

Comparison of Food Consumption Pattern, Nutrient and Dietary Fiber Intakes between Female College Students and Middle Aged Women in Korea

Lee, Kang-Hee · Chyun, Jong-Hee

Department of Food and Nutrition, Inha University, Incheon, Korea

ABSTRACT

One hundred twenty healthy college students and housewives from urban middle income households were investigated in terms of food consumption patterns, nutrient intake and dietary fiber intake. Total food intake was slightly lower in college students(1059.9g/d) than in housewives(1160.9g/d). However, the ratio of animal food to total food was considerably higher in college students(23.7%) than in housewives(16.8%). College students tended to consume more dairy products, meat & meat products, and cereals & grain products but less vegetables, fruits, fish and shellfish than housewives. Although nutrient intake was not much different(except for total calories, fats, and ascorbic acid), dietary fiber intake was slightly and significantly lower in college students(14.9g/d, 8.3g/1000kcal) than in housewives(16.9g/d, 10.3g/1000kcal). That is partially due to college students' irregular food habits and the change in their meal patterns from traditional to western diets. There was a significantly positive correlation between dietary fiber intake and thiamin, riboflavin, niacin and crude fiber intake. (*Korean J Nutrition* 30(9) : 1088~1094, 1997)

KEY WORDS : food consumption pattern · dietary fiber intake.

Introduction

During the last two decades, rapid economic growth and improvement in the quality of life have largely changed people's food consumption patterns in Korea.

The consumption of animal fat and protein have been increased, while plant food consumption and the intake of carbohydrates and dietary fiber, especially from grains, have been reduced gradually¹⁻³.

With these dietary changes, the incidence of chronic degenerative diseases such as coronary heart disease, hypertension, hyperlipidemia, diabetes mellitus and cancer has increased⁴.

The reduced dietary fiber intake seems to relate to

the higher incidence of obesity, diabetes, ischemic heart disease and rectal cancer because of the physiological importance of dietary fiber.

Compared to people in Western countries, Koreans were thought to consume considerable amounts of dietary fiber because of traditional meal patterns mainly based on plant foods. However, the dietary fiber intake of Korean has been reduced with rapid economic growth and partial Westernization of meal pattern⁴.

College women spend most of their time at school or outside of home and they have fewer opportunities to eat traditional home meals of rice, soup, and side dishes. Rather, they have more chances to have various fast foods. They also easily change their meal pattern from traditional to Western foods. Some college women worry about their figures too much and skip meals frequently, leading to poor nutritional

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status⁵⁻⁷.

On the other hand, most middle aged women, as housewives, usually eat home-cooked meals. They are not affected much by popular dietary trends because they already have their own fixed food habits.

Therefore, this study was planned to investigate the differences in food consumption patterns, nutrient intake and dietary fiber intake between young and middle aged women in Korea.

Materials and Methods

1. Subjects and food intake

Sixty healthy female college students and sixty healthy housewives who were registered in adult classes in the same college participated in this study. All subjects were city residents. Each Subject's age, recent height and weight, education level, household income and general living conditions were recorded.

During the study, food intake records of three consecutive ordinary days were collected and the subjects were interviewed to check the records everyday. Measuring cups, spoons, several sizes of glasses, bowls, rulers, food exchange lists and food models were used to remember the sizes of food portions eaten. According to Oh Se Young et al.⁸⁾, group mean nutrient intake from 24 hour recall and food record showed little difference depending on days of dietary studies and methods. They suggest these methods are reliable in evaluating the nutrient intake of groups.

2. Food consumption pattern, nutrient and diet analysis

The foods consumed were classified into 17 food groups according to the Food Composition Table⁹⁾. Energy, nutrient and crude fiber intake was analyzed according to Food Composition Table using RMCOBOL-85.

