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A Study on Dietary Intake and Vitamin and Mineral Supplement Use by Korean College Students Attending Web Class

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ABSTRACT

The purpose of this study was to investigate the dietary intake of nutrients and the use of vitamin and mineral supplements by Korean college students attending Web class and the socioeconomic, dietary and health-related factors involved. The subjects were 137 male and 115 female students attending a health and nutrition-related Web class at a cyber university. This cross-sectional survey was conducted by self-administered questionnaire and the data were analyzed by SAS and SPSS PC package programs. Nutrient intake data collected using three-day recall method were analyzed by the Computer Aided Nutritional Analysis Program. Average intake by male students of most nutrients except energy, vitamin B_2 and calcium and intake by female students of those except energy, vitamin B_2, calcium and iron was higher than Korean RDA. Nutrient intake of male students was significantly influenced by the mother's job, skipping meals, exercise, vitamin and mineral supplement use, food supplement use and self-evaluated anemia. Skipping meals and food supplement use significantly influenced the nutrient intake of female students. A total of 47.4% of male students and 53.9% of female students were vitamin and mineral supplement users. In female students, socioeconomic characteristics such as the father's education level and household income were significantly different between vitamin and mineral supplement users and non-users. In both male and female students, there were significant differences in cross analysis between vitamin and mineral supplement use and food supplement use. As for the self-reported health status of male and female students, vitamin and mineral supplement users perceived their health status to be worse compared to non-users. Therefore, nutrition education via the Internet is necessary in order to encourage college students to practice optimal nutrition strategies, including maintaining well-balanced diets by choosing various foods wisely.

KEY WORDS: college students, Internet, nutrient intake, supplement use.

INTRODUCTION

It is important for college students to promote good health and reduce the risk of chronic disease by optimal nutrient intake through wise food choices.[1] However, the Korean college students surveyed did not recognize the importance of proper nutrient intake and female students, in particular, showed an energy imbalance and a lack of essential nutrients such as calcium and iron due to extreme weight control.[1,2] Intake of nutrients other than protein, vitamin B_1, vitamin B_2 and niacin were lower than Korean RDA (recommended dietary allowances) in female college students in the Kyonggi-do area.[3] Also, intake of most nutrients except phosphorus was lower than Korean RDA in male and female college students in the Inchon area.[4] In female students who participated in a study conducted in the United States for three years, intake of energy, iron and vitamin B_1 were lower than RDA and intake of vitamin A and vitamin C were twice the RDA.[5]

Most college students get nutrition and health-related information through media such as television, radio, newspapers, magazines and the Internet. This information, which lacks scientific evidence or has a commercial inclination, can disrupt the dietary life of college students.[6-8]

Vitamin and mineral supplements are preparations intended to supply the vitamins and minerals that some people may not get in their regular diet. Supplements are divided into vitamin supplements, mineral supplements, multi vitamins and mineral supplements.[7] Many people have begun to benefit from judiciously selected vitamin and mineral supplements, although food is the preferred source.[6] In attempts at extreme weight control, some female college students tend to avoid eating and instead use vitamin and mineral supplements to make up for nutrient deficiencies.[9]

It has been reported that vitamin and mineral supplement use correlates to sex, age, residence, education level, household income, family recommendations, concern about health status and chronic disease.[7,8,10]

Recently it has been reported that healthy adults were

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unconcerned about the side effects of overdosing on vitamin and mineral supplements.[10][12] In a previous study of adults conducted in Southern California, healthy subjects consumed excess vitamin C and vitamin E, and experienced toxicity problems from excess vitamin A intake.[18] Also, it was reported that well-nourished people thoughtlessly using high levels of vitamin and mineral supplements suffered from bad health such as toxicosis.[14]

Nutrition education to encourage proper intake of nutrients from food may be necessary to ensure the good health of college students who use vitamin and mineral supplements imprudently. Therefore, the purpose of this study was to investigate the dietary intake of nutrients and the use of vitamin and mineral supplements by Korean college students in a Web class and the influence of socioeconomic, dietary and health-related factors.

SUBJECTS AND METHODS

1. Subjects and period

The subjects were 300 college students attending a nutrition and health-related Web class at a cyber university. This survey was carried out using a self-administered questionnaire from November 1 to 15, 1999. For statistical analysis, 252 (male: 137, female: 115) well-completed questionnaires were used (collection rate: 84%).

