

Influence of stress on snack consumption in middle school girls*

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Received November 5, 2007; Revised November 29, 2007; Accepted December 12, 2007

Abstract

Stress has been known to change dietary behaviors and food intakes in individuals. The purpose of this study was to investigate the effect of stress level on the frequency and the amount of snack consumption. The high stress group (HS) showed significantly higher frequency of consumption for bread, chips, cookies, ramyeon, and frozen snacks ($p < 0.05$) compared to low stress group (LS) with higher frequency of snack consumption ($p < 0.01$), and increased intakes of energy, carbohydrates, and sodium from snacks ($p < 0.01$) than LS. As the stress level became higher, the proportions of students with irregular meals, overeating, and night snacking increased ($p < 0.01$). Also, 33.0% of the subjects answered that they consumed an increased amount of snacks when they were feeling stressed. Our results indicated that stress has negative influence on snack consumption in middle school girls.

Key Words: Stress, snack consumption, middle school girls

Introduction

Adolescence is an important period of growth as well as establishment of healthy dietary behaviors for balanced nutrient intakes. Balanced nutrient intakes promote appropriate physical growth and development and play an important role in maintaining mental and emotional stability. However, three meals a day may not be sufficient for providing nutrients required for growth, and snack consumption between regular meals are necessary to supplement nutrients.

A healthy snack includes some foods that have short gastric emptying time, lower degree of satiety, and various nutrients with 10-15% of daily total energy intake (Koo *et al.*, 2006). However, according to previous studies (Jang *et al.*, 2000; Joo & Park, 1998; Joo *et al.*, 2006; Kwon, 2005; Park & Kim, 1995; Park, 2003), adolescents eat snacks too frequently and sometimes replace meals with snacks, and then overeat the next meal, and are more likely to become obese by consuming high calorie snacks such as soft drinks and cookies. In addition, the preference for a specific snack food may result in preference of rejecting a certain food. Improper dietary attitude can lead to consuming a large amount of snacks, and further to undesirable dietary behaviors such as skipping or irregular of meals. Factors associated with snack consumption have been reported to be a sense of values, belief, knowledge, attitude, economic status, parents' occupations and academic background, number of siblings and family members, and birth order (Choi, 1995; Joo

& Park, 1998; Parraga, 1990).

Meanwhile, stress has been reported to affect dietary behaviors. Adler (1994) reported that stress had influences on health behaviors, particularly dietary behaviors such as increasing dietary intakes. One study of elementary · middle · high school students in Korea showed that dietary behaviors changed during the school examination periods when students were under stress (Jang *et al.*, 2000). Also in Kim's study among high school students, (2001) increased stress induced overeating. Some studies on the relationship between stress and certain nutrients showed that individuals with higher levels of stress consumed more carbohydrates (McCann, 1990; Michard, 1990; Wardle, 2000), and another study (Oliver, 1999) showed that individuals with greater stress chose high carbohydrates or high fat foods. In Yeom's (2001) study with elementary school students, subjects with higher stress levels had higher intakes of fat and vitamin B₁ and lower intakes of calcium and vitamin C.

Adolescents are full of anxiety, conflict, and agony. They experience the most significant changes and the most serious stress than in any other developmental stage because of many tasks to be accomplished (Han & Cho, 2000). Such stress can greatly affect eating habits and health of adolescents. As snacks tend to value preference more than nutrition, unhealthy snack consumption behaviors due to stress may have adverse effects on health.

Although there are some reports on the associations of stress and eating behaviors in adolescents, few studies have observed

* This study was supported by the research grant of the Chungbuk National University in 2006.

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the relationship between stress and snack consumption. Previous studies showed that stress was higher in female students than in male students (Han & Cho, 2000; Kim *et al.*, 1995; Kim *et al.*, 2002; Lee & Park, 2000) and so was the frequency of snack consumption (Cho, 1993; Ha & Lee, 1995; Kim & Park, 2004; Lee *et al.*, 1985; Park & Kim, 1995).

Therefore, this study was performed to investigate the status of stress and the relationship between stress and snack consumption in middle school girls.