Dietary fiber intake of subjects was calculated by using 「Dietary Fiber Composition of Foods」¹⁰⁾¹¹⁾, which was analyzed by Prosky-AOAC method and published in Japan. However the amounts of dietary fiber in some Korean traditional foods such as corn starch jelly, chajang, chwi, dried turnip greens, red pepper, and red pepper paste were calculated ac-

ording to the data of Lee Hye Sung³⁾.

Data was analyzed using SAS program(Statistical Analysis System)¹²⁾. Results were expressed as mean value and standard errors and percentages. Statistical differences between two groups were compared by Student's t-test at $\alpha=0.05$. Correlation coefficients between dietary fiber and nutrient intake were analyzed.

Results and Discussion

1. Characteristics of subjects

Average age, height, body weight of the college students and housewives were 20.7 ± 1.1 years, 161.6 ± 4.8 cm, 50.9 ± 7.0 kg and 45.3 ± 5.3 years, 158.4 ± 3.5 cm, 57.6 ± 7.6 kg respectively (Table 1). Mean BMI (Body Mass Index) for the college students was slightly lower than normal of 19.6 ± 2.4 kg/m², while BMI of housewives was in the normal range of 23.0 ± 3.0 kg/m². BMIs of five college students and one housewife were below 17.0 kg/m² while those of two housewives were over 30 kg/m². Education levels of 75% of the housewives was over 12 years. Household incomes of the two groups were all near or above the average urban household income. All subjects were living in Incheon.

2. Food consumption pattern

The average amounts of total and animal food consumed were 1059.9 ± 321.5 g/day : 251.3 ± 158.8 g/day in college student and 1160.9 ± 332.4 g/day : 194.7 ± 133.9 g/day in housewives respectively. The ratio of animal food to total food was higher than in the past and much higher in college students (23.7%) than in housewives (16.8%). The changes in dietary quantity and quality are thought to be due to the rapid economic growth of the nation and the improvement in quality of life of people.

Among seventeen food groups, the college studen-

Table 1. Physical characteristics of subjects (Mean \pm S.E.)

	College student (n=60)	Housewife (n=60)
Age (year)	20.7 ± 1.1	45.3 ± 5.8
Height (cm)	161.0 ± 4.8	158.4 ± 3.5
Weight (kg)	50.9 ± 7.0	57.6 ± 7.6
BMI (kg/m ²) ¹⁾	19.6 ± 2.4	23.0 ± 3.0

¹⁾ BMI = weight (kg) / height (m)²

ts tended to consume more milk & milk products, meats, meat products, eggs, and cereals & grain products, but they ate less vegetables, fruits, bean & bean products, fish & shellfishes than housewives. The reason that college students consumed more cereals & grain products than housewives was not because they ate more rice or grains, but because they ate more grain products such as biscuits, cookies, snacks, breads, and cakes.

Kim Sun Hyo⁶ reported that college women got considerable energy from between-meal snacks of carbonated beverages, candies and biscuits. Meal patterns of college women were characterized by night meals, skipping breakfast and irregular meals¹³.

Lee Seon Heui et al.¹⁴ reported that middle aged women taking breakfast regularly tended to consume more rice, meats, vegetables, kimchi and fruits.

3. Energy and nutrient intakes

Caloric intake levels were 1805.7kcal in college students and 1650.5kcal in housewives, which were lower than the results of National Nutrition Survey(2,126kcal)¹⁵ and RDA level(2000kcal)¹⁶. Although the caloric intake of the college students was higher than the reports of Choi(1985)¹⁷, Hwang(1991)¹⁸, Nam(1992)¹⁹ and similar to Hong's results(1993)²⁰, that of the housewives was relatively lower than in the other reports²¹⁻²³.

Average ratios of protein, fat and carbohydrates to total caloric intake(PFC ratio) in all subjects was very similar to the results of National Nutrition Survey(16.3 : 18.4 : 65.3)¹⁵. However, college students tended to eat more fat and less carbohydrates than middle-aged women. Major sources of energy in college students were cereals & grain product(59.5%), meat & meat products(10.1%), fruits(4.9%), fish & shellfishes (4.1%), and dairy products(4.3%). In housewives, cereals & grain product(57.3%), fruits(9.4%), meat & meat products(6.7%), fish & shellfish(5.9%) made up the majority of their energy intake. Therefore, the contribution of cereals & grain product to total energy intake seems to be less than in the past.

