

Concern about Body Weight and Dietary Intake by BMI Distribution in Korean University Students

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ABSTRACT

The purpose of the study was to investigate attitude about self-weight reduction and dietary intakes by body mass index (BMI) of university students. The subjects were Korean university students (male : 1,024, female : 1,575) who were participating in a nutritional education class via the internet. This survey was carried out using a self-administered questionnaire. The questionnaire included items about demographic characteristics, nutrient intakes, health-related lifestyles, dietary behaviors, body images and diet experiences. As for prevalence of obesity, 3.2% of male subjects were underweight, 64.2% were normal weight, 20.8% were overweight, and 11.8% were obese. In female subjects, 25.8% were underweight, 67.1% were normal weight, 5.3% were overweight, and 1.7% were obese. Distribution of obesity by BMI was significantly different between male and female subjects. There was a significant difference in perceptions of body weight between male and female subjects. The female subjects were more likely to perceive themselves as overweight. As for weight reduction, the higher BMI was, the more weight reduction was tried in both male and female subjects. As for average daily intakes for energy and 11 nutrients, most nutrient intakes were not significantly different by distribution of BMI. However, obese subgroup showed the lowest nutrient intakes compared to other subgroups. As BMI increased, mean adequacy ratio (MAR) significantly decreased. Therefore, nutritional education via the internet is necessary for university students to establish physically and mentally optimal health condition through nutritional intervention. (*J Community Nutrition* 5(3) : 141~150, 2003)

KEY WORDS : BMI · body weight · weight reduction · dietary intake · university students.

Introduction

Obesity is currently an increasing disease that affects many countries in the world including the United States where this condition is responsible for 300,000 deaths annually (Allison et al. 1999). According to Korean National Health and Nutrition Surveys, the prevalence of obesity in adults over 20 years of age has been rapidly increasing from 1991, 1992 with 17.1%, 19.6%, respectively to 1998 with 26% (French, Jeffery 1994 ; Kim et al. 1997). Now, obesity causes many health-problems which have much concern and assignment to solve (French et al. 1995).

As obesity is increasingly a target of concern and is related

to other health-disorders, including high risk of diabetes, cardiac vascular disease (CVD), and cancer, etc., weight reduction is the most popular issue for both young people and old people for health and physical appearance (Ryu, Yoon 2000). These chronic and degenerative diseases can be decreased through weight reduction, however, preference for thinness causes incorrect recognition for body image together with unhealthy weight loss methods (Mary et al. 1999).

For overweight and obesity, the effort to reduce weight with proper methods (behavior modification, increase of physical activity and balanced low calorie diet) is desirable phenomenon from the viewpoint of obesity prevention ; it is not desirable for underweight and normal people (Ryu et al. 1999 ; Yim 2001). Specially, female university students have much concern about their appearance ; they tried much weight reduction without correct information (Ryu, Yoon 1999 ; Kim et al. 1999). Consequently, problems of dietary habits and nutritional unbalance happened (Park et al. 1997).

There are different opinions about ideal weight between

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female and male students (Connor-Green 1988). Most male students considered that their weight is proper, on the other hand, most female students considered that their weight is overweight (Lee et al. 2001). Therefore, female university students are susceptible to developing poor eating habits and dietary problems due to greater desire for slimness in comparison to male university students (Koszewski, Kuo 1996).

The university students' views about obesity problems are very important because they are going to be parents in the next generation as younger owner of present generation and their opinion will largely affect national health (Park, Yoo 1998).

Nutrition education with correct nutritional information may be necessary for university students to establish desirable dietary habits and balanced body images. Therefore, the purpose of the study was to investigate attitude about self-weight reduction and nutritional intake by BMI of Korean university students participating in a nutritional education class via the internet.

Subjects and Methods

1. Subjects

The subjects were 2,660 Korean university students who were participating in a nutritional education class on weight control via the internet. This survey was carried out using a self-administered questionnaire from November 1 to November 30, 2000. For statistical analysis, 2,599 (male : 1,024 ; female : 1,575) well-completed questionnaires were used.

2. Questionnaire

The questionnaire included items about demographic cha-

racteristics, nutrient intakes, health-related lifestyles, dietary behaviors, body images and weight reduction experiences.

3. Anthropometric measurement

The height and weight were measured for both male and female subjects. The BMI was calculated as weight (kg) divided by height (m²). Subjects were divided into 4 subgroups by BMI based on Korean Society for Obesity (1999) ; as being underweight (BMI < 18.5kg/m²), normal (BMI 18.5 – 23 kg/m²), overweight (BMI 23 – 25kg/m²) and obese (BMI > 25kg/m²).