Subjects and Methods

Subjects

This study was performed by using a survey questionnaire for female students in three middle schools located in Suwon. The preliminary survey was undertaken for 41 middle school girls from June 10 to June 11, 2005, and the survey questionnaire was modified and complemented based on the results of the preliminary study. The survey of the study was performed between July 7 and July 15, 2005; a total of 370 questionnaires were distributed and 360 were collected (response rate 97.3%). Finally, a total of 350 questionnaires were used in the statistical analysis, excluding 10 with incomplete answers for the analysis.

Characteristics of subjects

For general characteristics of subjects, 5 questions such as grade, father's occupation, the presence of mother's occupation, monthly household income, and monthly allowance were included. Questions on dietary behavior were constructed with reference to previous studies (Ha & Lee, 1995; Hong, 1999; Jang *et al.*, 2000; Yeom, 2001), including 4 questions such as regularity of meals, frequency of overeating, frequency of skipping breakfast, and reasons for skipping breakfast.

Measurement tools of stress

The questionnaire for stress measurement was used with 7 categories related to parents, home environment, friends, study, teachers and school, body, and boyfriends, for a total of 45 questions as in the previous studies (Kim, 2000; Kim, 2003; Yoo & Han, 1995).

The Cronbach's α of questions in 7 categories were 0.70~0.85. The degree of stress was checked by the 4-point Likert scale, and scored as follows: 1 for 'Disagree strongly', 2 for 'Agree slightly', 3 for 'Agree', and 4 for 'Agree strongly', and thus the higher score meant a higher degree of stress. Participants were divided into 3 groups according to the total stress score: low stress group (LS) with the score of lower 0%~25%, medium stress group (MS) with the score of 25%~75%, and high stress group (HS) with the score of 75%~100%.

Development of a questionnaire on snack consumption behaviors

A questionnaire on behaviors of snack consumption was developed with reference to previous studies (Lee & Han, 1996; Park & Kim, 1995; Park, 2003) and 'a collection of survey questions related to dietary practices' (2000). Four questions included were the frequencies of snack consumption, craving for snacks, frequency of night snacks, and change of snack consumption in stressful conditions.

Development of a semi-quantitative food frequency questionnaire and calculation of nutrient intake

A questionnaire on the frequency of snack consumption was also constructed with reference to previous studies (Choi *et al.*, 1995; Lee & Han, 1996; Park & Kim, 1995; Park, 2003) and 'a collection of survey questions related to dietary practices' (2000). Seventeen snack items, frequently consumed by middle school students such as bread, chips, cookies etc. were selected, and for each snack item, five frequency categories including 'almost everyday', '3~5 times a week', '1~2 times a week', '2~3 times a month', 'rarely' were presented, and for each snack item, eating frequencies per week were calculated as follows: 7 times a week for 'Almost everyday', 4 times a week for '3~5 times a week', 1.5 times a week for '1~2 times a week', 0.625 times a week for '2~3 times a month', and 0.25 times a week for 'Rarely'.

The amount of snacks consumed by the subject was assessed using a semi-quantitative food frequency questionnaire. Frequency and a portion size of snacks frequently consumed were checked in the questionnaire using DS 24 program. Three different portion sizes were presented as shown in reference materials (National Rural Living Science Institute, 2002; The Korean Dietetic Association, 1999; The Korean Nutrition Society, 2000).

Statistical analysis

All statistical analyses were performed by using SPSS 12.0 program. For general characteristics, dietary behaviors, snack consumption of the subjects, the frequency and percentage, average and standard deviation were calculated.

To investigate the relationships among stress and snack consumption behavior, frequency of snack consumption by types, and daily average nutrient intakes from snack, χ^2 -test, analysis of variance and Duncan's post hoc test, Pearson's correlation analysis were performed.