The subjects of both groups consumed more protein than the RDA level in quantity. The quality of protein in the diet was also fairly good, because the proportion of animal protein to total protein was about 46.0%. Major sources of protein in college students were cereals & grain product(34.1%), meats & meat products(21.1%), fish & shellfish(16.7%), and dairy products(5.8%), while housewives got their protein from cereals & grain product(28.8%), fish & shellfish(23.2%), meats & meat products(15.7%), and vegetables(7.1%).

Average fat intake of the subjects was not very different from the results of National Nutrition Survey¹⁵. The college students tended to consume more fat

Table 2. Amounts of daily food intake by food groups

(Mean ± S.E.)

	College student(n=60) g(%)	Housewife(n=60) g(%)	Total(n=120) g(%)
Meats & meat products	77.8 ± 82.9 (7.3)	56.5 ± 54.9 (4.9)	67.1 ± 70.7 (6.0)
Eggs	24.8 ± 26.1 (2.3)	15.5 ± 19.0 (1.3)	20.1 ± 23.2 (1.8)
Fish & shellfishes	53.5 ± 49.5 (5.1)	79.2 ± 58.5 (6.8)	66.5 ± 55.5 (6.0)
Bean & bean products	27.5 ± 59.1 (2.6)	36.8 ± 58.6 (3.2)	32.2 ± 58.8 (2.9)
Milk & milk products	95.1 ± 130.5 (9.0)	43.5 ± 114.8 (3.8)	69.1 ± 125.0 (6.2)
Vegetables	209.3 ± 102.2 (19.8)	244.4 ± 101.3 (21.0)	227.0 ± 102.8 (20.4)
Mushrooms	4.6 ± 11.0 (0.4)	2.8 ± 7.8 (0.2)	3.7 ± 9.5 (0.3)
Fruits	173.1 ± 178.1 (16.3)	311.4 ± 223.6 (26.8)	242.8 ± 213.1 (21.9)
Seaweeds	3.6 ± 6.7 (0.3)	5.2 ± 8.5 (0.5)	4.4 ± 7.7 (0.4)
Cereals & grain product	296.7 ± 97.3 (28.0)	262.7 ± 73.6 (22.6)	279.6 ± 87.5 (25.2)
Potatoes	22.9 ± 48.6 (2.2)	34.3 ± 88.2 (3.0)	28.7 ± 71.3 (2.6)
Sugar & sweets	6.3 ± 10.7 (0.6)	4.8 ± 8.1 (0.4)	5.6 ± 9.5 (0.5)
Nuts & seeds	4.9 ± 28.4 (0.5)	10.0 ± 34.3 (0.9)	7.5 ± 31.5 (0.7)
Fats & oils	7.0 ± 7.0 (0.7)	5.3 ± 6.2 (0.5)	6.1 ± 6.6 (0.6)
Beverages	21.4 ± 55.6 (2.0)	12.2 ± 58.1 (1.1)	16.7 ± 56.8 (1.5)
Animal food	251.3 ± 158.8 (23.7)	194.7 ± 133.9 (16.8)	222.7 ± 148.8 (20.1)
Plant food	808.6 ± 251.0 (76.3)	966.2 ± 296.1 (83.2)	888.1 ± 284.7 (79.9)
Total	1059.9 ± 321.5 (100)	1160.9 ± 332.4 (100)	1110.8 ± 329.5 (100)

than housewives because they ate more meat & meat products, eggs, dairy products, and snacks. All these foods are high in fat content. Major sources of fat in college students were meats & meat products (28.5%), cereals & grain product(22.0%), fats(14.8%), and dairy products(7.0%). In housewives, the major fat sources were meats & meat products(27.1%), fats (18.8%), cereals & grain product(14.4%), bean & bean product(10.1%) and fish & shellfishes(9.8%).

