gender, kept their meal time regularly. However, females significantly skipped their breakfast more often than males ($p<0.05$). Though breakfast is an important source of nutrients that are essential, skipping breakfast was widespread among subjects. It seems that females manipulated their diets by restricting their food intake in fear of gaining weight and having an undesirable body image (3,10).

Furthermore, snacking was significantly widespread among girls rather than boys in this study. Snacking is not necessarily harmful. If chosen wisely, snack foods can contribute substantially to nutritional needs of children. Unfortunately, the poor food choices were made by children while snacking tend to be high in sugar, sodium and fat but relatively low in vitamins and minerals (11-13). Children should be educated to choose healthy snacks.

On the other hand, more males drank more milk daily than females. Milk is a good source of Ca and riboflavin which is deficient in Korean diet (14). The healthy practice of drinking milk in children should be encouraged to endure into the adult years. In the present study more males were peaky eaters than females. The reasons for common food taboo among males were not identified in this study. More valuable and enjoyable experiences should be given to children to try various kinds of foods in the school lunch program.

Nutrient intakes

Nutrient intakes between two genders were compared and shown in Table 5. Unexpectedly, nutrient intakes of males were less than those of females. Since nutritional requirements are influenced by growth and the change in body composition and physiology that takes place as a result of maturation (15), nutrient requirements for females might be high. It was found in the study that females in the 5th and 6th grades were taller than male children in the same grades (3). This is consistent with other findings that young females usually mature earlier and become taller because of her growth spurt than males (2).

High levels of physical activity, combined with growth and development, increase children's needs for energy and protein. In the present study mean energy intakes in males were equivalent to 78.2% of Korean RDA,

Table 4. Dietary habit of the subjects by gender N (%)

		Yes	No	Total	x^2
Regularity of meal time	Male	266 (46.8)	15 (2.6)	281 (49.4)	5.013
	Female	266 (46.8)	22 (3.9)	288 (50.6)	
	Total	532 (93.5)	37 (6.5)	569 (100.0)	
Skipping breakfast	Male	88 (15.5)	193 (33.9)	281 (49.4)	12.005*
	Female	120 (21.1)	168 (29.5)	288 (50.6)	
	Total	208 (36.6)	361 (63.4)	569 (100.0)	
Eating advised food	Male	119 (20.9)	162 (28.5)	281 (49.4)	1.709
	Female	125 (22.0)	163 (28.6)	288 (50.6)	
	Total	244 (42.9)	325 (57.1)	569 (100.0)	
Snack	Male	220 (38.7)	61 (10.7)	281 (49.4)	9.600*
	Female	246 (43.2)	42 (7.4)	288 (50.6)	
	Total	466 (81.9)	103 (18.1)	569 (100.0)	
Daily milk drinking	Male	206 (36.2)	75 (13.2)	281 (49.4)	4.674*
	Female	187 (32.9)	101 (17.8)	288 (50.6)	
	Total	393 (69.1)	176 (30.9)	569 (100.0)	
Food taboo	Male	146 (25.7)	135 (23.7)	281 (49.4)	5.646*
	Female	121 (21.3)	167 (29.3)	288 (50.6)	
	Total	267 (46.9)	302 (53.1)	569 (100.0)	
Dietary Supplement	Male	55 (9.7)	226 (39.7)	281 (49.4)	0.624
	Female	49 (8.6)	239 (42.0)	288 (50.6)	
	Total	104 (18.3)	465 (81.7)	569 (100.0)	
Drinking	Male	20 (3.5)	261 (45.9)	281 (49.4)	5.086
	Female	9 (1.6)	279 (49.0)	288 (50.6)	
	Total	29 (5.1)	540 (94.9)	569 (100.0)	

*$p<0.05$.

Table 5. Nutrient intakes by gender

Nutrients	Male	Female
Energy (kcal)	1719.9±477.3[1)] (78.2[2)])	1762.4±530.9 (88.1)
Protein (g)	63.8±21.4 (115.9)	67.1±23.2 (122.0)
Calcium (mg)	467.5±251.0 (58.4)	481.7±244.8 (60.2)
Phosphorus (mg)	969.3±330.9 (121.2)	1005.3±357.8 (125.7)
Iron (mg)	9.3±3.6 (77.7)	10.0±4.5 (62.2)
Vitamin A (RE)	523.7±356.1 (87.3)	575.9±373.5 (96.0)
Thiamin (mg)	1.2±0.5 (109.1)	1.3±0.5 (125.6)
Riboflavin (mg)	1.0±0.4 (74.5)	1.0±0.5 (87.0)
Niacin (mg)	12.7±4.6 (84.6)	13.6±5.7* (104.5)
Vitamin C (mg)	144.3±125.0 (206.1)	163.8±135.7 (234.1)

[1)]Mean±SD.
[2)]% RDA.
*$p<0.05$.

while mean energy intakes in females were equivalent to 88.1% of Korean RDA. Thus, energy intakes in both males and females were not sufficient. This trend was more pronounced in males than females. However, protein intakes in both males and females were above the RDA. Intakes of thiamin and phosphorus were above the RDA in both genders, too. Especially vitamin C intake was over twice the RDA for all subjects.