Results

Characteristics of the subjects

1) General characteristics

General characteristics of the subjects are shown in Table 1. The subjects consisted of 198-8th grade and 152-9th grade female

Table 1. General characteristics of the subjects

Item	Group	n(%)
Grade	8th grade	198(56.6)
	9th grade	152(43.4)
	Total	350(100.0)
Father's job	Sales, service (office worker)	123(35.1)
	Self-employed	121(34.5)
	Management, professional	46(13.2)
	Production, labor	43(6.0)
	Others	17(4.9)
	Total	350(100.0)
Mother's job	Yes	171(49.0)
	No	178(51.0)
	Total	349(100.0)
Monthly household income (won)	<1,000,000	13(3.7)
	1,000,000 ~ 1,999,999	49(14.0)
	2,000,000 ~ 2,999,999	113(32.7)
	3,000,000 ~ 3,999,999	91(26.3)
	>4,000,000	81(23.3)
	Total	347(100.0)
Monthly allowance (won)	<30,000	202(57.9)
	30,000 ~ 49,999	115(33.0)
	50,000 ~ 69,999	22(6.3)
	>70,000	4(2.8)
	total	343(100.0)

Table 2. Characteristics of dietary behaviors of the subjects

Item	Group	n(%)
Regularity of meals	Always regular	92(26.3)
	Sometimes irregular	189(54.0)
	Always irregular	69(19.7)
	Total	350(100.0)
Frequency of overeating	Almost everyday	14(4.0)
	Sometimes	118(33.7)
	Rarely	169(48.3)
	Never	49(14.0)
	Total	350(100.0)
Frequency of skipping breakfast	Never	215(61.4)
	Sometimes	58(16.6)
	Often	44(12.6)
	Always	33(9.4)
	Total	350(100.0)
Reason for skipping breakfast	Oversleeping	46(34.1)
	Habitually	44(32.6)
	No appetite	33(24.5)
	Others	12(8.8)
	Total	135(100.0)

students. Fathers' occupations were mostly office workers (35.1%) and self-employed (34.5%), and 49.0% of mothers had jobs.

The monthly average household income was mostly 2-3 million won (32.7%), and more than half had a monthly allowance of less than 30,000 won (57.9%), followed by 30,000~49,999 won (33.0%) and 50,000~69,999 won (6.3%).

Table 3. Stress score by category of stress and stress level

Category of stress	Stress score ¹⁾				Mean (SD)
	LS ³⁾ (n=83)	MS ⁴⁾ (n=175)	HS ⁵⁾ (n=82)	Total(n=340)	
Parents related	1.27(0.27)	1.82(0.48)	2.56(0.58)	1.86(0.65)	
Home environment related	1.08(0.17)	1.31(0.32)	1.88(0.58)	1.39(0.47)	
Friends related	1.07(0.19)	1.31(0.34)	1.77(0.57)	1.36(0.45)	
Study related	1.81(0.43)	2.58(0.54)	3.13(0.46)	2.52(0.68)	
Teachers & school related	1.24(0.23)	1.62(0.38)	2.19(0.47)	1.66(0.50)	
Body related	1.52(0.38)	2.25(0.59)	2.96(0.57)	2.24(0.74)	
Boyfriend related	1.67(0.44)	2.21(0.53)	2.81(0.61)	2.22(0.66)	
Total stress ²⁾	1.38(0.14)	1.87(0.17)	2.47(0.24)	1.90(0.42)	

¹⁾ Stress was scored 1~4 points using a 4-point Likert scale. A higher score means higher stress

²⁾ Total stress means the average for a total of 45 questions on stress

³⁾ LS: low stress group with a total stress score of lower 0%~25%

⁴⁾ MS: medium stress group with a total stress score of 25%~75%

⁵⁾ HS: high stress group with a total stress score of 75%~100%

2) Characteristics of dietary behaviors (Table 2)

For the regularity of meals, 73.7% of the subjects answered as irregular (sometimes irregular 54.0%, always irregular 19.7%), and 37.7% of the subjects answered with overeating habits (sometimes 33.7%, everyday 4.0%).

For skipping breakfast, 22.0% answered as skipping breakfast 'always' or 'often', and the reasons for skipping breakfast were 'oversleeping' (34.1%), 'habitually' (32.6%), and 'no appetite' (24.5%), in respective order.