However, the proportion of animal fat to total fat consumption was almost same in both groups. The amount of fat intake of housewives was similar to the results of Park(1981)²¹, Lim(1982)²², Oh(1987)²³ but lower than in Kim's reports(1989)²⁴. Total fat intake of college students was higher than in previous studies^{25,26}.

Carbohydrate consumption of both group was not much different but it was lower than the result of National Nutrition Survey¹⁵. Major carbohydrate sources of college students were cereals & grain product (79.2%), fruits(7.2%), vegetables(3.8%), milk & milk products(2.5%), and potatoes(2.3%). Carbohydrate sources for housewives were cereals & grain product (71.6%), fruits(12.9%), vegetables(4.1%), potatoes(3.3%), and bean & bean product(1.8%).

As we can see from the above results, major food groups supplying carbohydrate, protein, fat and en-

ergy are cereals & grain product and meats & meat products. According to the reports by Kye Seung Hee et al.²⁷, rice(222.7g/d), kimchi(85.0g/d), beef (39.8g/d), pork(31.1g/d) and breads(27.3g/d) were the most frequently used foods by Koreans.

Although college students consumed more milk & milk products, their calcium intake was slightly less than that of housewives because they ate less fish, shellfishes, and pulse products. Calcium intake of both groups, however, was less than 75% of the RDA and lower than the results of the National Nutrition Survey¹⁵ and of other reports²⁴. Major calcium sources of college students were dairy products (27.2%), vegetables(19.1%), cereals & grain product (11.6%), fish & shellfishes(11.4%), and bean & bean products(9.2%). Housewives got their calcium from fish & shellfishes(20.6%), vegetables(20.6%), dairy products(14.3%), bean & bean products(14.2%), and fruits(7.7%). Proportion of animal calcium to total calcium intake was higher in college students(41.7%) than in housewives(37.2%).

Iron intake of the subjects almost approached RDA levels. However, the iron availability in the body is thought to be low because over 50% of iron was of plant origin. Major iron sources of college students were cereals & grain product(44.8%), vegetables(9.9%), meats & meat products(6.4%), and fish & shellf-

Table 3. Energy and nutrients intakes and PFC ratio of subjects (Mean ± S.E.)

	College student(n=60) (%RDA)	Housewife(n=60) (%RDA)	Total(n=120) (%RDA)
Energy	1,805.7 ± 518.7 (90.3)	1,650.5 ± 358.6 (82.5)	1,727.4 ± 450.1 (86.4)
Proteins	68.4 ± 25.4 (113.9)	69.4 ± 19.7 (115.7)	68.9 ± 22.6 (114.8)
Fats	45.8 ± 24.4	27.8 ± 13.7	36.7 ± 21.6
Carbohydrates	276.0 ± 78.3	283.0 ± 70.0	279.6 ± 73.9
Calcium	460.6 ± 201.4 (65.8)	497.7 ± 197.6 (71.1)	479.3 ± 199.5 (68.5)
Iron	17.0 ± 5.6 (94.4)	18.8 ± 4.4 (104.4)	17.9 ± 5.1 (99.4)
Vitamin A(R.E.)	448.9 ± 329.9 (64.1)	482.2 ± 288.1 (68.9)	465.7 ± 308.6 (66.5)
Thiamin(mg)	1.27 ± 0.7 (127.0)	1.24 ± 0.5 (124.0)	1.25 ± 0.6 (125.0)
Riboflavin(mg)	1.14 ± 0.5 (95.0)	1.15 ± 0.4 (95.8)	1.15 ± 0.5 (95.8)
Niacin(mg)	15.0 ± 6.9 (115.4)	15.9 ± 5.2 (122.3)	15.5 ± 6.1 (119.2)
Vitamin C(mg)	86.0 ± 60.0 (156.4)	127.1 ± 68.0 (231.0)	106.7 ± 67.1 (194.0)
PFC ratio(%)	15 : 23 : 62	17 : 15 : 68	16 : 19 : 65
Proportion of animal protein(%)	47.4	44.5	46.0
Proportion of grain-derived energy(%)	59.5	57.3	58.5
Proportion of animal calcium(%)	41.7	37.2	39.5

ishes(5.8%). In housewives, cereals & grain products (43.9%), fish & shellfishes(9.1%), vegetables(9.1%), and fruits(8.0%) were the major iron sources.