2. Questionnaire

The questionnaire included items about demographic characteristics, health-related lifestyles, nutrient intake and dietary behaviors. Items about health-related lifestyle included exercise, smoking and drinking, supplement use and mobile phone use. Items about dietary behaviors included self-recognition of bad eating habits such as overeating, unbalanced meals, skipping meals and the reasons for skipping meals.

3. Anthropometric measurements

The subjects reported their height and weight. BMI was calculated by dividing body weight in kilograms by height in meters and squaring the total.

4. Dietary assessment

The three-day recall method was used for usual dietary assessment. Nutrient intake was analyzed using computer-aided nutritional program for professionals (CAN-Pro, Korean Nutrition Society, 1997) and results were compared with Korean RDA (Korean Nutrition Society, 7th revision, 2000).

5. Statistical analysis

The statistical analysis was conducted using the SAS PC package program and SPSS 10.0 program. Frequency counts (%), mean and standard deviation were calculated for all variables. Students' t-tests and Chi-square tests were used to determine statistical significance. The correlation between nutrient intake and anthropometric data was measured using Pearson's correlation coefficient.

RESULTS

1. Nutrient intake

1) Daily nutrient intake and % RDA

Daily dietary intake of energy and other nutrients are presented in Table 1. Intake by male students of nutrients other than energy, vitamin B_2 and calcium and intake by female students of those except energy, vitamin B_2, calcium and iron were higher than Korean RDA. Calcium and iron intake by female students was under 90% of Korean RDA. On the other hand, average daily intake of phosphorus by college students was above 170% of Korean RDA and intake of vitamin C and niacin by female students was above 150% of Korean RDA.

Table 1. Daily nutrient intake of the subjects

Nutrient	Male (n = 137)		Female (n = 115)	
	Mean ± S.D	%RDA[1)]	Mean ± S.D	%RDA
Energy (kcal)	2246.3 ± 457.8	94.8	1933.5 ± 419.0	90.8
Protein (g)	92.2 ± 39.3	149.7	85.4 ± 53.2	133.8
Fat (g)	65.7 ± 17.5		58.0 ± 16.4	
Carbohydrate (g)	319.1 ± 62.4		283.2 ± 59.2	
Vitamin A (RE)	895.5 ± 346.3	128.4	956.9 ± 512.3	136.2
Vitamin B_1 (mg)	1.5 ± 0.4	125.0	1.3 ± 0.3	119.1
Vitamin B_2 (mg)	1.4 ± 1.2	99.0	1.2 ± 0.4	94.8
Vitamin C (mg)	104.5 ± 55.9	110.5	119.9 ± 55.9	163.7
Niacin (mg)	18.3 ± 4.7	114.1	15.4 ± 4.7	155.6
Calcium (mg)	614.9 ± 179.2	94.8	668.9 ±1019.4	87.3
Phosphorus (mg)	1295.4 ± 315.7	174.5	1108.4 ± 291.9	170.9
Iron (mg)	15.1 ± 5.8	125.9	13.2 ± 5.4	82.7

1) Percent Korean RDA values of daily nutrient intakes (7th revision, 2000)

2) Dietary intake by socioeconomic, dietary and health-related factors

Figure 1 presents the dietary intake of nutrients by male and female students according to socioeconomic, dietary and health-related factors. As for the influence on nutrient intake of the mother's employment status, the calcium intake of male students whose mothers had no job was significantly higher compared to that of male students whose mothers were employed ($p < 0.05$). Howev-

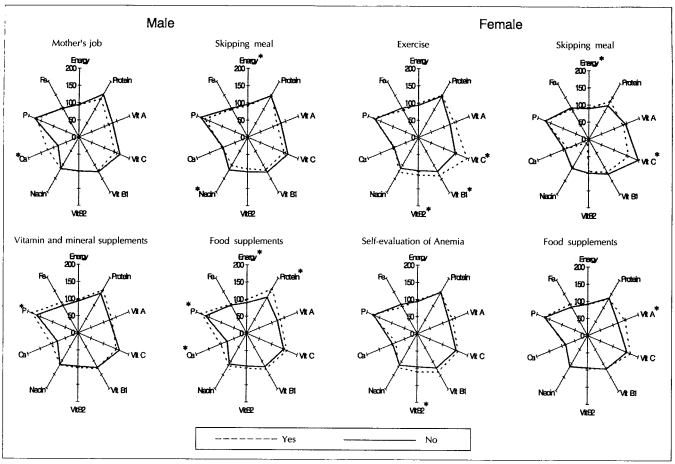

Fig. 1. Nutrient intakes by socioecomic, dietary and health-related factors.

er, there was no significant difference in nutrient intake among female students whose mothers work and female students whose mothers didn't work.

