

## Research Article



# Relationship between sweet food intake and stress among college students in Seoul and Gyeonggi areas

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### Conflict of Interest

There are no financial or other issues that might lead to conflict of interest.

## ABSTRACT

**Purpose:** For college students, poor eating habits can cause problems with adult health. This study investigated the status of sweet food intake and the degree of stress in college students in the Seoul and Gyeonggi areas to provide a basis for nutrition education by analyzing the relationship between stress and sugar intake.

**Methods:** The subjects were 760 college students, and the survey was conducted using a questionnaire. Statistical analysis for collected data was performed using SPSS (version 21.0).

**Results:** The stress score showed higher stress in female students. Females had more stress in their employment and study-related problems than males. For changes in food intake under stress, the intake was increased greatly in females than in males. For food preference changes before and after stress, males preferred more spicy foods and less salty foods after stress. After stress, females significantly preferred sweeter and spicier foods and less salty, sour, and bitter foods. The intake of sweet foods by stress factors showed that the intake of snacks was higher under the condition of 'worry, fatigue, and tension', and the intake of beverages was increased significantly under the condition of 'anger and aggression'.

**Conclusion:** Sweet foods were preferred under stress, and the amount of intake was increased. Education on food selection and nutrition information should be provided to prevent health problems that can be developed by the reckless intake of sweet foods. Active guidance is needed for college students to select the proper snacks instead of nutritionally insufficient foods to relieve stress.

**Keywords:** sweet food, dietary habits, students

## INTRODUCTION

The college years are an important period in life, a turning point from adolescent to adulthood, when dietary habits built over the years can develop health problems. In Korea, college students can easily have irregular dietary habits due to changed lifestyle after graduating high school and become under stress due to career and employment problems [1]. According to the recent survey on the stress recognition rate by life cycle conducted by the National Statistical Office in 2020 [2], the highest rate was observed in college students as 47.5%, compared to the level of high school students (27.8%). Among studies related to

stress and dietary habits, some has reported that the tendency for food selection or dietary intake can be changed due to physical and psychological stress, and the dietary intake or the neural response to energy-dense food was increased as stress became high [3,4], but others reported that the dietary intake significantly showed negative correlations with stress and people with higher stress showed lower caloric intake because of meal skipping and irregular dietary habits due to frequent alcohol drinking, compared to people with lower stress [5-7]. In particular, it has been reported that the intake of foods containing high amount of sugars or fats was increased under stress, and the intake of sugars was increased as stress was getting higher [8-10]. Higher intake of dietary sugars or sugar sweetened beverages would be leading to excess weight, dental caries, and cardiovascular disease and type 2 diabetes [11,12]. Also, some studies showed different stress levels depending on gender, that is, males preferred foods with higher nutrient content and convenient warm meals compared to females while females preferred crispy foods such as cookies, and the changes in food intake under stress were higher in females than in males and both males and females preferred spicy taste and sweet taste [13-15]. Although several studies have been performed on the relationship between stress and dietary factors and different researchers showed conflicting results, it is still insufficient and more studies on these topics are needed. It is very important to analyze the relationship between stress and the intake of sweet foods, since the stress recognition rate has been increased in the society in addition to the increased intake of favorite foods such as cookies, chocolates, and beverages of sweet taste as the intake of various snacks increases due to westernized dietary life recently. Thus, this study was performed to provide the basic data for nutrition education by investigating the current status of stress and the intake of sweet foods and by analyzing the relationship between the stress levels and the sweet food intake in college students (aged 18–28 years) in Seoul and Gyeonggi areas.

## METHODS

### Study participants

The survey was conducted in college students aged between 18 and 28 years in Seoul and Gyeonggi areas from June to September, 2014. We collected 1,050 copies of questionnaire collected and used data of 760 subjects (72.4%), excluding those with incomplete responses. This research was approved by the Institutional Review Board of Myongji University, Korea (mju-2014-09-004-02).