Status of stress

The average stress score was 1.90 out of 4 points (Table 3). While the average score of HS group was 2.47 points and those of MS and LS groups were 1.87 and 1.38 points, respectively. Study-related stress was the highest as 2.52 points, and then body related stress (2.24 points), boyfriend-related stress (2.22 points), parent-related stress (1.86 points), teachers and school-related stress (1.66 points), home environment-related stress (1.39 points), and friends-related stress (1.36 points) in that order.

Stress and snack consumption

1) Stress and behaviors of snack consumption

The frequency of snack consumption was the highest in answering '1~2 times a day' as 39.1%, and the rate for 'over 3 times a day' was 30.6% (3~4 times a day 8.8%, more than 4 times a day 21.8%). For the desire for snacks, 98.5% of the respondents answered as 'yes'. The frequency of night snacking per week was the highest in '1~2 times a week' as 36.8% and then '3~5 times a week' as 34.1%. 33.0% of the subjects answered that they consumed an increased amount of snacks when they were more stressed. The results of χ^2 test, which was performed to find out the influence of stress level on the snack

Table 4. Snacking behaviors of the subjects by stress level

						n (%)
Item	Group	LS ¹⁾	MS ²⁾	HS ³⁾	Total	χ^2 value
Snacking frequency	Never	5(6.0)	5(2.9)	0(0.0)	10(2.9)	15.604 [*]
	2~3 times a week	23(27.7)	53(30.3)	17(20.7)	93(27.4)	
	1~2 times/day	38(45.8)	65(37.0)	30(36.6)	133(39.1)	
	3~4 times/day	6(7.2)	12(6.9)	12(14.6)	30(8.8)	
	>4 times/day	11(13.3)	40(22.9)	23(28.1)	74(21.8)	
	Total	83(100.0)	175(100.0)	82(100.0)	340(100.0)	
Desire for snack	Never	1(1.2)	3(1.7)	1(1.2)	5(1.5)	16.358 [*]
	Slightly	51(61.4)	74(42.3)	32(39.0)	157(46.1)	
	Moderately	27(32.4)	70(40.0)	42(51.3)	139(40.9)	
	Very much	4(4.8)	28(16.0)	7(8.5)	39(11.5)	
	Total	83(100.0)	175(100.0)	82(100.0)	340(100.0)	
Frequency of night snacking	None	20(24.1)	32(18.3)	8(9.8)	60(17.6)	17.918 ^{**}
	1~2 times/week	40(48.2)	59(33.7)	26(31.7)	125(36.8)	
	3~5 times/week	17(20.5)	63(36.0)	36(43.9)	116(34.1)	
	6~7 times/week	6(7.2)	21(12.0)	12(14.6)	39(11.5)	
	Total	83(100.0)	175(100.0)	82(100.0)	340(100.0)	
Changes of snacking under stress	None	19(22.9)	18(10.3)	11(13.4)	48(14.1)	23.131 ^{**}
	Less than usual	7(8.4)	31(17.7)	7(8.5)	45(13.2)	
	Same as usual	35(42.2)	76(43.4)	24(29.3)	135(39.7)	
	More than usual	22(26.5)	50(28.6)	40(48.8)	112(33.0)	
	Total	83(100)	175(100)	82(100)	340(100)	

* p<0.05, ** p<0.01

¹⁾ LS: low stress group with a total stress score of lower 0%~25%²⁾ MS: medium stress group with a total stress score of 25%~75%³⁾ HS: high stress group with a total stress score of 75%~100%

consumption behavior, as presented in Table 4, showed that middle school girls with higher stress levels (HS) had higher daily frequencies of snack consumption and weekly night snacking, and higher rates of answering 'yes' for the desire for snacks compared to those with lower stress levels (LS). HS group showed higher snack consumption under stress conditions than usual compared to LS group (Table 4).