As for meal skipping, energy intake by male and female students who skipped meals was significantly lower than Korean RDA ($p < 0.05$, respectively). Niacin intake of male students who skipped meals was significantly lower compared to that of male students who did not skip meals ($p < 0.05$). Also, vitamin C intake of female students who skipped meals was significantly lower compared to that of female students who did not skip meals ($p < 0.05$).

Intake of vitamin C, vitamin B_1 and vitamin B_2 by male students who exercised was significantly higher compared to those who did not exercise ($p < 0.05$). On the other hand, there was no significant difference in nutrient intake among female students who exercised and those that didn't (data is not shown).

With regard to vitamin and mineral supplement use, the phosphorus intake of male students taking vitamin and mineral supplements was significantly higher compared to those who did not ($p < 0.05$). There was no significant difference in vitamin and mineral supplement use by female students, although their intake of energy, vitamin B_2, calcium and iron was significantly lower than Korean RDA (data is not shown).

As for the use of food supplements, male students' intake of energy, protein, calcium and phosphorus using food supplements was significantly higher compared to non-users ($p < 0.05$). In female students, vitamin A intake by food supplement users was significantly higher compared to non-users ($p < 0.05$). These results showed that college students get excessive amounts of some nutrients from food supplements as well as food.

As for self-evaluation of anemia, vitamin B_2 intake of the male anemia group was significantly higher than that of the male non-anemia group ($p < 0.05$). On the other hand, iron intake by the female anemia group was lower than that of the non-anemia female group, but the difference was not significant (data is not shown).

3) Correlation between anthropometric data and dietary intake

The correlation between anthropometric data and diet-

ary intake of nutrients is shown in Table 2. Height of female students negatively correlated with intake of vitamin B_2 ($p < 0.05$) and vitamin C ($p < 0.01$). However, there was no significant correlation between height and nutrient intake in male students. Vitamin B_1 intake by male students positively correlated with weight ($p < 0.01$), and intake of vitamin C ($p < 0.01$) and niacin ($p < 0.05$) in female students negatively correlated with weight.

In male students, intake of vitamin B_1 ($p < 0.01$) and vitamin B_2 ($p < 0.05$) positively correlated with BMI. In female students, however, nutrient intake did not correlate with BMI.

2. Use of vitamin and mineral supplements

1) Age and anthropometric data

The age and anthropometric characteristics of subjects by vitamin and mineral supplement use is shown in Table 3. The usage rate of vitamin and mineral supplements by male students was 47.4% and the rate by female students was 41.7%.

In female students, there was a significant difference in age between vitamin and mineral supplement users and non-users ($p<0.05$). The average age of users was 22.4 years and that of non-users was 24.2 years.

The average body weight, height and BMI of vitamin and mineral supplement users were compared with the Korean Standard for age (male students: height 174 cm, weight 67 kg, female students: height 161 cm, weight 54 kg)(Korean Nutrition Society 2000). The height of male and female subjects was higher compared to the Korean standard for age. The weight of male students using vitamin and mineral supplements was higher compared to the Korean standard for age. However, the weight of male students who did not use vitamin and mineral supplements was lower compared to the Korean standard for age. Also the weight of female students was lower compared to the Korean standard for age.

In male students, there was a significant difference in BMI between vitamin and mineral supplement users and non-users ($p < 0.05$). However, there was no significant difference in the height and weight of male students by use of vitamin and mineral supplements. In female students, the height, weight and BMI of vitamin and mineral supplement users was higher compared to non-users but the difference was not significant. The average BMI of male and female vitamin and mineral supplement users was 22.6 kg/m^2 and 19.8 kg/m^2, respectively. That of non-users was 21.7 kg/m^2 and 19.5 kg/m^2, respectively. These were in the normal range based on classification of BMI: with less than 18.5 underweight, 18.5 – 22.9 normal, 23.0 – 24.9 overweight, 25.0 – 29.9 obese Ⅰ, 30.0 – 34.9 obese Ⅱ and more than 35.0 obese Ⅲ(Korean Society of Obesity, 1997).