### Questionnaire

The survey questionnaire was made up of items related to general characteristics, health-related lifestyle, frequency and amount of sweet food intake, stress-related dietary habits, and the stress recognition rate. General characteristics of the subjects included age, height, weight, type of residence, monthly pocket money, and monthly household income. The body mass index (BMI) of each subject was calculated by dividing weight in kilograms by height on meters squared. BMI status was classified into the 4 groups: 1) underweight ( $< 18.5 \text{ kg/m}^2$ ), 2) normal weight ( $18.5\text{--}22.9 \text{ kg/m}^2$ ), 3) overweight ( $23.0\text{--}24.9 \text{ kg/m}^2$ ), and 4) obesity ( $\geq 25.0 \text{ kg/m}^2$ ). The health-related lifestyle consisted of sleeping hours, smoking, alcohol drinking, exercise, and concerns about health. The intake of sweet foods was measured by answering the number of intakes per month and the amount of food per each intake for 24 items, as in previous studies [16,17]. The 24 food items containing sugars were classified into the 6 groups: 1) confectionary (i.e., biscuit, cookie, and cereal); 2) candy and chocolate (i.e.,

candy, caramel, chocolate, and jelly); 3) bread (i.e., cream bread, muffin, cake, and waffle); 4) milk and dairy products (i.e., milk, yogurt, and ice cream); 5) drink (i.e., soy milk, fruit or vegetable juice, soda, sports drink, and Korean traditional drinks); and 6) coffee group (i.e., caramel latte, mocha coffee, frappe, and bubble tea). Total sugar intake was calculated by multiplying the frequency of food intake and the amount of each intake and adding up each amount of sugar intake. The stress recognition rate was measured by referring the stress measurement tool for Korea National Health and Nutrition Examination Survey developed in 2010 by Lee et al. [18] as a research project of Korea Centers for Disease Control and Prevention. This scale, which can evaluate the causes of stress and the responses to it experienced during the past one month, is made of a total of 20 questions in 3 sub-scales such as factor 1 (worries, fatigue and tension), factor 2 (depression and frustration), and factor 3 (anger and aggression). Each question was scored by Likert 5-point scale to make a total of 100 points. Questions for stress-related dietary habits were made up of items such as the changes of meal intake under stress and the preferences for taste at usual times and under stress, by modifying and supplementing the question items used in the previous study [16]. We conducted a pilot test of 30 college students and revised them for the final version of the questionnaire.

### Statistical analysis

The SPSS 21.0 statistics package was used for the analysis of this study data. Descriptive statistics were expressed as mean  $\pm$  standard deviation. Frequency analysis for health-related habit, stress cause and dietary habits of the subjects was performed. Significantly differences among groups were performed using Student's t-test,  $\chi^2$ -test and one-way analysis of variance, and Duncan multiple range test was performed if significance was present after significance testing among groups. A reliability test was used to assess the consistency of measurement items by stress score. The value of the Cronbach's alpha was 0.935. All the results were administered to examine the association between categorical variables using a significance level of  $p < 0.05$ .

## RESULTS

### General characteristics

General characteristics and health related habit of subjects are presented in **Table 1**. Among the 760 study samples, 48.7% were male students, which gender distribution was approximately balanced. The average age of the subjects was  $22.4 \pm 2.0$  years in males and  $20.9 \pm 1.8$  years in females, and the average BMI was  $22.9 \pm 2.7$  in males and  $20.0 \pm 2.1$  in females. The results for health-related factors showed that the average number of smoking, drinking alcohol and weekly exercise was higher in males than in females ( $p < 0.001$ ), and the subjective health status was more highly recognized as good in males compared to females ( $p < 0.001$ ).

### Monthly sugar intake from sweet foods

**Table 2** presents the monthly sugar intake amount from sweet foods. Monthly sweet food intake was higher in females as shown in biscuit & cookies ( $p < 0.01$ ), chocolate-containing snacks ( $p < 0.05$ ), candies, caramels and chocolates, and jelly ( $p < 0.001$ ), muffins & cakes ( $p < 0.01$ ), waffles & honey breads ( $p < 0.05$ ), flavored milk ( $p < 0.001$ ), drinking yogurt ( $p < 0.01$ ), caramel latte ( $p < 0.05$ ), mocha latte ( $p < 0.01$ ), and frappe & bubble tea ( $p < 0.001$ ). However, male subjects showed higher beverage intake such as carbonated drinks and traditional Korean beverages compared to females ( $p < 0.001$ ).