4. Dietary assessment

Three-days (including a weekend and 2 weekdays) recall methods were used for dietary assessment. Nutrient and food intakes were analyzed using Computer-Aided Nutritional Program for Professionals (CAN-Pro, Korean Nutrition Society, 1997) and were compared with Korean RDA (Korean Nutrition Society, 7th revision, 2000). In order to estimate adequacy of each nutrient intake, nutrient adequacy ratio (NAR) and mean adequacy ratio (MAR) were observed. NAR indicates degree of intake about nutrient recommendation in individual specific nutrient intake and NAR is used to understanding of intake problems in each nutrient. In case of NAR > 1, in order to protect increment of index, this value was considered 1. MAR is the mean value of each nutrient and indicates overall quality of diet.

5. Statistical analysis

The statistical analysis was conducted using SPSS 10.0 program. Frequency counts (%), mean, and standard deviation were calculated for all variables. Student's t-test, Chi-square

Table 1. Age, anthropometric data and distribution of obesity

	Male (n = 1,024)		Female (n = 1,575)		Significance
	Mean ± SD		Mean ± SD		
Age (years)	24.06 ± 3.44		22.22 ± 5.27		p = 0.000
Height (cm)	174.63 ± 4.71		162.38 ± 4.62		
Weight (kg)	67.92 ± 8.31		52.32 ± 6.07		
Weight status ¹⁾	N (%)	Mean ± SD ²⁾	N (%)	Mean ± SD	p = 0.000 ^{***3)}
Underweight : BMI < 18.5	33 (3.2)	17.87 ± 0.58	407 (25.8)	17.57 ± 0.70	
Normal weight : BMI 18.5 – 22.9	657 (64.2)	21.12 ± 1.14	1,057 (67.2)	20.21 ± 1.13	
Overweight : BMI 23 – 24.9	213 (20.8)	23.82 ± 0.53	84 (5.3)	23.80 ± 0.59	
Obese : BMI > 25	121 (11.8)	26.79 ± 1.48	27 (1.7)	26.56 ± 1.63	
Total	1,024 (100)	22.24 ± 2.36	1,575 (100)	19.83 ± 2.02	

1) Distribution of BMI based on the Korean society of obesity

2) SD = standard deviation

3) BMIs are significantly different between male and female (***) : p < 0.001

test and analysis of variance (ANOVA ; Duncan's multiple range test) were used to determine statistical significance.

Results

1. Age, anthropometric data and distribution of obesity

Age, anthropometric data and the prevalence of obesity are shown in Table 1. The average age of the male and female subjects was 24.06 (SD = 3.44) and 22.22 (SD = 5.27) years, respectively. The mean height and weight of male subjects were 174.6cm, and 67.9kg, respectively. And the mean height and weight of female subjects were 162.4cm, and 52.3kg, respectively. As for prevalence of obesity, 3.2% of male subjects were underweight, 64.2% were normal, 20.8% were overweight and 11.8% were obese. In case of female subjects, 25.8% were underweight, 67.1% were normal, 5.3% were

overweight and 1.7% were obese. There was a significant difference in distribution of obesity by BMI between male and female subjects. The overall incidence of overweight and obese subgroups was higher in male subjects compared to female subjects. However, the incidence of underweight subgroup was higher in female subjects compared to male subjects. The mean BMI of male subjects was $22.24 \pm 2.36\text{kg/m}^2$, and the mean BMI of female subjects was $19.83 \pm 2.02\text{kg/m}^2$. The mean BMI of both subjects fell within the normal range.

2. Relation between self-perceived weight and actual weight

Relation between self-perceived weight and actual weight is shown in Table 2. There was a significant difference in perceptions of body weight between male and female subjects. The female subjects were more likely to perceive themselves as overweight. Most of the underweight male subjects saw themselves as being slim, while only 37.3% of the underwei-

Table 2. Relationship between perceived weight and actual weight n(%)

Perceived weight	Actual weight							
	Underweight		Normal weight		Overweight		Obese	
	Male	Female	Male	Female	Male	Female	Male	Female
Fatty	1 (3.0)	82(20.4)	40(6.1)	719(68.2)	89(42.4)	80(95.3)	107(88.5)	27(100.0)
Moderate	0(0.0)	171(42.4)	349(53.5)	319(30.3)	117(55.7)	4(4.7)	13(10.7)	0(0.0)
Slim	32(97.0)	150(37.2)	263(40.4)	16(1.5)	4(1.9)	0(0.0)	1(0.8)	0(0.0)
Significance	p = 0.000*** ¹⁾				p = 0.000*** ²⁾			

1) Male, 2) Female, *** : p < 0.001

Table 3. Weight reduction-related life style by BMI distribution n(%)