On the other hand, riboflavin and Ca intakes in males, and Ca and Fe intakes in females were below 75% of the RDA. These results were in agreement with those from Nutrition Survey for Koreans (14). These marginal levels of dietary Ca intake in subjects are inadequate to support the development of optimal bone mass. Effective nutrition education program should be developed and implemented to improve Ca intake in subjects.

In addition, iron intakes in both genders were not sufficient when compared with the RDA. Iron deficiency anemia is the most common nutritional problem seen among teenagers (16,17). Due to inappropriate Fe intake, special attention should be given to females particularly. More caution should be taken to include a meal that can enhance iron absorption. At this age, their demand for iron increases with rapid growth and there is additional iron need with menarche in females because of menstrual losses of iron.

Dietary quality

To evaluate the diet quality, indices of INQ, NAR and MAR were used in the study. Table 6 presents index

Table 6. Index of nutritional quality (INQ) of various nutrients by gender

Nutrients	Male	Female
Protein	1.5±0.3[1)]	1.4±0.3
Calcium	0.7±0.3	0.7±0.3*
Phosphorus	1.6±0.3	1.4±0.3
Iron	1.0±0.2	0.7±0.2*
Vitamin A	1.1±0.7	1.1±0.7
Thiamin	1.4±0.4	1.4±0.4
Riboflavin	0.9±0.3	1.0±0.3
Niacin	1.1±0.3	1.2±0.4
Vitamin C	2.7±2.3	2.7±2.1

[1)]Mean±SD.
*$p<0.05$.

Table 7. Nutrient adequacy ratio (NAR) and mean adequacy ratio (MAR) of various nutrients by gender

Nutrients	Male	Female
Energy	0.7±0.2[1)]	0.8±0.3*
Protein	0.9±0.4	0.9±0.4
Calcium	0.5±0.3	0.5±0.3
Phosphorus	0.8±0.4	0.6±0.5
Iron	0.7±0.3	0.5±0.3
Vitamin A	0.8±0.6	0.9±0.6
Thiamin	0.8±0.4	0.9±0.5*
Riboflavin	0.6±0.3	0.8±0.4*
Niacin	0.8±0.3	0.9±0.4**
Vitamin C	1.0±0.0	1.0±0.0
MAR	0.8±0.4	0.9±0.4*

[1)]Mean±SD.
*$p<0.05$, **$p<0.01$.

of nutritional quality (INQ) of various nutrients in diet. This index is a concept related to nutrient density that allows the amount of a nutrient per 1000 kcal in diet to be compared with a nutrient standard (18). Male and female subjects did not differ significantly in INQ of most nutrients. However, males were better to choose Ca and iron dense foods. The results suggest that, though energy intakes in males were lower, they selected more rich dietary sources of Ca and Fe. Since main sources of dietary Ca are milk and dairy products, it seems that males consumed more milk than females (Table 4). In addition, it appears that males consumed more meat per 1000 kcal because main dietary source of Fe is mostly from animal products. Actually, it was found in the food preference study that they significantly preferred pork, beef and chicken than females (3). More study should be done to elucidate the association of dietary quality with dietary sources of various nutrients by gender.

Table 7 shows adequacy ratio using NAR and MAR of various nutrients. With NAR, there are significant differences in energy, thiamin, riboflavin and niacin between males and females. Since females consumed more energy than males, adequacy ratio of energy in

females was significantly higher than males. However, NARs of energy and riboflavin were respectively below 1 in both males and females, which indicated that their dietary qualities in energy and riboflavin by NAR were not adequate. Surprisingly, NAR of vitamin C was the highest and protein was the second highest in both genders. This result is agreeable to other finding (14). In this study, MAR in females was higher than male, which indicated that overall nutrient intakes in females were more adequate than males. However, low Ca and Fe intake and qualities in both males and females were serious. The important functions of Ca, Fe and other nutrient during the growing years should be stressed. Furthermore, nutrition intervention strategies might be developed and implemented to choose nutrient dense foods for the improvement of their health.

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