**Table 1.** General characteristics and health related habits of the subjects

Characteristics	Male (n = 370)	Female (n = 390)	Total (n = 760)	p-value
Age (yrs)	22.4 ± 2.0	20.9 ± 1.8		0.000***
Height (cm)	175.4 ± 5.1	161.5 ± 5.0		0.000***
Weight (kg)	70.5 ± 9.3	52.2 ± 6.4		0.000***
BMI (kg/m <sup>2</sup> ) <sup>1)</sup>				0.000***
Underweight	10 (2.7)	87 (22.3)	97 (12.8)	
Normal	209 (56.5)	276 (70.8)	485 (63.8)	
Overweight	88 (23.8)	19 (4.9)	107 (14.1)	
Obesity	63 (17.0)	8 (2.1)	71 (9.3)	
Mean ± SD	22.9 ± 2.7	20.0 ± 2.1	21.5 ± 2.4	
Hours of sleep (hrs/day)				0.655
< 6	102 (27.6)	107 (27.4)	209 (27.5)	
6-< 8	167 (45.1)	162 (41.5)	329 (43.3)	
≥ 8	101 (27.3)	121 (31.0)	222 (29.2)	
Smoking (cigarettes/day)				0.000***
None	262 (70.8)	368 (94.4)	630 (82.9)	
< 10	49 (13.2)	16 (4.3)	66 (8.6)	
10-< 15	29 (7.8)	2 (0.5)	31 (4.1)	
≥ 15	30 (8.1)	3 (0.8)	33 (4.4)	
Alcohol drinking				0.000***
Never	64 (17.3)	123 (31.5)	187 (24.6)	
1-2 times/month	117 (31.6)	146 (37.4)	263 (34.6)	
1-< 2 times/week	112 (30.3)	61 (15.6)	173 (22.8)	
≥ 2 times/week	67 (20.8)	60 (15.4)	137 (18.0)	
Frequency of exercise (times/week)				0.000***
Never	65 (17.6)	216 (55.4)	281 (37.0)	
1-< 2	123 (33.2)	85 (21.8)	208 (27.4)	
2-< 4	106 (28.6)	54 (13.8)	160 (21.1)	
≥ 4	76 (20.6)	35 (8.9)	111 (14.6)	
Concerns about health				0.000***
Little	3 (0.8)	4 (1.0)	7 (0.9)	
Some	35 (9.5)	71 (18.2)	106 (13.9)	
Normal	129 (34.9)	196 (50.3)	325 (42.8)	
Much	147 (39.7)	95 (24.4)	242 (31.8)	
Very much	56 (15.1)	24 (6.2)	80 (10.5)	
Type of residence				0.000***
Home with parents	158 (42.7)	277 (71.0)	435 (57.2)	
Dormitory, boarding of relative house	121 (32.7)	58 (14.9)	179 (23.6)	
Cooking for oneself or the others	91 (24.6)	55 (14.1)	146 (19.2)	
Monthly pocket money (KRW)				0.000***
< 300,000	130 (35.1)	176 (45.1)	306 (40.3)	
300,000-< 400,000	111 (30.0)	130 (33.3)	241 (31.7)	
≥ 400,000	129 (34.8)	84 (21.5)	213 (28.1)	
Monthly household income (KRW)				0.451
< 3,000,000	87 (24.1)	107 (27.9)	194 (26.0)	
3,000,000-< 5,000,000	128 (35.5)	136 (35.5)	264 (35.5)	
5,000,000-< 7,000,000	73 (20.2)	82 (21.9)	157 (21.1)	
≥ 7,000,000	73 (20.2)	56 (14.6)	129 (17.3)	

Values are presented as mean ± SD or number (%).

<sup>1)</sup>Underweight: < 18.5 kg/m<sup>2</sup>, normal: 18.5-22.9 kg/m<sup>2</sup>, overweight: 23-24.9 kg/m<sup>2</sup>, obesity: ≥ 25 kg/m<sup>2</sup>.

\*\*\*p < 0.001, significant difference between male and female by independent t-test and  $\chi^2$ -test.