Table 2. Correlation coefficient between anthropometric measurements and daily nutrient intakes

	Male			Female		
	Height	Weight	BMI[1]	Height	Weight	BMI
Energy (kcal)	-.026	.122	.158	-.111	-.157	-.121
Protein (g)	-.034	.037	.064	.083	.055	-.115
Fat (g)	-.117	.072	.144	-.020	-.092	-.094
Carbohydrate	.009	.079	.089	-.131	-.178	-.134
Vitamin A (RE)	-.091	.019	.065	-.089	.016	.063
Vitamin B_1	.073	.225**[2]	.224**	-.128	-.149	-.100
Vitamin B_2	.096	.117	.182*	-.188*	-.156	-.073
Vitamin C (mg)	-.022	.091	.117	-.285**	-.284**	-.170
Niacin (mg)	.112	.034	.097	.135	.191*	-.146
Calcium (mg)	-.139	-.019	.053	-.176	.157	-.147
Phosphorus	-.095	.082	.149	-.169	-.146	.074
Iron (mg)	.018	.011	.013	-.049	-.142	.142

1) BMI: body weight in kilograms divided by height in meters squared
2) *: significant at $p < 0.05$, **: significant at $p < 0.01$

2) Socioeconomic characteristics

The father's education level and household income of the subjects by vitamin and mineral supplement use are shown in Table 4. The father's education level and household income of female vitamin and mineral supplement users was significantly higher compared to non-users ($p < 0.05$). Among male students, however, there was no significant difference between vitamin and mineral supplement users and non-users, although the father's education level and

Table 3. Age and anthropometric data of the subjects by use of vitamin and mineral supplements

	Male			Female		
	User (n = 65)	Non-user (n = 72)	Significance	User (n = 48)	Non-user (n = 89)	Significance
Age(years)	24.5 ± 0.3[1]	24.0 ± 0.4	$p = 0.222^{NS2)}$	22.4 ± 0.3	24.2 ± 0.7	$p = 0.026^{*1)}$
BMI[4]	22.6 ± 0.2	21.7 ± 0.3	$p = 0.036^{*}$	19.8 ± 0.2	19.6 ± 0.3	$p = 0.623^{NS}$
Height (cm)	174.4 ± 0.4	174.5 ± 0.8	$p = 0.890^{NS}$	162.7 ± 0.5	161.7 ± 0.7	$p = 0.267^{NS}$
Weight(kg)	68.7 ± 0.8	66.1 ± 1.1	$p = 0.078^{NS}$	52.5 ± 0.7	51.3 ± 0.8	$p = 0.276^{NS}$

1) Mean ± S.D
2) NS: not significant
3) *: $p < 0.05$ by Student's t-test
4) BMI: body weight in kilograms divided by height in meters squared

household income of users seemed higher compared to non-users.

There was no significant difference in other socioeconomic factors such as the mother's education level, mother's job and pocket money between vitamin and mineral supplement users and non-users (data is not shown).

3) Self-evaluation of health status

The self-reported health status of subjects by use of vitamin and mineral supplements is shown in Table 5. There was a significant difference in the self-reported health status of male and female students by use of vitamin and mineral supplements ($p < 0.01$ and $p < 0.05$, respectively). Vitamin and mineral supplement users perceived their health status to be worse compared to non-users. Among male students, users answered moderate (46.2%), good (23.1%), very good (15.4%), poor (13.8%) and very poor (1.5%). Non-users answered moderate (50%), good (43.1%), very good (13.9%), very poor (1.4%), poor (0%). Among female students, users answered moderate (45.2%), poor (27.4%), good (24.2%), very good (1.6%), very poor (1.6%) and non-users answered moderate (58.5%), good (24.5%), very good (9.4%) and poor (5.7%).