	Underweight		Normal weight		Overweight		Obese	
	Male	Female	Male	Female	Male	Female	Male	Female
Weight reduction experience								
Yes	1 (3.0)	168(41.3)	88(13.4)	811(76.7)	72(33.8)	69(82.1)	73(60.3)	23(85.2)
No	32(97.0)	239(58.7)	569(86.6)	246(23.3)	141(66.2)	15(17.9)	48(39.7)	4(14.8)
Significance	p = 0.000*** ¹⁾				p = 0.000*** ²⁾			
Weighing oneself once a week								
Yes	14(42.4)	247(60.7)	245(37.3)	717(67.9)	87(40.8)	56(66.7)	62(51.2)	18(66.7)
No	19(57.6)	160(39.3)	412(62.7)	339(32.1)	126(59.2)	28(33.3)	59(48.8)	9(33.3)
Significance	p = 0.036*				p = 0.078			
Willing to change diets								
Yes	11(33.3)	142(35.0)	149(22.7)	510(48.3)	67(31.5)	50(60.2)	59(48.8)	17(63.0)
No	22(66.7)	264(65.0)	507(77.3)	545(51.7)	146(68.5)	33(39.8)	62(51.2)	10(37.0)
Significance	p = 0.000***				p = 0.000***			
Calculating food calories								
Yes	0(0.0)	123(30.2)	61(9.3)	522(49.5)	18(8.5)	38(45.2)	17(14.0)	15(55.6)
No	33(100.0)	284(69.8)	595(90.7)	533(50.5)	195(91.5)	46(54.8)	104(86.0)	12(44.4)
Significance	p = 0.081				p = 0.000***			

Weight reduction-related lifestyle was significantly different by BMI distribution, 1) Male, 2) Female, * : p < 0.05, *** : p < 0.001

Table 4. Weight-reduction experience by BMI distribution

	Underweight		Normal weight		Overweight		Obese	
	Male	Female	Male	Female	Male	Female	Male	Female
	N = 1	N = 168	N = 88	N = 811	N = 72	N = 69	N = 73	N = 23
Exercise								
Yes	1 (100.0)	142 (84.5)	80 (90.9)	692 (85.3)	68 (94.4)	62 (89.9)	66 (90.4)	20 (87.0)
No	0 (0.0)	26 (15.5)	8 (9.1)	119 (14.7)	4 (5.6)	7 (10.1)	7 (9.6)	3 (13.0)
Significance	p = 0.000***				p = 0.000***			
Willing to change bad diet behavior								
Yes	0 (0.0)	113 (67.3)	53 (60.2)	560 (69.1)	53 (73.6)	57 (82.6)	47 (64.4)	16 (69.6)
No	1 (100.0)	55 (39.8)	35 (39.8)	251 (30.9)	19 (26.4)	12 (17.4)	26 (35.6)	7 (30.4)
Significance	p = 0.000***				p = 0.000***			
Self-perception of symptom after weight control								
Yes	1 (100.0)	103 (61.3)	35 (39.8)	482 (59.4)	30 (41.7)	47 (68.1)	25 (34.2)	15 (65.2)
No	0 (0.0)	65 (38.7)	53 (60.2)	329 (40.6)	42 (58.3)	22 (31.9)	48 (65.8)	8 (34.8)
Significance	p = 0.000***				p = 0.000***			
Weight loss								
Yes	1 (100.0)	156 (92.9)	82 (93.2)	765 (94.3)	69 (95.8)	62 (89.9)	69 (94.5)	23 (100.0)
No	0 (0.0)	12 (7.1)	6 (6.8)	46 (5.7)	3 (4.2)	7 (10.1)	4 (5.5)	0 (0.0)
Significance	p = 0.000***				p = 0.000***			
Yo-yo effect								
Yes	0 (0.0)	112 (66.7)	46 (52.3)	642 (79.2)	54 (75.0)	60 (87.0)	58 (79.5)	22 (95.7)
No	1 (100.0)	56 (33.3)	42 (47.7)	169 (20.8)	18 (25.0)	9 (13.0)	15 (20.5)	1 (4.3)
Significance	p = 0.000***				p = 0.000***			

Weight reduction experience of subjects was significantly different by BMI distribution, 1) Male, 2) Female, * : $p < 0.05$, *** : $p < 0.001$

ght female subjects saw themselves as being slim. Also 20.4% of the underweight female subjects and 68.2% of the normal female subjects saw themselves as being fatty. The majority of female subjects who were in range of overweight and obesity saw themselves accurately. Unlike the female subjects, the male subjects were more likely to perceive themselves as being underweight. Also 40.4% of the normal male subjects saw themselves as being slim, 55.7% of the overweight male subjects saw themselves as being moderate and 10.7% of the obese male subjects saw themselves as being moderate.