### Dietary habits according to stress

**Table 3** shows the stress score and dietary habits according to stress. The stress score was 53.0 ± 15.1 in females and 50.0 ± 15.3 in males, showing higher stress in female students (p < 0.01). The stress score according to stress factors showed that females were significantly higher the factor 1 (worries, fatigue and tension) (p < 0.01) and factor 3 (anger and aggression) (p < 0.001) compared to males. For the causes of stress, females had more stress in circumstances

**Table 2.** Monthly sugar intake from sweet foods according to sex

Characteristics	Male (n = 370)	Female (n = 390)	Total (n = 760)	p-value
<b>Confectionaries (g)</b>				
Biscuit, cookies	30.9 ± 53.6	45.4 ± 67.9	38.4 ± 61.7	0.002**
Chips	16.2 ± 22.3	17.2 ± 21.9	16.8 ± 22.1	0.536
High-sugar cereals	54.0 ± 135.8	67.2 ± 124.2	60.8 ± 130.0	0.163
Chocolate-containing snacks	38.6 ± 74.4	49.7 ± 77.9	44.3 ± 76.4	0.047*
<b>Candies and chocolates (g)</b>				
Candies	13.7 ± 34.4	24.5 ± 52.7	19.2 ± 45.0	0.000***
Caramels	6.1 ± 19.9	11.6 ± 37.9	8.9 ± 30.6	0.000***
Chocolates	27.8 ± 57.4	56.6 ± 92.5	42.5 ± 78.7	0.000***
Jelly	36.5 ± 93.0	78.6 ± 148.1	58.1 ± 26.0	0.000***
<b>Breads (g)</b>				
Stuffed breads	61.1 ± 80.0	60.1 ± 89.4	60.9 ± 87.9	0.808
Muffins, cakes	37.7 ± 58.8	54.5 ± 87.5	46.3 ± 75.3	0.002**
Waffles, honey breads	9.7 ± 22.4	13.1 ± 23.2	11.4 ± 22.9	0.042*
<b>Milk and dairy products (g)</b>				
Flavored milk	152.5 ± 212.9	120.8 ± 150.1	136.2 ± 184.0	0.000***
Drinking yogurt	81.0 ± 126.5	100.3 ± 158.8	90.9 ± 144.2	0.007**
Yogurt	81.1 ± 168.4	95.0 ± 145.2	88.2 ± 157.0	0.225
Ice cream	182.6 ± 206.5	200.8 ± 203.6	191.9 ± 205.1	0.221
<b>Beverages (g)</b>				
Soy milk	24.5 ± 55.1	22.0 ± 50.3	23.2 ± 52.7	0.513
Juice	107.0 ± 172.3	110.9 ± 146.8	109.0 ± 159.6	0.735
Carbonated drinks	209.6 ± 225.0	176.0 ± 247.5	192.3 ± 237.3	0.051
Sports drinks	79.9 ± 95.2	40.0 ± 65.3	59.4 ± 83.6	0.000***
Traditional Korean beverages	51.8 ± 88.3	28.3 ± 57.4	39.8 ± 74.9	0.000***
<b>Coffees (g)</b>				
Caramel latte	26.6 ± 73.9	38.2 ± 145.5	32.5 ± 116.3	0.024*
Mocha latte	37.7 ± 101.8	56.5 ± 184.0	47.3 ± 149.9	0.007**
Frappe	52.0 ± 101.5	116.0 ± 193.3	84.8 ± 158.7	0.000***
Bubble tea	28.2 ± 74.7	67.2 ± 177.2	48.2 ± 138.5	0.000***
Total	1,447.3 ± 1,186.8	1,648.0 ± 1,344.2	1,550.1 ± 1,273.0	0.030*

Values are presented as mean ± SD.

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001, significant difference between male and female by independent t-test.