The intake of thiamin, niacin, and ascorbic acid by the subjects all exceeded RDA level and the reports of Lee Hye Sung²⁶. Riboflavin intake was near the RDA level. However, vitamin A consumption in college students and housewives was only 64.1% and 68.9% of RDA respectively. Major sources of vitamin A in college students were vegetables(65.1%), eggs(11.0%), seaweed(9.2%), dairy products(6.5%), and fruits (3.5%), while housewives ate vegetables(59.2%), seaweed(17.6%), fruits(9.4%), eggs(7.4%), and dairy products(2.7%) to get vitamin A.

The ratios of retinol to total vitamin A intake were only 21.2% in college students and 13.2% in housewives. Because vegetables are the most important food supplying β -carotene, the subjects are recommended to take more green and yellow vegetables rather than pale or white vegetables.

4. Dietary fiber and crude fiber intakes

Average dietary fiber and crude fiber intake per day, per 1000kcal, per 100g food, and the ratio of dietary fiber to crude fiber are shown in Table 4.

Mean daily dietary fiber intake of all subjects was 15.9g and there was no significant difference between the two groups(14.9g/d in college student, 16.9g/d in housewives). This was much lower than the dietary fiber intake level of female college student(22.5g/d) reported by Seung Chung Ja²⁸ and slightly lower than the dietary fiber intake of nationwide populations reported by Lee Kyu-Han et al.²⁹. Dietary fiber intake per 1000kcal in housewives was significantly higher than that in college students, while the amount of dietary fiber per 100g food was not significantly different. Therefore, housewives are thought to consume foods with lower caloric density and higher dietary fiber than those eaten by college students.

When we compare the dietary fiber intake in

Table 4. Dietary fiber & crude fiber intake of subjects

(Mean \pm S.E.)

	Intakes(g)/day		Intakes(g)/1000kcl		Intakes(g)/100g food		DF/CF ratio
	DF	CF	DF	CF	DF	CF	
College student(n=60)	14.9 \pm 6.7	4.9 \pm 2.3*	8.3 \pm 2.7*	2.8 \pm 1.3*	1.42 \pm 0.5	0.46 \pm 0.2*	3.3 \pm 1.1
Housewife(n=60)	16.9 \pm 5.0	7.3 \pm 2.6*	10.3 \pm 2.4*	4.5 \pm 1.6*	1.48 \pm 0.3	0.63 \pm 0.2*	2.4 \pm 0.5
Total(n=120)	15.9 \pm 6.0	6.1 \pm 2.8*	9.3 \pm 2.7*	3.7 \pm 1.7*	1.46 \pm 0.4	0.55 \pm 0.2*	2.8 \pm 1.0

DF : dietary fiber, CF : crude fiber

*p<0.001

Table 5. Dietary fiber and crude fiber sources of subjects

(Mean \pm S.E.)