3. Weight reduction-related lifestyle

Weight reduction-related lifestyles are shown in Table 3. The greater interest in body image was the concern about weight reduction increased more. Especially, female subjects were strongly interested in weight reduction. Although underweight and normal female subjects were not obese, 41.3% of the underweight female subjects and 76.7% normal female subjects were trying to lose weight. The higher BMI was, the more weight reduction was tried in both male and female subjects. The weight reduction of the female subjects was tried significantly more compared to the male subjects.

Regardless of BMI distribution, approximately 60% of the female subjects were weighing themselves once a week. In case of the male subjects, they were significantly weighing themselves less than once a week compared to the female subjects. The percentage of obese subgroup weighing oneself once a week was the highest compared to other subgroups. The percentage of the female subjects who want to change current diets was increased as their BMI was increased ; 63% of the female obese subgroup and 48.8% of the male obese subgroup want to change current diets. Also the percentage of the female subjects who want to change current diets was higher compared to the male subjects. As for calculating food calories, the percentage of the female subject was increased as their BMI was increased. However, most of the male subjects did not calculate food calories.

Among those who were trying weight reduction, weight reduction experiences were examined (Table 4). As stated above, weight reduction was tried by 41.3% of the underweight subgroup, 76.7% of the normal weight subgroup, 82.1% of the overweight subgroup and 85.2% of the obese subgroup in female subjects. In case of male subjects, weight reduction

Table 5. Dietary intakes of male subjects by BMI distribution

	Underweight	Normal weight	Overweight	Obese
Energy (kcal)	2169.03 ± 560.94	2158.87 ± 453.20	2124.12 ± 495.07	2074.99 ± 529.77
% RDA	87.73 ± 22.77	86.20 ± 17.04	85.13 ± 19.81	83.35 ± 20.72
Protein (g)	81.93 ± 21.22	84.40 ± 26.54	81.75 ± 24.27	84.74 ± 38.87
% RDA	113.50 ± 29.78	117.80 ± 37.06	114.27 ± 35.10	117.75 ± 52.87
% kcal	15.17 ± 2.00	15.70 ± 4.49	15.50 ± 3.10	16.26 ± 5.50
Fat (g)	61.54 ± 22.02	63.58 ± 17.82	62.74 ± 18.75	60.84 ± 20.97
% kcal	25.16 ± 3.8	26.34 ± 3.88	26.50 ± 4.64	26.10 ± 4.37
Carbohydrate (g)	318.87 ± 78.69 ¹⁾	310.52 ± 65.47 ^{ab}	309.94 ± 74.97 ^{ab}	293.62 ± 73.91 ^a
% kcal	59.20 ± 4.78	57.80 ± 5.43	58.78 ± 8.42	57.11 ± 6.60
Calcium (mg)	553.93 ± 194.28	575.06 ± 188.22	549.65 ± 193.25	550.74 ± 230.46
% RDA	79.37 ± 27.52	82.00 ± 26.76	78.69 ± 27.37	78.31 ± 31.35
Phosphorus (mg)	1207.84 ± 294.03	1220.02 ± 288.75	1188.35 ± 285.59	1186.21 ± 351.73
% RDA	172.86 ± 42.76	175.65 ± 63.98	169.43 ± 40.92	168.96 ± 48.48
Iron (mg)	15.12 ± 6.09	14.68 ± 6.40	14.47 ± 6.23	14.14 ± 6.22
% RDA	122.41 ± 45.12	121.56 ± 53.20	119.85 ± 50.17	116.99 ± 52.19
Vitamin A (RE)	906.35 ± 386.71	869.04 ± 352.44	919.07 ± 393.46	890.17 ± 504.89
% RDA	127.63 ± 56.24	124.00 ± 50.20	135.98 ± 87.84	127.37 ± 71.97
Thiamin (mg)	1.52 ± 0.56	1.52 ± 0.38	1.51 ± 0.59	1.44 ± 0.40
% RDA	118.14 ± 42.83	116.49 ± 29.06	116.27 ± 45.31	110.79 ± 30.27
Riboflavin (mg)	1.36 ± 0.62	1.33 ± 0.47	1.31 ± 0.44	1.23 ± 0.48
% RDA	88.28 ± 41.71	86.96 ± 31.18	85.75 ± 29.34	80.36 ± 30.08
Niacin (mg)	17.34 ± 5.20	17.30 ± 4.55	16.95 ± 4.65	16.71 ± 4.91
% RDA	102.56 ± 31.51	101.66 ± 26.41	99.72 ± 27.35	98.87 ± 29.12
Vitamin C (mg)	117.50 ± 65.38	105.91 ± 51.06	105.01 ± 52.21	108.30 ± 60.25