**Table 3.** Stress score and dietary habits according to stress

Characteristics	Male (n = 370)	Female (n = 390)	Total (n = 760)	p-value
<b>Stress score<sup>1)</sup></b>				
Factor 1	27.5 ± 8.3	29.1 ± 8.0	28.4 ± 8.2	0.008**
Factor 2	13.1 ± 5.0	13.6 ± 5.0	13.4 ± 5.0	0.123
Factor 3	9.3 ± 3.6	10.3 ± 3.8	9.8 ± 3.7	0.001***
Total	50.0 ± 15.3	53.0 ± 15.1	51.5 ± 15.3	0.005**
<b>Stress cause</b>				
Circumstances associated with the school	170 (45.9)	236 (60.5)	406 (53.4)	0.000***
Interpersonal relationships	100 (27.0)	84 (21.6)	184 (24.2)	
Own or someone else's illness	9 (2.4)	9 (2.3)	18 (2.4)	
Money matters	54 (14.6)	43 (11.0)	97 (12.8)	
Unusual events	3 (0.8)	5 (1.3)	8 (1.1)	
No changes in the daily life	34 (9.2)	13 (3.3)	47 (6.2)	
<b>Changes in meal size</b>				
Increased a lot	43 (11.6)	90 (23.1)	133 (17.5)	0.000***
Increased	122 (33.0)	154 (39.5)	276 (36.3)	
No change	164 (44.3)	88 (22.6)	252 (33.2)	
Decreased	23 (6.2)	47 (12.1)	70 (9.2)	
Decreased a lot	18 (4.9)	11 (2.8)	29 (3.8)	

Values are presented as mean ± SD and number (%).

<sup>1)</sup>Factor 1: worries, fatigue and tension; Factor 2: depression and frustration; Factor 3: anger and aggression.

\*\*p < 0.01, \*\*\*p < 0.001, significant difference between male and female by independent t-test and  $\chi^2$ -test.

**Table 4.** Changes in preferred taste<sup>1)</sup> according to stress

Characteristics	Normal	Stress	Distance	p-value
Male (n = 370)				
Sweet	4.0 ± 1.2	4.1 ± 1.1	0.1 ± 0.9	0.120
Salt	3.5 ± 1.2	3.3 ± 1.1	-0.3 ± 0.9	0.000***
Sour	2.6 ± 1.1	2.6 ± 1.0	-0.1 ± 0.9	0.252
Bitter	1.6 ± 1.0	1.6 ± 1.0	-0.0 ± 0.6	0.689
Spicy	3.3 ± 1.3	3.5 ± 1.4	0.3 ± 1.0	0.000***
Female (n = 390)				
Sweet	4.1 ± 1.1	4.2 ± 1.0	0.2 ± 0.9	0.000***
Salt	3.2 ± 1.2	2.9 ± 0.9	-0.2 ± 0.9	0.000***
Sour	2.8 ± 1.0	2.6 ± 0.8	-0.3 ± 0.9	0.000***
Bitter	1.4 ± 0.8	1.3 ± 0.7	-0.1 ± 0.6	0.012*
Spicy	3.6 ± 1.2	4.0 ± 1.1	0.4 ± 0.9	0.000***

Values are presented as mean ± SD.

<sup>1)</sup>Preferred taste score: 5, best; 4, good; 3, so so; 2, bad; 1, worst.

\*p < 0.05, \*\*\*p < 0.001, significant difference about preferred taste according to stress by paired t-test.

associated with the school (60.5%) compared to males (45.9%), and males had more stress in interpersonal relations (27.0%) and money related problems (14.6%) compared to females (p < 0.001). For changes in food intakes under stress, the intake was greatly increased in females than in males (p < 0.001).

Changes in preferred taste according to stress are presented in **Table 4**. For food preference changes before and after stress, males preferred more hot and spicy foods (3.5 ± 1.4 vs. 3.3 ± 1.3) and less salty foods (3.3 ± 1.1 vs. 3.5 ± 1.2) under stress compared to normal condition (p < 0.001). Females significantly preferred more sweet (4.2 ± 1.0 vs. 4.1 ± 1.1) and spicy foods (4.0 ± 1.1 vs. 3.6 ± 1.2) and less salty (2.9 ± 0.9 vs. 3.2 ± 1.2) and sour foods (2.6 ± 0.8 vs. 2.8 ± 1.0) under stress compared to normal condition (p < 0.001).