	College student(n=60)		Housewife(n=60)		Total(n=120)	
	Dietary fiber g(%)	Crude fiber g(%)	Dietary fiber g(%)	Crude fiber g(%)	Dietary fiber g(%)	Crude fiber g(%)
Meats & meat products	0.3 \pm 0.4 (2.0)	0.0 \pm 0.0 (0.0)	0.2 \pm 0.2 (1.2)	0.0 \pm 0.0 (0.0)	0.2 \pm 0.3 (1.3)	0.0 \pm 0.0 (0.0)
Fish & shellfishes	0.2 \pm 0.2 (1.4)	0.0 \pm 0.0 (0.0)	0.3 \pm 0.3 (1.8)	0.0 \pm 0.0 (0.0)	0.3 \pm 0.3 (1.9)	0.0 \pm 0.0 (0.0)
Bean and bean products	0.6 \pm 1.0 (4.1)	0.2 \pm 0.3 (4.1)	2.0 \pm 1.9 (11.8)	0.6 \pm 0.6 (8.1)	1.3 \pm 1.7 (8.3)	0.4 \pm 0.5 (6.5)
Milk & milk products	0.2 \pm 0.3 (1.4)	0.0 \pm 0.0 (0.0)	0.1 \pm 0.2 (0.6)	0.0 \pm 0.0 (0.0)	0.1 \pm 0.2 (0.6)	0.0 \pm 0.0 (0.0)
Vegetables	4.7 \pm 3.0 (31.8)	1.7 \pm 1.4 (34.7)	5.1 \pm 2.2 (30.2)	1.9 \pm 1.0 (25.7)	4.9 \pm 2.6 (31.2)	1.8 \pm 1.2 (29.0)
Mushrooms	0.1 \pm 0.3 (0.7)	0.0 \pm 0.1 (0.0)	0.1 \pm 0.2 (0.6)	0.0 \pm 0.1 (0.0)	0.1 \pm 0.3 (0.6)	0.0 \pm 0.1 (0.0)
Fruits	1.5 \pm 1.7 (10.1)	1.1 \pm 1.4 (22.5)	2.9 \pm 2.4 (17.2)	2.6 \pm 2.0 (35.1)	2.2 \pm 2.2 (14.0)	1.9 \pm 1.9 (30.7)
Seaweeds	0.5 \pm 1.4 (3.4)	0.1 \pm 0.1 (2.1)	0.8 \pm 1.1 (4.7)	0.1 \pm 0.1 (1.4)	0.6 \pm 1.3 (3.8)	0.1 \pm 0.1 (1.6)
Cereals & grain products	4.6 \pm 2.2 (30.4)	1.0 \pm 0.4 (20.4)	3.5 \pm 1.8 (20.7)	1.1 \pm 0.5 (14.9)	4.0 \pm 2.1 (25.5)	1.0 \pm 0.5 (16.1)
Potatoes	0.3 \pm 0.7 (2.0)	0.1 \pm 0.3 (2.1)	0.5 \pm 1.8 (3.0)	0.2 \pm 0.6 (2.7)	0.4 \pm 1.4 (2.6)	0.1 \pm 0.5 (1.6)
Sugar & sweets	0.2 \pm 0.4 (1.4)	0.0 \pm 0.0 (0.0)	0.0 \pm 0.1 (0.0)	0.0 \pm 0.0 (0.0)	0.1 \pm 0.3 (0.6)	0.0 \pm 0.0 (0.0)
Nuts & seeds	0.1 \pm 0.7 (0.7)	0.0 \pm 0.2 (0.0)	0.3 \pm 0.8 (1.8)	0.1 \pm 0.2 (1.4)	0.2 \pm 0.8 (1.3)	0.1 \pm 0.2 (1.6)
Beverages	0.6 \pm 3.4 (4.1)	0.2 \pm 0.3 (4.1)	0.0 \pm 0.1 (0.0)	0.2 \pm 0.4 (2.7)	0.3 \pm 2.4 (1.9)	0.2 \pm 0.4 (3.2)
Seasonings	1.0 \pm 0.8 (6.7)	0.5 \pm 0.5 (10.2)	1.1 \pm 0.8 (6.5)	0.6 \pm 0.5 (8.1)	1.0 \pm 0.8 (6.4)	0.6 \pm 0.5 (9.7)
Animal food	0.7 \pm 0.5 (4.7)	0.0 \pm 0.0 (0.0)	0.6 \pm 0.4 (3.6)	0.0 \pm 0.0 (0.0)	0.6 \pm 0.4 (4.4)	0.0 \pm 0.0 (0.0)
Plant food	14.2 \pm 6.6 (95.3)	4.9 \pm 2.3 (100)	16.3 \pm 5.1 (96.4)	7.3 \pm 2.6 (100)	15.3 \pm 5.9 (95.6)	6.1 \pm 2.8 (100)
Total	14.9 \pm 6.7 (100)	4.9 \pm 2.3 (100)	16.9 \pm 5.0 (100)	7.3 \pm 2.6 (100)	15.9 \pm 6.0 (100)	6.1 \pm 2.8 (100)