4) Mobile phone using hours

Daily usage of mobile phones in hours by vitamin and mineral supplement users are shown in Table 6. Among male students, vitamin and mineral supplement users used mobile phones significantly less than non-users ($p < 0.05$). Users used mobile phones less than a half-hour (78.5%), no use (10.8%), 1/2 - 1 hour (9.2%) and more than 2 hours (1.5%). Non-users used less than a half-hour (62.5%), 1/2 - 1 hour (18.3%), 1 - 2 hours (11.1%), no use (4.2%) and more than 2 hours (4.2%). Among female students, vi-

Table 4. Father's education level and household income of subjects by use of vitamin and mineral supplements

Variable	Male			Female		
	User (n = 65)	Non-user (n = 72)	Significance	User (n = 62)	Non-user (n = 53)	Significance
Father's education level						
≤ Elementary school	4 (6.2)	6 (8.3)	$p = 0.166^{NS1)}$	3 (4.8)	5 (9.5)	$p = 0.019^{*2)}$
Middle school	9 (13.8)	7 (9.7)		1 (1.6)	9 (17.0)	
High school	18 (27.7)	34 (47.2)		29 (46.8)	21 (39.6)	
University	26 (40.0)	17 (23.6)		23 (37.1)	17 (32.1)	
Graduate school	8 (12.3)	8 (11.1)		6 (9.7)	1 (1.9)	
Household income (10,000 won/month)						
< 60	0 (0.0)	0 (0.0)	$p = 0.432^{NS}$	0 (0.0)	0 (0.0)	$p = 0.037^{*}$
60 - 90	3 (4.6)	4 (5.6)		1 (1.6)	1 (1.9)	
90 - 120	3 (4.6)	9 (12.5)		0 (0.0)	5 (9.4)	
120 - 150	9 (40.9)	13 (18.1)		4 (6.5)	9 (17.0)	
150 - 200	18 (27.7)	15 (20.8)		19 (30.6)	14 (26.4)	
≥ 200	32 (49.2)	31 (43.1)		38 (61.3)	24 (45.3)	

1) NS: not significant 2) *: $p < 0.05$ by χ^2-test

Table 5. Self-reported health status of subjects by use of vitamin and mineral supplements

Variable	Male			Female		
	User (n = 65)	Non-user (n = 72)	Significance	User (n = 62)	Non-user (n = 53)	Significance
Very good	10 (15.4)	10 (13.9)	$p = 0.007^{**1)}$	1 (1.6)	5 (9.4)	$p = 0.016^{*}$
Good	15 (23.1)	31 (43.1)		15 (24.2)	13 (24.5)	
Moderate	30 (46.2)	30 (50.0)		28 (45.2)	31 (58.5)	
Poor	9 (13.8)	0 (0.0)		17 (27.4)	3 (5.7)	
Very poor	1 (1.5)	1 (1.4)		1 (1.6)	1 (1.9)	

1) *: significant at $p < 0.05$ by χ^2-test, **: $p < 0.01$ by χ^2-test

Table 6. Daily mobile phone using hours of subjects by use of vitamin and mineral supplements

Variable	Male			Female		
	User (n = 65)	Non-user (n = 72)	Significance	User (n = 62)	Non-user (n = 53)	Significance
No use	7 (10.8)	3 (4.2)	$p = 0.015^{*1)}$	1 (1.6)	8 (15.1)	$p = 0.028^{*}$
< 1/2 hour	51 (78.5)	45 (62.5)		45 (72.6)	36 (67.9)	
1/2 - 1 hour	6 (9.2)	13 (18.1)		11 (17.7)	5 (9.4)	
1 - 2 hours	0 (0.0)	8 (11.1)		4 (6.5)	1 (1.9)	
≥ 2 hours	1 (1.5)	3 (4.2)		1 (1.6)	3 (5.7)	

1) *: significant at $p < 0.05$ by χ^2-test

Table 7. Cross analysis between use of vitamin and mineral supplement and use of food supplements

Food supplements use \ Vitamin & mineral supplements use	Male			Female		
	User (n = 65)	Non-user (n = 72)	Significance	User (n = 62)	Non-user (n = 53)	Significance
User	31 (47.7)	17 (23.6)	p = 0.003**[1)]	31 (50.0)	13 (24.5)	p = 0.004**
Non-user	34 (52.3)	55 (76.4)		31 (50.0)	40 (75.5)	

1) **: $p<0.01$ by χ^2-test

tamin and mineral supplement users used mobile phones significantly less than non-users ($p<0.05$). Users used mobile phone less than a half-hour (72.6%), 1/2 – 1 hour (17.7%), 1 – 2 hours (6.5%), no use (1.6%) and more than 2 hours (1.6%). Non-users used less than a half-hour (67.9%), no use (15.1%), 1/2 – 1 hour (9.4%), more than 2 hours (5.7%), 1 – 2 hours (1.9%), which represented a significant difference between users and non-users ($p < 0.05$).