1) By Duncan's Multiple Range test. Mean with same letter in each group was not significantly different

was tried by 3.0% of the underweight subgroup, 13.4% of the normal weight subgroup, 33.8% of the overweight subgroup and 60.3% of the obese subgroup. As for exercise, approximately 90% of the subjects took exercise, and the percentage of the male subjects was somewhat higher than that female subjects. In both male and female subjects, overweight subgroup showed the highest percentage of taking exercise. As for willing to change bad dietary behavior, the percentage of the 73.6% and 82.6% of overweight subgroups wanted to change bad dietary behavior in male and female subjects, respectively. Self-perception of side symptoms after weight reduction was the highest in overweight subgroups of both male and female subjects and male subjects showed significantly lower self-perception compared to female subjects. As for weight loss, most subjects experienced weight loss. However, most of them experienced a yo-yo effect. Especially, female subjects experienced more yo-yo effect. In both male and female subjects, the higher BMI, the more the yo-yo effect was experienced.

4. Dietary intake

Average daily intakes of energy and 11 nutrients for in male subjects are presented in Table 5. Most nutrient intakes were not significantly different among subgroups by distribution of BMI. However, there was a tendency that the intakes of nutrients such as energy, fat, phosphorus, iron, thiamin, riboflavin and niacin were the lowest in male obese subgroup compared to other groups.

When dietary intakes of the male subjects were compared to the Korean RDA, most nutrient intakes except calcium and riboflavin were above the RDA. The ratio of calcium : phosphorus was 1 : 2.2, which was higher than the recommended level of 1 : 1 – 1.5. In male subjects, energy intake was below Korean RDA ; obesity subgroup was the lowest as 83% of Korean RDA.

Average daily intakes of energy and 11 nutrients in female subjects are presented in Table 6. Most of the nutrient intakes were significantly different among subgroups by distribution of BMI. The intakes of energy, fat, carbohydrate, calcium,

phosphorus, iron, thiamin, riboflavin and niacin were significantly the lowest in female obese subgroup compared to other groups. The higher BMI was, the lower the nutrient intakes were. When dietary intakes of the female subjects were compared to the Korean RDA, the intakes of calcium, iron and riboflavin were lower than Korean RDA. The intake of cal-

cium in underweight and obesity subgroups was 78% and 63% of Korean RDA, respectively. Similar to male subjects, the ratio of calcium : phosphorus was 1 : 2.0, which was higher than recommended level of 1 : 1 – 1.5. The intake of iron in underweight, normal weight, overweight and obese subgroups was 78%, 76%, 68% and 61% of Korean RDA, respectively

Table 6. Dietary intakes of female subjects by BMI distribution

	Underweight	Normal weight	Overweight	Obese
Energy (kcal)	1924.40 ± 427.57 ^{c1)}	1836.64 ± 421.89 ^{ab}	1769.80 ± 527.55 ^{ab}	1646.57 ± 406.55 ^a
% RDA	96.23 ± 21.47	91.63 ± 21.02	87.99 ± 26.58	82.09 ± 19.87
Protein (g)	79.43 ± 44.27	72.19 ± 36.20	73.63 ± 42.17	77.66 ± 57.60
% RDA	139.16 ± 79.04	125.29 ± 63.85	126.97 ± 73.59	133.96 ± 100.20
% kcal	16.53 ± 8.50	15.78 ± 7.74	16.78 ± 9.33	18.39 ± 10.76
Fat (g)	57.46 ± 15.71 ^b	54.40 ± 16.47 ^b	52.14 ± 16.87 ^{ab}	48.06 ± 16.60 ^a
% kcal	26.86 ± 4.22	26.51 ± 4.22	26.64 ± 4.54	26.10 ± 5.87
Carbohydrate (g)	282.03 ± 62.10 ^c	269.90 ± 62.36 ^{bc}	256.75 ± 79.32 ^{ab}	239.99 ± 60.83 ^a
% kcal	58.79 ± 4.85	58.97 ± 5.17	58.16 ± 5.78	58.32 ± 6.26
Calcium (mg)	546.98 ± 169.36 ^b	516.91 ± 173.57 ^b	497.47 ± 171.00 ^b	442.02 ± 135.35 ^a
% RDA	77.87 ± 24.32	73.59 ± 24.80	70.93 ± 24.55	62.67 ± 18.52
Phosphorus (mg)	1073.10 ± 263.56 ^b	1021.17 ± 275.60 ^b	993.17 ± 305.51 ^{ab}	923.92 ± 220.71 ^a
% RDA	152.95 ± 37.61	145.51 ± 39.29	141.51 ± 43.81	132.06 ± 28.56
Iron (mg)	13.04 ± 4.94 ^a	12.83 ± 5.48 ^b	11.55 ± 4.81 ^{ab}	10.57 ± 3.09 ^a
% RDA	77.62 ± 29.45	75.83 ± 33.44	68.33 ± 28.67	61.36 ± 17.28
Vitamin A (RE)	787.00 ± 294.57	768.09 ± 314.34	779.02 ± 420.49	715.36 ± 324.39
% RDA	113.29 ± 45.54	109.83 ± 44.76	111.28 ± 60.07	102.28 ± 46.32
Thiamin (mg)	1.26 ± 0.34 ^b	1.21 ± 0.43 ^b	1.20 ± 0.44 ^b	1.06 ± 0.27 ^a
% RDA	126.18 ± 34.21	122.36 ± 64.03	119.16 ± 44.12	105.05 ± 25.73
Riboflavin (mg)	1.17 ± 0.42 ^b	1.12 ± 0.37 ^b	1.09 ± 0.43 ^{ab}	0.97 ± 0.25 ^a
% RDA	97.58 ± 34.74	93.29 ± 30.93	90.89 ± 34.89	80.75 ± 20.60
Niacin (mg)	15.18 ± 4.52 ^b	14.53 ± 4.44 ^b	14.53 ± 6.08 ^b	12.56 ± 3.31 ^a
% RDA	116.95 ± 34.74	111.75 ± 33.99	111.35 ± 47.11	96.71 ± 25.40
Vitamin C (mg)	110.64 ± 54.89	106.36 ± 56.67	99.02 ± 46.56	102.99 ± 53.68