2) Stress and frequency of snack consumption

Table 5 presents the six snack types which showed significant differences by ANOVA test to find out the influence of stress

Table 5. Comparison of snack foods consumption frequency per week by stress level

Type	LS ¹⁾ (n=83)	MS ²⁾ (n=175)	HS ³⁾ (n=82)	Total (n=340)	F-value
Bread (bun)	1.05 (1.43) ^a	1.11 (1.24) ^a	1.53 (1.65) ^b	1.20 (1.41)	3.187 [*]
Chips	2.44 (2.08) ^a	2.76 (2.15) ^{ab}	3.28 (2.42) ^b	2.80 (2.22)	3.038 [*]
Cookies	1.71 (1.95) ^a	1.65 (1.71) ^a	2.39 (2.36) ^b	1.84 (1.96)	4.343 [*]
Soft drinks	1.09 (1.36) ^a	1.67 (1.89) ^b	1.29 (1.36) ^{ab}	1.44 (1.67)	3.729 [*]
Ramyeon	1.51 (1.27) ^a	1.73 (1.50) ^a	2.54 (2.12) ^b	1.87 (1.66)	9.596 ^{***}
Frozen sweets	3.29 (2.38) ^a	3.88 (2.38) ^{ab}	4.20 (2.36) ^b	3.81 (2.39)	3.141 [*]
Total snacks/day	1.85 (0.97) ^a	1.95 (0.78) ^a	2.20 (0.95) ^b	2.00 (0.88)	3.474 [*]

* p<0.05, *** p<0.001

^{ab}: different superscripts are significantly different at p<0.05¹⁾ LS: low stress group with a total stress score of lower 0%~25%²⁾ MS: medium stress group with a total stress score of 25%~75%³⁾ HS: high stress group with a total stress score of 75%~100%

level of the subject on the frequency of snack consumption by type. Among snack types, bread, cookies, and ramyeon showed the highest weekly frequency in the high stress group (HS) compared to other two groups (MS, LS), and chips and frozen snacks also showed higher frequencies in the HS group than in the LS group. Total frequency of snack consumption per day was 2.2 in the HS group which was significantly higher (p<0.05) than those of LS group (1.85) and MS group (1.95).

3) Stress and nutrient intakes from snack consumption

The results of ANOVA test, which was performed to find out

Table 6. Daily nutrient intake from snack consumption by stress level

Nutrient	LS ¹⁾ (n=49)	MS ²⁾ (n=114)	HS ³⁾ (n=55)	Total (n=218)	F-value
Energy(kcal)	717.8 (355.6) ^a	845.6 (388.2) ^{ab}	948.8 (474.5) ^b	842.9 (410.9)	4.217 [*]
Carbohydrate(g)	100.3 (49.1) ^a	121.7 (54.8) ^b	135.8 (64.8) ^b	120.5 (57.4)	5.182 ^{**}
Fat(g)	26.1 (14.0) ^a	29.9 (15.3) ^a	33.9 (19.0) ^a	30.0 (16.2)	2.987
Calcium(mg)	233.0 (144.8) ^a	250.2 (148.3) ^a	268.8 (158.2) ^a	251.0 (149.9)	0.741
Iron(mg)	2.35 (1.18) ^a	2.74 (1.28) ^a	2.97 (1.54) ^a	2.71 (1.34)	2.856
Sodium(mg)	882.3 (470.5) ^a	1066.5 (669.7) ^a	1311.0 (893.1) ^b	1086.8 (709.5)	5.006 ^{**}
Vit.C(mg)	56.0 (39.2) ^a	73.8 (53.9) ^a	66.0 (40.5) ^a	67.8 (48.1)	2.435

* p<0.05, ** p<0.01

^{ab}: different superscripts are significantly different at p<0.05¹⁾ LS: low stress group with a total stress score of lower 0%~25%²⁾ MS: medium stress group with a total stress score of 25%~75%³⁾ HS: high stress group with a total stress score of 75%~100%

Table 7. Correlation coefficient among stress, dietary behaviors and snack consumption