Korea to that in other countries, it was similar to the 15.4g in college students in United States³⁰ and higher than the 11.1-13.3g in American adults³¹ but lower than the 17.3g mean dietary fiber intake of Japanese(1985)³².

Crude fiber intake per day, per 1000kcal, and per 100g food were significantly higher in housewives than in college students. The ratio of dietary fiber to crude fiber was 3.3 in college students and 2.4 in housewives. The amount of dietary fiber in diet can be roughly estimated from crude fiber intake when dietary fiber contents of foods are not available.

Regression Equation between crude fiber(X) and dietary fiber(Y) was as follows.

$$Y = 2.0140X + 5.0435 \quad \dots \text{college students}$$

$$Y = 1.5997X + 5.1579 \quad \dots \text{housewives}$$

$$Y = 1.5910X + 6.1506 \quad \dots \text{total}$$

Major sources of dietary fiber in college students were vegetables(31.8%), cereal grains(30.4%), fruits (10.1%), seasonings(6.7%), pulse products(4.1%), while dietary fiber for housewives came from vegetables (30.2%), cereals & grain products(20.7%), fruits(17.2%), bean & bean products(11.8%), and seasonings(6.5%).

According to other studies of the nationwide population²⁹, food groups supplying dietary fiber were vegetables, grains, seaweeds, fruits, mushrooms, and legumes, in that order.

There was a positive correlation between dietary fiber intake and some nutrients, food intake and crude fiber intake. Among them riboflavin, niacin and crude fiber in college student, thiamin, niacin and crude fiber in housewives showed significantly positive correlation.

Major sources of riboflavin were cereals & grain products(21.82%), vegetables(17.27%), dairy products (10.91%), and those of niacin were cereal grains(31.47%), vegetables(19.90%), and fish & shellfish(18.14%). Major sources of thiamin were cereal grains(35.0%), meats & meat products(22.50%), fruits(13.33%), and vegetables(11.67%).

Park Mi-A et al.³³ also reported that best sources of thiamin were rice, pork, and kimchi, those of riboflavin were rice, egg, milk, lavar, and kimchi. The

Table 6. Correlation coefficients of dietary fiber and nutrients

	College student (n=60)	Housewife (n=60)	Total (n=120)
Food intake	0.644	0.709	0.673
Energy	0.658	0.640	0.603
Proteins	0.590	0.518	0.559
Fats	0.398	0.150	0.216
Carbohydrates	0.625	0.650	0.631
Calcium	0.407	0.525	0.461
Iron	0.658	0.618	0.653
Vitamin A(R.E.)	0.478	0.500	0.486
Thiamin(mg)	0.403	0.453*	0.406
Riboflavin(mg)	0.554*	0.516	0.533*
Niacin(mg)	0.542*	0.539**	0.544**
Vitamin C(mg)	0.269	0.324	0.322
Crude fiber	0.702**	0.831**	0.734**

*p<0.05, **p<0.001

best niacin sources were rice, beef, mackerel, apple, and radish. Therefore 40-50% of these vitamins are supplied by plant foods, which can explain partially the positive correlations. We expected positive correlations between dietary fiber and vitamin C intake. However, the relation was not significant because the subjects consume large portions of vitamin C as fruit juices rather than the fruits themselves.

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