1) By Duncan's Multiple Range test. Mean with same letter in each subgroup was not significantly different

Table 7. Nutrient adequacy ratio (NAR) and Mean adequacy ratio (MAR) of male subjects by BMI distribution

	Underweight	Normal weight	Overweight	Obese
Protein (g)	0.95 ± 0.10	0.96 ± 0.12	0.95 ± 0.11	0.94 ± 0.11
Calcium (mg)	0.75 ± 0.21	0.77 ± 0.19	0.75 ± 0.21	0.73 ± 0.22
Phosphorus (mg)	0.99 ± 0.01	0.99 ± 0.04	0.99 ± 0.01	0.99 ± 0.03
Iron (mg)	0.93 ± 0.14	0.94 ± 0.12	0.92 ± 0.13	0.90 ± 0.15
Vitamin A (RE)	0.91 ± 0.16	0.93 ± 0.13	0.93 ± 0.15	0.89 ± 0.16
Thiamin (mg)	0.94 ± 0.14	0.95 ± 0.12	0.94 ± 0.11	0.92 ± 0.13
Riboflavin (mg)	0.78 ± 0.19 ^{ab1)}	0.83 ± 0.17 ^b	0.81 ± 0.18 ^{ab}	0.77 ± 0.20 ^a
Niacin (mg)	0.90 ± 0.14	0.91 ± 0.13	0.89 ± 0.15	0.87 ± 0.16
Vitamin C (mg)	0.93 ± 0.16	0.94 ± 0.14	0.94 ± 0.13	0.92 ± 0.15
MAR ²⁾	0.90 ± 0.12 ^{ab}	0.91 ± 0.01 ^b	0.90 ± 0.10 ^{ab}	0.88 ± 0.12 ^a

1) NAR (nutrient adequacy ratio)s were significantly different by Duncan's multiple range test (Mean with same letter in each subgroup was not significantly different). NAR = The subject's daily intake of a nutrient/RDA of that nutrient. All NAR values are truncated at 1.0

2) MAR (mean adequacy ratio) : Average of NAR for 9 nutrients (Protein, Ca, P, Fe, Vit. A, Vit. B₁, Vit. B₂, Niacin, Vit. C)

Table 8. Nutrient adequacy ratio(NAR) and Mean adequacy ratio(MAR) of female subjects by BMI distribution

	Underweight	Normal weight	Overweight	Obese
Protein (g)	0.98 ± 0.16 ¹¹	0.96 ± 0.18 ^{ab}	0.94 ± 0.11 ^a	0.96 ± 0.18 ^{ab}
Calcium (mg)	0.75 ± 0.19 ^b	0.71 ± 0.20 ^b	0.69 ± 0.21 ^{ab}	0.63 ± 0.19 ^a
Phosphorus (mg)	0.99 ± 0.02	0.99 ± 0.05	0.98 ± 0.07	0.98 ± 0.04
Iron (mg)	0.76 ± 0.19 ^c	0.74 ± 0.20 ^{bc}	0.68 ± 0.21 ^{ab}	0.66 ± 0.19 ^a
Vitamin A (RE)	0.90 ± 0.15 ^b	0.88 ± 0.17 ^{ab}	0.87 ± 0.17 ^{ab}	0.83 ± 0.25 ^a
Thiamin (mg)	0.97 ± 0.12 ^b	0.95 ± 0.10 ^{ab}	0.94 ± 0.12 ^{ab}	0.93 ± 0.14 ^a
Riboflavin (mg)	0.87 ± 0.15 ^c	0.85 ± 0.17 ^{bc}	0.81 ± 0.20 ^{ab}	0.79 ± 0.16 ^a
Niacin (mg)	0.94 ± 0.11 ^b	0.92 ± 0.13 ^{ab}	0.89 ± 0.16 ^a	0.88 ± 0.15 ^a
Vitamin C (mg)	0.94 ± 0.14	0.93 ± 0.15	0.92 ± 0.15	0.95 ± 0.15
MAR	0.90 ± 0.08 ^c	0.88 ± 0.10 ^{bc}	0.86 ± 0.12 ^{ab}	0.85 ± 0.11 ^a

