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...
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 Diabetic 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, χ²-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                   | 20(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 |           |
| Over sleeping             | 46(34.1)      |
| Habitually                | 44(32.8)      |
| No appetite               | 33(24.5)      |
| Others                    | 12(8.8)       |
| Total                     | 135(100.0)    |

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

| Category of stress | Stress score | Mean (SD) |
|--------------------|-------------|-----------|
| LS(n=83)           | 1.27(0.27)  | 1.38(0.14) |
| MS(n=175)          | 1.82(0.48)  | 1.87(0.17) |
| HS(n=82)           | 2.56(0.58)  | 2.47(0.24) |
| Total(n=340)       | 1.86(0.65)  | 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 2.24 points, and then body related stress (2.22 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 χ² test, which was performed to out the influence of stress level on the snack

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 30,000 won (57.9%), followed by 30,000~40,999 won (33.0%) and 50,000~69,999 won (6.3%).
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 level on snack consumption behavior. 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

| Group         | Snacking frequency (Mean (SD)) | Total (Mean (SD)) |
|---------------|-------------------------------|-------------------|
| LS            | 5.60 (2.9)                    | 10.29 (2.9)       |
| 2-3 times/day | 23 (27.7)                     | 17 (20.7)         |
|                | 53 (30.3)                     | 17 (20.7)         |
| 3-4 times/day | 11 (13.3)                     | 23 (28.1)         |
|                | 11 (13.3)                     | 23 (28.1)         |
| Total         | 83 (100.0)                    | 82 (100.0)        |

| Group         | Desire for snack (Mean (SD)) | Total (Mean (SD)) |
|---------------|------------------------------|-------------------|
| LS            | 1 (1.2)                      | 5 (1.5)           |
| Slightly      | 5 (61.4)                     | 157 (46.1)        |
| Moderately    | 27 (32.4)                    | 139 (40.9)        |
| Very much     | 4 (4.8)                      | 39 (11.5)         |
| Total         | 83 (100.0)                   | 82 (100.0)        |

| Group         | Frequency of night snacking (Mean (SD)) | Total (Mean (SD)) |
|---------------|----------------------------------------|-------------------|
| LS            | 20 (24.1)                              | 80 (25.7)         |
| MS            | 40 (48.2)                              | 125 (36.8)        |
| HS            | 40 (48.2)                              | 155 (48.2)        |
| Total         | 83 (100.0)                             | 340 (100.0)       |

Changes of snacking under stress

| Group         | MS (n=175)               | HS (n=340)          | Total (n=515)          |
|---------------|--------------------------|---------------------|------------------------|
| Bread (bun)   | 1.05 (1.11)              | 2.00 (1.95)         | 2.00 (1.95)            |
| Chips         | 2.44 (2.76)              | 3.28 (2.80)         | 3.038***               |
| Cookies       | 1.71 (2.39)              | 1.84 (1.64)         | 4.343**                |
| Soft drinks   | 1.09 (1.12)              | 1.44 (1.16)         | 3.720                  |
| Ramyeon       | 1.51 (2.54)              | 1.87 (1.67)         | 9.596***               |
| Frozen sweets | 3.29 (4.20)              | 3.81 (2.68)         | 3.141*                 |
| Total snacks/day | 1.85 (2.20)            | 2.00 (0.88)         | 3.474*                 |