		Stress	Dietary behavior			Snack behavior			Nutrient from snack		
			①	②	③	④	⑤	⑥	⑦	⑧	⑨
Stress		1.00									
Dietary behavior	①	-0.12*	1.00								
	②	0.17**	-0.05	1.00							
	③	0.05	0.38**	0.04	1.00						
Snack behavior	④	0.20**	-0.07	0.22**	0.01	1.00					
	⑤	0.15**	-0.11	0.23*	-0.02	0.32**	1.00				
	⑥	0.14**	0.01	0.19**	-0.05	0.16**	0.14**	1.00			
Nutrient from snack	⑦	0.22**	-0.08	0.28**	-0.04	0.34**	0.87**	0.22**	1.00		
	⑧	0.24**	-0.10	0.29**	-0.02	0.37**	0.87*	0.23**	0.98**	1.00	
	⑨	0.19**	-0.05	0.26**	0.07	0.29**	0.83*	0.20**	0.97**	0.90**	1.00

* $p < 0.05$, ** $p < 0.01$

① regularity of meals ② degree of overeating ③ frequency of breakfast

④ frequency of night snacking ⑤ frequency of snacking

⑥ amount of snack consumption changed under stressful conditions

⑦ daily energy intake from snacks ⑧ daily carbohydrate intake from snacks

⑨ daily sodium intake from snacks

the relationship between stress and daily average nutrient intake from snacks, are shown in Table 6. The stress level of middle school girls was significantly correlated with daily average intakes of energy, carbohydrates, and sodium from snacks. An average energy intake from snacks in HS group was 948.8 kcal, which was higher than 717.8 kcal in LS group ($p < 0.05$), and average carbohydrate intake in HS group was 135.8 g, which was significantly higher than 121.7 g in MS group or 100.3 g in LS group ($p < 0.01$). In case of sodium intake, HS group had an average of 1311.0 mg, which was significantly higher than 1066.5 mg of MS group or 882.3 mg of LS group ($p < 0.01$).

4) Relationships among stress, dietary behaviors and snack consumption

The correlation between the stress level and snack consumption in middle school girls, as examined as above, was summarized by using Pearson's correlation coefficient. The stress level, as is shown in Table 7, had positive correlations with the degree of overeating, frequency of night snacking, frequency of snack consumption, and the amount of snack consumption changed due to stress, and energy intake, carbohydrate and sodium intake from snacks. That is, middle school girls with higher levels of stress tended to have higher frequency of overeating ($p < 0.01$), weekly frequency of night snacking ($p < 0.01$) and snack consumption ($p < 0.01$), more snack consumption when stressed than usual ($p < 0.01$), and daily average energy intake ($p < 0.01$), carbohydrates ($p < 0.01$) and sodium ($p < 0.01$) from snacks. Also, higher stress levels caused irregularities in regular meal eating patterns ($p < 0.05$).

Discussion

The study on the stress level in middle school girls showed

that study-related stress was the highest as 2.52 points, and then body-related stress (2.24 points) and boyfriend-related stress (2.22 points). These results were similar to the results of Cho *et al.* (1998) and Lee and Park (2000) with adolescents and Yoo and Han (1994) and Yeom (2001) with elementary school students. The high scores of body-related stress and boyfriend-related stress were considered as an observation due to the developmental stage of adolescence in middle school girls, when the interests in personal appearance and in boyfriends have increased. In addition, the subject schools in this study were co-ed schools and thus the interests for boyfriends might be higher.

The results from the influence of stress on snack consumption behaviors of middle school girls showed that the stress level had significant correlation with the frequency of night snacking ($p < 0.01$), with more than 3 times of night snacking per week as 27.7% in LS group, 48.0% in MS group, and 58.5% in HS group, suggesting the highest frequency of night snacking is in the HS group. These results were similar to the results of Nam *et al.* (2002), in which female college students had more snacks before regular meals and before sleep at night when they had higher levels of stress.

The amount of snack consumption changed due to stress also showed significant correlation with the stress level ($p < 0.01$), with the rate of more snack consumption than usual as 26.5% in LS group, 28.6% in MS group, and 48.8% in HS group, suggesting the highest snack consumption is in the stressed HS group. Other studies (Jang *et al.*, 2000; Kim, 2001; McCann, 1990; Michard, 1990; Oliver, 1999; Wardle, 2000; Yeom, 2001) also showed that stress increased dietary intakes.