5) Cross analysis between use of vitamin and mineral supplements and use of food supplements

Cross analysis results between vitamin and mineral supplement use and food supplement use is shown in Table 7. Among both male and female students, vitamin and mineral supplement users took significantly more food supplements than non-users ($p < 0.01$).

DISCUSSION

Average intake by male students of most nutrients other than energy, vitamin B_2 and calcium and intake by female students of those except energy, vitamin B_2, calcium and was higher than Korean RDA. Average daily intake of calcium and iron by female students was under 90% of Korean RDA. In a previous study of female college students in the Kyonggi area, average daily intake of nutrients except energy, calcium, iron and vitamin A was higher than Korean RDA.[8] On the other hand, all nutrient intake by male and female students attending nutrition and health-related Web class at a cyber university was higher than that of male and female students at regular universities.[6] In a previous study conducted in the United States, average daily intake of riboflavin, niacin, and calcium by female college students was slightly in excess of the recommended allowances, with those of energy and thiamin below the recommended allowances.[5] In this study, average iron intake by male and female college students was similar compared to data in previous studies.[4,6] The previous study in the United States showed a low mean dietary iron intake of 12.4 mg by female college students.[9] Calcium and iron intake is very important in young women of child-bearing age. Therefore, nutrition education via the Internet for proper intake of nutrients, especially calcium and iron, is necessary for college students at cyber universities.

Nutrient intake by male students was influenced by socioeconomic, dietary and health-related factors such as mother's job, skipping meals, exercise, vitamin and mineral supplement use, food supplement use and self-evaluation of anemia. Nutrient intake by female students was influenced by skipping meals and food supplement use. In previous studies, college students whose mothers had no job ate well-balanced meals at the mother's direction but the quantity and quality of dietary intake among those whose mothers had jobs was restricted.[4,6] In a previous study conducted at a university located in Mokpo, energy, calcium, iron and vitamin A intake was lacking because the rate of skipping meals was high among female students due to extreme weight control.[7] In previous studies of college students, intake of vitamin A and vitamin C increased in female students who exercised.[8,11] It was reported that vitamin and mineral supplement use was significantly higher in female adults compared to male adults, and vitamin C, vitamin B_1 and vitamin B_2 supplements, in that order, were used frequently by female adults.[10] In the previous study conducted in the United States, 3.2% of elderly people consumed potentially toxic daily doses of vitamin A of 25,000 IU or more.[12] Therefore, guidelines for use of vitamin and mineral supplements are advised in order to make college students aware that excessive doses of vitamin and mineral supplements could be harmful due to their adverse effect on the body. Also, that vitamin and mineral supplements should be used according to the recommendations of specialists such as doctors or dieticians. It was reported that healthy individuals who maintained diets selected from a wide variety of foods would likely obtain adequate amounts of necessary nutrients and have no need to use food supplements.[12] Therefore, it is necessary for college students to be provided with proper information showing that a healthy diet is more likely than supplements to ensure good health. Also, nutrition education for proper intake of iron

may be necessary for female college students who tend to lack iron due to menstruation.

Among male students, vitamin B_1 intake positively correlated with weight, and intake of vitamin B_1 and vitamin B_2 positively correlated with BMI. Among female students, intake of vitamin B_2 and vitamin C negatively correlated with height, and intake of vitamin C and niacin negatively correlated with weight. In the previous study of Korean college students, intake of calories and vitamin C positively correlated with height in male students, and intake of calories, protein, carbohydrates and vitamin B_2 positively correlated with height in female students.[4] However, the results among female students were not the same as previous results showing that nutrient intake did not correlate with weight in female students.[4] In the previous study conducted at a university in Mokpo, energy intake positively correlated with BMI in male college students, and intake of calcium, iron and vitamin A positively correlated with BMI in female college students.[2] However, in another study conducted at a university located in Inchon, nutrient intake did not correlate with BMI in male college students, and intake of energy and fat negatively correlated with BMI in female college students.[4] Also, it was reported that intake of energy, protein, vitamin A, vitamin B_1, vitamin B_2 and vitamin C positively correlated with BMI in male college students in Seoul.[7]

In this study, there was a significant difference in BMI between male vitamin and mineral supplement users and non-users. Among female students, there was a significant difference in age between users and non-users. The usage rate among male students of vitamin and mineral supplements was 47.4% and the rate among female students was 41.7%, which was different from previous results showing that more women than men took vitamin and mineral supplements.[3,5,8,10,13] However, in the previous study on vitamin and mineral usage among adults, use of the vitamin and mineral supplements increased with age.[8,11,16,19]