1) NAR(nutrient adequacy ratio)s were significantly different by Duncan's multiple range test (Mean with same letter in each subgroup was not significantly different). NAR = The subject's daily intake of a nutrient/RDA of that nutrient All NAR values are truncated at 1.0
 2) MAR(mean adequacy ratio) : Average of NAR for 9 nutrients(Protein, Ca, P, Fe, Vit.A, Vit.B₁, Vit.B₂, Niacin, Vit. C)

and the intake of iron in obese subgroup was the most serious.

5. Nutrient adequacy ratio(NAR) and Mean adequacy ratio(MAR)

In order to estimate adequacy of nutrient intake, NAR and MAR of the subjects were observed by BMI distribution (Table 7, 8). In case of male subjects, NARs of most nutrients were high value above 8.5 except calcium and riboflavin. It showed a tendency that MAR as an index to estimate general dietary quality was decreased as BMI was increased; male obese subgroup showed the lowest MAR significantly compared to other male subgroups

Female subjects showed similar results to male subjects. NARs of most nutrients were high value above 8.5 except calcium, iron and riboflavin in female subjects. As BMI was increased, NARs of calcium, iron, vitamin A, thiamin, riboflavin and niacin significantly were decreased in female subjects. Also, as BMI was increased, MAR was decreased; obese subgroup showed the lowest MAR significantly compared to other subgroups.

Discussion

From the result of this study, it was found that 3.2% of male subjects were underweight, 64.2% were normal weight, 20.8% were overweight and 11.8% were obese. In case of female subjects, 25.8% were underweight, 67.1% were normal weight, 5.3% were overweight and 1.7% were obese. This result indicated that higher obesity rate was shown in male subjects compared to female subjects in Korea. This tendency was similar to result of Yim's study (Yim 2001). Because

Korean societal norms for a thinner body figure put pressure on female students to attempt loss weight, female university students showed a strong desire for thinness and a greater interest in body image (Kim et al. 1998; Won 1998; Yim 2001).

Several studies (Davis, Katzman 1998; Jack, Elsa 1996; Park et al. 1997; Smith et al. 1998) reported that self-perception of body weight differs by sex; male subjects were more likely to want to gain rather than lose weight, while female subjects were much more likely to want to lose rather than gain weight. In our result, the female subjects were more likely to perceive themselves as overweight in spite of underweight and normal weight subjects. This situation resulted from the discrepancy between actual weights and desired weights which reflects an unrealistic view of the ideal female body. Mass media reinforces this unrealistic standard, conveying the message that females must be slim in order to be happy. The dissatisfaction about body figure causes negative attitudes to shrink social activity with psychological anxiety, self-confidence loss and self-esteem loss, etc. (Striegel-Moore et al. 1989). Therefore, in order to give satisfaction about body figure, young females must establish a healthy perception of ideal body weight. In our study, 71% of the female subjects tried weight reduction and 28% of the male subjects tried weight reduction. The higher BMI was, the higher percentage of subjects tried weight reduction. Like this, relatively high rate of weight reduction was reported in female students in Korea; 57.4% (Yim 2001) and 78.5% (Kim et al. 1997) of the female college students, 57.2% (Kang et al. 1998) of the female high school students and 65.1% (Jeong, Park 1997) of the female middle school students were reported to try

weight reduction in order to lose their weight. This leads to poor eating behaviors and undesirable patterns of food consumption. Their eating behavior is represented by irregular meal patterns. This was related to development of bulimia as well as binge eating disorder (Mary et al. 1999). On the other hand, in our study, the higher BMI was, the more weighing of oneself once a week, willing to change diets and calculating food calories were shown. This result suggests that obese people were more sensitive to weight gain and made efforts to lose their weight.

It has been reported that the most commonly used weight reduction methods included healthful eating and exercise behaviors such as increasing exercise, decreasing fat intake, increasing fruit and vegetable consumption, decreasing caloric intake, and decreasing consumption of sweets and junk foods (Neumark-sztainer et al. 1996). In our study, the high percentage of weight reduction-experienced subjects answered exercise practice. A like report by Smith, et al (1998), the degree of exercise was higher in our male subjects compared to female subjects. Also the higher BMI was, the more exercise was done by our subjects. Most of weight reduction-experienced by our subjects perceived a yo-yo effect. Actually, dieting without exercise produces rapid weight regain after weight loss (Meeks 1997). In spite of doing exercise, our subjects experienced weight regain phenomenon and especially obesity subgroup did it very seriously. Therefore, a well-programmed weight reduction method will be established with effective exercise and diet preventing a yo-yo effect.