### Sweet food intake by the stress factor

Sweet food intake by the stress factor in female and male students were shown in **Tables 5** and **6**. In the state of factor 1 (worries, fatigue and tension), the intake of biscuits and cookies was significantly higher in females (p < 0.01) and the intake of chocolate-containing snacks was significantly higher in males (p < 0.05) compared those in the state factor 2 (depression and frustration) and factor 3 (anger and aggression). In the state of factor 3 (anger and aggression), the intake of waffles & honey breads (p < 0.05), drinking yogurt (p < 0.05), yogurt (p < 0.01), ice cream (p < 0.001), sports drinks (p < 0.01) and frappe (p < 0.05) was significantly higher in females than those in the condition of factor 1 (worries, fatigue and tension). Additionally, in the condition of factor 3 (anger and aggression), intake of flavored milk (p < 0.05), drinking yogurt (p < 0.01), yogurt (p < 0.05) and soy milk (p < 0.01) was significantly higher in males compared those in the state of factor 1 (worries, fatigue and tension).

## DISCUSSION

The stress score of the subjects in the study was higher in female students than in male students. The study on stress and dietary behaviors of college students in Seoul and Incheon areas [19] and the study on Swedish college students [20] showed that female students had higher stress condition than male students, which is consistent with the results of our study showing females were more sensitive to stress than males. The causes of stress were higher in the order of academic affairs, interpersonal relationship, and financial problems. In the study

**Table 5.** Sweet food intake by the stress factor in females

Characteristics	Factor 1 <sup>1)</sup> (n = 91)	Factor 2 (n = 76)	Factor 3 (n = 76)	p-value
<b>Confectionaries (g)</b>				
Biscuit, cookies	48.88 ± 56.39 <sup>a</sup>	24.18 ± 29.48 <sup>b</sup>	32.33 ± 51.34 <sup>b</sup>	0.003 <sup>**</sup>
Chips	18.44 ± 20.96	14.97 ± 14.58	17.05 ± 17.76	0.470
High-sugar cereals	53.31 ± 98.47	62.17 ± 115.73	68.68 ± 120.50	0.668
Chocolate-containing snacks	40.23 ± 61.29	33.58 ± 46.44	35.32 ± 67.90	0.751
<b>Candies and chocolates (g)</b>				
Candies	16.40 ± 35.63	16.24 ± 45.08	17.27 ± 29.63	0.983
Caramels	5.23 ± 15.43	6.40 ± 13.38	10.40 ± 24.49	0.172
Chocolates	37.94 ± 80.33	40.39 ± 61.21	42.99 ± 78.09	0.908
Jelly	49.58 ± 97.56	57.99 ± 90.27	86.30 ± 178.94	0.161
<b>Breads (g)</b>				
Stuffed breads	47.83 ± 61.57	68.76 ± 97.64	68.25 ± 96.90	0.192
Muffins, cakes	41.72 ± 57.36	45.35 ± 59.47	47.28 ± 68.04	0.838
Waffles, honey breads	7.56 ± 13.21 <sup>a</sup>	12.40 ± 16.01 <sup>b</sup>	13.14 ± 16.24 <sup>b</sup>	0.034 <sup>*</sup>
<b>Milk and dairy products (g)</b>				
Flavored milk	118.29 ± 186.03	168.71 ± 248.17	147.62 ± 156.03	0.262
Drinking yogurt	59.34 ± 97.67 <sup>a</sup>	82.24 ± 113.33 <sup>ab</sup>	105.76 ± 127.27 <sup>b</sup>	0.031 <sup>*</sup>
Yogurt	42.74 ± 77.08 <sup>a</sup>	123.10 ± 260.27 <sup>b</sup>	109.96 ± 159.92 <sup>b</sup>	0.007 <sup>**</sup>
Ice cream	121.37 ± 119.96 <sup>a</sup>	192.88 ± 167.80 <sup>b</sup>	199.71 ± 169.43 <sup>b</sup>	0.001 <sup>***</sup>
<b>Beverages (g)</b>				
Soymilk	15.64 ± 40.00	16.32 ± 36.96	22.78 ± 41.55	0.458
Juice	113.26 ± 149.55	89.45 ± 119.20	112.18 ± 135.25	0.465
Carbonated drinks	169.12 ± 219.21	189.24 ± 198.23	167.30 ± 194.87	0.761
Sports drinks	34.30 ± 61.98 <sup>a</sup>	50.33 ± 51.82 <sup>ab</sup>	71.94 ± 92.30 <sup>b</sup>	0.003 <sup>**</sup>
Traditional Korean beverages	27.83 ± 57.71	37.16 ± 65.50	32.93 ± 52.09	0.590
<b>Coffees (g)</b>				
Caramel latte	34.49 ± 127.26	23.06 ± 82.83	34.09 ± 90.64	0.736
Mocha latte	47.85 ± 201.93	43.51 ± 146.32	60.06 ± 172.31	0.835
Frappe	60.38 ± 106.82 <sup>a</sup>	78.53 ± 124.54 <sup>ab</sup>	106.94 ± 127.11 <sup>b</sup>	0.043 <sup>*</sup>
Bubble tea	33.87 ± 62.34	45.63 ± 97.50	69.51 ± 122.54	0.055