The father's education level and household income of female vitamin and mineral supplement users were significantly higher compared to non-users. These results are similar to previous results showing a positive correlation among education level,[8,11,15,16,19] household income[8,10,11,14,16,19] and usage of vitamin and mineral supplements. Unlike this study, other previous studies reported that vitamin and mineral supplement use positively correlated among race, residence, mother's job and marital status.[8,10,11,14] Also, it was reported that high school graduates used more vitamin and mineral supplements than college graduates.[10]

As for the self-reported health status of male and female students, vitamin and mineral supplement users perceived their health status to be worse compared to non-users. It was reported previously that there was a significant difference between vitamin and mineral supplement usage and health-related factors such as self-evaluation of health status, illness, stress and obesity.[8] In previous studies of college students, vitamin and mineral supplement users showed significantly stronger beliefs than non-users about the health benefits of vitamin and mineral supplements. These beliefs might prompt the subjects to use multi vitamins, vitamin C and multi vitamins plus iron more frequently.[8,10,12,13]

Recently, the use of mobile phones by college students has grown more common. In both male and female students, vitamin and mineral supplement users used mobile phones significantly less compared to non-users. In previous studies conducted in the United States, vitamin and mineral supplement users were more concerned about their health than non-users.[6,10,13,16] Therefore, it may be considered that both male and female vitamin and mineral supplement users used mobile phones less because of the harmful electromagnetic waves emitted by mobile phones.

Among both male and female students, vitamin and mineral supplement users took significantly more food supplements than non-users. In a previous study of community college students in the United States, vitamin and mineral supplement users took many kinds of food supplements such as amino acids/protein and garlic in that order.[18] In another previous study about the use of vitamin and mineral supplements or food supplements, variable factors were found that significantly related to greater food supplement usage: decreasing age ($p < 0.001$), increasing education ($p < 0.01$), female ($p < 0.001$) and the perception that the nutritional quality of food had decreased over the past 10 years ($p < 0.001$).[10,12] Overdoses of vitamin and mineral supplements or toxicity problems due to trace elements caused by the interaction of nutrients was reported.[8,13] Therefore, it may be suggested that college students need proper nutrition education so that they do not use excessive amounts of vitamin and mineral supplements or food supplements, and instead choose a variety of foods wisely for an optimal nutrient intake.

SUMMARY AND CONCLUSION

In order to investigate the dietary intake of nutrients and

use of vitamin and mineral supplements among Korean college students attending a Web class by socioeconomic, dietary and health-related factors, a cross-sectional survey was carried out using a self-administered questionnaire from November 1 to 15, 1999. Subjects were 300 college students attending a nutrition and heath-related Web class at a cyber university. For statistical analysis, 252 (male: 137, female: 115) well-completed questionnaires were used. The results are as follows:

1) Average intake of most nutrients except energy, vitamin B_2 and calcium by male students and those except energy, vitamin B_2, calcium and iron by female students was higher than Korean RDA. Average daily intake of calcium and iron by female students was under 90% of Korean RDA.

2) Nutrient intake among male students was influenced by socioeconomic, dietary and health-related factors such as the mother's employment status, skipping meals, exercise, vitamin and mineral supplement use, food supplement use and self-evaluation of anemia. Female students' nutrient intake was influenced by skipping meals and food supplements.

3) Among male students, vitamin B_1 intake positively correlated with weight and intake of vitamin B_1 and vitamin B_2 positively correlated with BMI. In female students, intake of vitamin B_2 and vitamin C negatively correlated with height and intake of vitamin C and niacin negatively correlated with weight.

4) In male students, there was a significant difference in BMI between vitamin and mineral supplement users and non-users. In female students, there was a significant difference in age between users and non-users.

5) The father's education level and household income of female vitamin and mineral supplement users was significantly higher compared to non-users.

6) As for the self-reported health status of male and female students, vitamin and mineral supplement users perceived their health status to be worse compared to non-users.

7) In both male and female students, vitamin and mineral supplement users used mobile phones significantly less compared to non-users.

8) In both male and female students, vitamin and mineral supplement users took significantly more food supplements than non-users.

Therefore, nutrition education via the Internet is necessary to encourage college students to practice optimal nutrition strategies, including maintaining a well-balanced diet by choosing a variety of foods wisely.

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