The stress of middle school girls increased the weekly frequency of snack consumption of breads, chips, cookies, soft drinks, ramyeon, and frozen snacks. Total snack consumption frequency per day was 2.2 in HS group, which was significantly higher than those in LS and MS groups ($p < 0.05$). Foods related to stress in this study were found to be chips, cookies, soft drinks, ramyeon, frozen sweets, which were also showed high preference and high purchase frequency in the previous studies (Cho, 2002; Kang *et al.*, 2004). In the study of Moon and Lee (1987), children consumed 27% of the whole snack as cookies, instant foods such as ramyeon and refined sugars. Joo *et al.* (2006) reported that higher intakes of chips, biscuits (cookies), candies, fast foods, and soft drinks had possibility for hyperactivity. In the study of juvenile criminals (Gray, 1987), it was reported that the frequent use of natural foods corrected their impulsiveness and aggressiveness. Thus it is needed to introduce nutrition education for selecting healthy snacks to students.

The results of the relationship between stress and daily average nutrient intake from snacks showed that stress of middle school girls had significant correlation with daily average nutrient intakes of energy, carbohydrates, and sodium from snacks. The average energy intake from snacks was 842.9 kcal, which was 42.2% of daily estimated energy requirement (2000 kcal) of middle school girls and particularly in the HS group, it was 948.8

kcal which was 47.4% of daily estimated energy requirement. Park (2002) reported that the snack consumption in adolescents increased with high proportion of energy among total energy intake from snacks, and the clear distinction between meals and snacks was disappearing. Also in the study of Cho (2002) with adolescents, they took more than 33% of daily total energy from snacks, and in the study of Sin and Lee (2005) with preschool children, snacks took more than 59% of daily total energy intake. These results showed far greater percentages than 10~15%, the ideal ratio of snacks for daily total energy (Koo *et al.*, 2006), suggesting the seriousness of the current situation. Frequent snack consumption can take the place of regular meals, which can lead to skipping meals and then overeating at the next meal, and also causes obesity and related diseases by consuming high-energy snacks such as soft drinks and cookies. Then the preference of certain types of snacks can promote unbalanced dietary practices (Park & Kim, 1995). The intake of carbohydrates was 135.8 g in HS group, which was significantly higher than 121.7 g in MS group and 100.3 g in LS group ($p<0.01$). The average intake of sodium was 1311.0 mg in HS group, which was also significantly higher than 1066.5 mg in MS group and 882.3 mg in LS group ($p<0.01$). These results can explain the relationship in which higher stress levels cause increased intakes of carbohydrates and sodium. For the relationship between stress and each nutrient, it has been reported that individuals with higher stress had higher intakes of carbohydrates (McCann, 1990; Michard, 1990; Oliver, 1999; Wardle, 2000), which is consistent with the results of this study.

The correlations among stress, dietary behaviors, and snack consumption in middle school girls showed that higher levels of stress caused higher frequency of snack consumption ($p<0.01$), frequency of overeating ($p<0.01$), frequency of night snacking ($p<0.01$), energy ($p<0.01$), carbohydrates ($p<0.01$) and sodium intake ($p<0.01$) from snacks, and irregular meals ($p<0.05$), and that they had higher snack consumption than usual when they were feeling stressed ($p<0.01$).

Therefore, a nutrition education program including stress management, proper snack choice, importance of regular meal eating, avoiding overeating, and proper night snacking should be developed and implemented to change the dietary behavior of a group with higher stress levels.

In conclusion, middle school girls in Korea have high stresses including study related stress, body related stress and boyfriend related stress, and those who had higher levels of stress showed higher frequencies of snack consumption and increased energy, carbohydrates, and sodium intakes from snacks. Also, higher levels of stress caused irregularity in regular meal eating patterns, higher frequencies of overeating and night snacking, and more snack consumption than usual when they were feeling stressed. Therefore, differentiated nutrition education is necessary for groups with higher stress and the contents for nutrition education including stress management should be developed.

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