Values are presented as mean ± SD.

<sup>1)</sup>Factor 1: worries, fatigue and tension; Factor 2: depression and frustration; Factor 3: anger and aggression.

<sup>a,b</sup>Different letters within a category represent statistical differences by sweet food intakes from Duncan's multiple test.

\*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001.

on stress in some adults in Chungnam area, the causes of stress were higher in the order of job, interpersonal relationship, one's own personality, and financial problems [21], and in the study on stress in college students [22], the causes of stress were higher in the order of identity-related factors, study related things, and financial problems, suggesting that college students receive greater stress from factors closely related to them.

The amount of meal intake was slightly increased under stress due to stress-oriented dietary habits, which is consistent with the result of the previous study showing that the response that the amount of meal intake was slightly increased was significantly higher in high school students under stress [17]. The changes of taste preferences before and after stress showed that the preference for spicy taste was significantly increased in male students and the preference for sweet taste and spicy taste was significantly increased in female students. In the study on worker's stress and dietary life [23], the workers preferred spicy taste and sweet taste under stress, and in the study on college students' dietary behaviors and stress [24], male students mostly preferred spicy taste and female students preferred sweet taste and spicy taste, suggesting that adults in their 20s tend to prefer spicy taste and sweet taste under the condition of stress.

The amount of sweet food intake for one month was higher in female students compared to male students in most foods, except sugar containing milk, sports drink, and Korean

**Table 6.** Sweet food intake by the stress factor in males

Characteristics	Factor 1 <sup>1)</sup> (n = 63)	Factor 2 (n = 101)	Factor 3 (n = 52)	p-value
<b>Confectionaries (g)</b>				
Biscuit, cookies	43.01 ± 61.55	37.19 ± 61.39	36.41 ± 63.16	0.804
Chips	21.79 ± 28.92	16.47 ± 18.54	15.46 ± 18.39	0.223
High-sugar cereals	118.14 ± 248.10	68.17 ± 158.54	64.21 ± 181.71	0.211
Chocolate-containing snacks	67.40 ± 101.37 <sup>a</sup>	38.29 ± 65.16 <sup>b</sup>	40.78 ± 52.52 <sup>b</sup>	0.044 <sup>*</sup>
<b>Candies and chocolates (g)</b>				
Candies	26.66 ± 53.35	16.16 ± 29.18	11.90 ± 22.23	0.077
Caramels	6.07 ± 16.66	10.68 ± 25.10	8.65 ± 20.03	0.417
Chocolates	30.75 ± 50.56	43.07 ± 75.39	37.55 ± 53.07	0.486
Jelly	61.89 ± 144.72	84.02 ± 210.37	83.89 ± 216.75	0.752
<b>Breads (g)</b>				
Stuffed breads	53.11 ± 73.49	59.23 ± 61.12	59.40 ± 58.41	0.814
Muffins, cakes	42.69 ± 50.10	50.91 ± 83.48	53.24 ± 87.97	0.723
Waffles, honey breads	12.55 ± 25.26	14.15 ± 19.19	15.61 ± 22.18	0.754
<b>Milk and dairy products (g)</b>				
Flavored milk	99.30 ± 107.14 <sup>a</sup>	167.90 ± 186.61 <sup>b</sup>	177.37 ± 199.45 <sup>b</sup>	0.020 <sup>*</sup>
Drinking yogurt	72.62 ± 130.66 <sup>a</sup>	141.34 ± 190.43 <sup>b</sup>	174.76 ± 228.89 <sup>b</sup>	0.010 <sup>**</sup>
Yogurt	52.56 ± 84.00 <sup>a</sup>	111.89 ± 165.32 <sup>b</sup>	119.27 ± 169.97 <sup>b</sup>	0.021 <sup>*</sup>
Ice cream	193.37 ± 187.32	229.12 ± 220.18	252.83 ± 246.73	0.334
<b>Beverages (g)</b>				
Soymilk	8.58 ± 15.87 <sup>a</sup>	34.97 ± 67.45 <sup>b</sup>	44.45 ± 82.05 <sup>b</sup>	0.005 <sup>**</sup>
Juice	107.15 ± 208.71	116.82 ± 144.75	131.04 ± 162.13	0.754
Carbonated drinks	217.08 ± 290.42	192.16 ± 227.66	208.89 ± 233.24	0.810
Sports drinks	61.04 ± 87.06	82.36 ± 95.80	77.28 ± 83.55	0.335
Traditional Korean beverages	28.87 ± 48.92	37.21 ± 69.08	45.61 ± 85.47	0.427
<b>Coffees (g)</b>				
Caramel latte	44.32 ± 213.13	30.73 ± 65.39	23.76 ± 44.19	0.661
Mocha latte	51.97 ± 231.01	55.79 ± 134.13	63.38 ± 137.88	0.935
Frappe	111.74 ± 281.19	103.76 ± 141.88	118.15 ± 171.76	0.909
Bubble tea	37.58 ± 117.99	79.99 ± 140.08	83.18 ± 143.01	0.099