Several studies reported that obese people took significantly fewer calories than non-obese people (Baecke et al. 1983 ; Bandini et al. 1990 ; Kromhout 1983 ; Kulesza 1982). Our result showed that energy intake and MAR of obesity subgroup were the lowest compared to other subgroups. However, dietary records may cause additional problems that affect records of intake such as errors in estimating portion size (Bandini et al. 1990). In the study by Prentice et al (1986), obese female subjects underreported energy intake (1,610kcal/day) compared with total energy expenditure (2,445kcal/day). The corresponding figures for underweight females underreported energy intake (1,878kcal/day) compared with total energy expenditure (1,911kcal/day). Like this, underreporting may be even more marked in those who are overweight and obese (Scholler 1990). Accordingly, in studies using self-reported dietary intake, subjects are trained for objective measurement and need to detailed examination about record items.

Several studies in Korea (Kwon 1993 ; Lee, Lee 1986 ; Park, Choi 1990), the nutrient intake showed different results between obese and non-obese. In the study by Lee et al (Kwon 1993), energy and nutrient intakes of overweight group were lower compared to underweight or normal weight group. However, Park et al reported that there was no significant difference between obese and non-obese groups (Park et al. 1990). In the study by Lee et al, the higher the obesity rate was, the higher the nutrient intakes were (Lee, Lee 1986). Therefore, it is not certain that our result was exact nor to what extent. However, obese subgroup had a tendency that they had rather decrease or restrain nutrient intake for weight loss. To find out differences among underweight, normal, overweight and obese subgroup, not short-term but long-term intake habits are needed to investigate accurately. Also examination about daily energy expenditure as well as daily energy intake must be completed together in study.

It is noticeable that intakes of calcium and iron were lower than Korean RDA, especially in obese group. This raises a concern, because young women who are deficient in calcium will have decreased level of bone mass and are more likely to be at risk of osteoporosis after menopause. Weight reduction which consuming low-energy diets diminish iron status and lead to at high risk of iron deficiency. Thus, low intake of iron needs special concern for female university students.

It is important for university students to develop desirable eating behaviors and make optimal health physically and mentally, because health-related behaviors will continue to later life. Accordingly, it needs to recognize that nutritional factors and psychosocial status have a major influence on health. This study provides information regarding obesity degree, attitude about self-weight reduction and nutrient intakes of Korean university students. Nutritional education might focus on helping university students to establish correct perception of obesity, ideal body image and adequate weight loss methods. In addition, nutritional education should include programs to help university students develop desirable eating patterns and consume adequate amounts of nutrients. Therefore, nutritional education via the internet is necessary for university students to establish physical and mental optimal health conditions through nutritional intervention.

Summary and Conclusion

In order to investigate the attitude about self-weight reduc-

tion and dietary intakes by body mass index (BMI) distribution in university students, a cross-sectional study was carried out from November 1 to November 30, 2000. The subjects were Korean university students (male : 1,024, female : 1,575) who were participating in a nutritional education class on weight control via the internet. The results are as follows :

1) The average age, height and weight of the male and female subjects were 24.06 years, 174.6cm, 67.9kg and 22.22 years, 162.4cm, 52.3kg, respectively. 2) The female subjects were more likely to perceive themselves as overweight compared to the male subjects. 3) Female subjects were strongly interested in weight reduction. Although underweight and normal female subjects were not obese, 41.3% of the underweight female subjects and 76.7% normal female subjects were trying to lose weight. The weight reduction of the female subjects was tried significantly more compared to the male subjects. 4) In male subjects, most nutrient intakes were not significantly different among subgroups by distribution of BMI. Energy intake was below Korean RDA ; obesity subgroup was the lowest as 83% of Korean RDA. On the other hand, the intakes of energy, fat, carbohydrate, calcium, phosphorus, iron, thiamin, riboflavin and niacin were significantly the lowest in female obese subgroup compared to other groups. 5) In male subjects, NARs of most nutrients were of high value above 8.5 except calcium and riboflavin. In female subjects, NARs of most nutrients were of high value above 8.5 except calcium, iron and riboflavin in female subjects. As BMI was increased, NARs of calcium, iron, vitamin A, thiamin, riboflavin and niacin significantly were decreased in female subjects. Also, as BMI was increased, MAR was decreased ; obese subgroup showed the lowest MAR significantly compared to other subgroups.

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