Values are presented as mean ± SD.

<sup>1)</sup>Factor 1: worries, fatigue and tension; Factor 2: depression and frustration; Factor 3: anger and aggression.

<sup>a,b</sup>Different letters within a category represent statistical differences by sweet food intakes from Duncan's multiple test.

\*p < 0.05, \*\*p < 0.01.

traditional beverages in which male students had higher intakes. The previous study indicated the similar results by showing that female college students consumed more sweet foods under stress than male college students [19]. In the previous study comparing stress and food consumption, the higher the stress, the more frequent the consumption of fast food-type instant snacks and sandwiches was. In addition, the total sample consumption of foods with high sugar content was higher than that of fruits and vegetables [25].

A foreign study on stress reported that the intake of sugar- or fat-concentrated foods was increased under stress [26]. In our study, there was no significant difference in the correlation between stress and sweet food intake, which was not included in the results. However, female students consumed more sweet foods under stress and had significantly higher stress score compared to male students, which suggests that stress affects the intake of sweet foods, in addition to similar results from a number of domestic studies [7,15].

The intake of sweet foods by stress factors showed that the intake of snacks was higher in the condition of 'worries, fatigue and tension' and the intake of beverages was significantly increased in the condition of 'anger and aggression'. Previous studies related to this reported that stress caused rough language and aggressive actions possibly leading to undesirable dietary habits [27], and in the relationship among stress, depression and dietary behaviors



in high school students, the higher degree of stress or depression was related to irregular meal numbers and meal time [28]. Also in the study on the tendency of food intake by stress in adults [29], the dietary habits were poor as the condition of tension and stress was higher, which was similar to the results of this study. This study provides invaluable information for developing nutrition intervention programs in South Korea to improve the dietary habits and the nutritional status by understanding how demographic characteristics and diet behaviors are associated with stress. For the future studies, we suggest use of the national representative samples of college students in South Korea and use of the validated food frequency questionnaire of sweet foods for college students.

## SUMMARY

In the study, the intake of sweet foods and the stress status for one month were surveyed and compared in male and female college students. From the analysis on the relationship between stress status and sweet food intake, both male and female students preferred sweet taste under stress. For the intake of sweet foods by stress condition, the intake of snacks was higher in the condition of 'worries, fatigue and tension' and the intake of beverages was higher in the condition of 'anger and aggression'. From the above results, we have known that sweet foods were preferred under stress and the amount of intake was also increased. Thus, it is thought that the education on food selection and nutrition information should be provided to prevent health problems that can be developed by reckless intake of sweet foods, and the active guidance is needed for college students to select proper snacks instead of nutritionally insufficient foods to relieve stress. It is also considered that national supportive measures are needed to develop various programs and personality education to reduce stress of college students which can be continuously maintained throughout the adulthood.

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