| Nutrient      | LS (n=83)                | MS (n=175)          | HS (n=340)             | Total (n=515) | F-value          |
|---------------|--------------------------|---------------------|------------------------|---------------|-----------------|
| Energy (kcal) | 717.8 (355.6)**          | 484.5 (382.8)**     | 948.8 (474.5)**        | 842.9 (410.9) | 4.217**         |
| Carbohydrate  | 100.3 (49.1)**           | 121.7 (54.8)**      | 135.8 (64.8)**         | 120.5 (57.4)  | 5.182**         |
| Fat (g)       | 26.1 (15.3)**            | 39.9 (19.0)**       | 33.9 (16.2)**          | 30.0 (12.0)   | 2.987           |
| Calcium (mg)  | 233.0 (148.3)**          | 250.2 (158.2)**     | 251.0 (149.9)          | 250.0 (131.2) | 0.741           |
| Iron (mg)     | 2.35 (1.18)**            | 2.97 (1.28)**       | 2.71 (1.54)**          | 2.71 (1.34)   | 2.856           |
| Sodium (mg)   | 882.3 (470.5)**          | 1065.0 (699.7)**    | 1311.0 (793.1)**       | 1086.8 (709.5) | 5.006**         |
| Vit.C (mg)    | 56.0 (39.2)**            | 73.8 (53.9)**       | 69.0 (40.5)**          | 67.8 (48.1)   | 2.435           |
levels caused irregularities in regular meal eating patterns (p<0.05). Also, higher stress (p<0.01), and daily average energy intake (p<0.01), carbohydrates (p<0.01), more snack consumption when stressed than usual frequency of night snacking (p<0.01) and snack consumption tended to have higher frequency of overeating (p<0.01), weekly snacks. That is, middle school girls with higher levels of stress to stress, and energy intake, carbohydrate and sodium intake from snacks. An average of 1311.0 mg, which was significantly higher than 121.7 g in MS group or 100.3 g average carbohydrate intake in HS group was 135.8 g, which was higher than 717.8 kcal in LS group (p<0.05), and average energy intake from snacks in HS group was 948.8 kcal, 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 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).

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

|                  | Stress | Dietary behavior | Snack behavior | Nutrient from snack |
|------------------|--------|------------------|----------------|--------------------|
| Stress           | 1.00   |                  |                |                    |
| Dietary behavior |        |                  |                |                    |
| ① regularity of meals | -0.12** | 1.00           |                |                    |
| ② degree of overeating | 0.17**| -0.05 1.00      |                |                    |
| ③ frequency of breakfast | 0.05 0.38** | 0.04 1.00    |                |                    |
| Snack behavior   |        |                  |                |                    |
| ④ amount of snack consumption changed under stressful conditions | 0.20** | -0.07 0.22** | 0.01 1.00       |                    |
| ⑤ frequency of night snacking | 0.15** | -0.11 0.23** | -0.02 0.32** 1.00 |                    |
| ⑥ frequency of snacking | 0.14** | 0.01 0.19** | -0.05 0.18** 0.14** 1.00 |                    |
| Nutrient from snack |        |                  |                |                    |
| ⑦ daily energy intake from snacks | 0.22** | -0.08 0.28** | -0.04 0.34** 0.87** 0.22** 1.00 |                    |
| ⑧ daily carbohydrate intake from snacks | 0.24** | -0.10 0.29** | -0.02 0.37** 0.87** 0.23** 0.98** 1.00 |                    |
| ⑨ daily sodium intake from snacks | 0.19** | -0.05 0.28** | 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

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 adolescents with higher stress had higher intakes of carbohydrates (McCann, 1990; Michaud, 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.

**Literature cited**

Adler N & Matthews K (1994). Why do some people get sick and some stay well? *Annu Rev Psychol* 45:229-259.

Cho JW (2002). Analysis of regional dietary intake of adolescents in Korea. Master’s Thesis, Seoul National University of Korea.

Cho KY (1993). The study on the dietary behavior and the state of health of boys' and girls' middle school students. Master’s Thesis, Hanyang University of Korea.

Cho WJ, Kwon IS & Lee HJ (1998). A study on dietary practice and stress. *Journal of the Korean Society of School Health* 11:285-295.

Choi JJ (1995). An ecological study on eating behaviors of middle school students in Seoul. Master’s Thesis, Yonsei University of Korea.

Gray GE (1987). Crime and Diet: is there a relationship? *World Rev Nutr Diet* 49:66-86.

Han MJ & Cho HA (2000). The Food habit and stress scores of high school students in Seoul area. *Korean Journal of Food and Cookery Science* 16:84-90.

Ha JS & Lee HG (1995). Effect of middle-school students' food behaviors on health conditions and degrees of study accomplishments. *Journal of Korean Home Economics Association* 33:225-242.

Holmes TH & Rahe RH (1967). The social readjustment rating scale. *Journal of Psychosomatic Research* 11:213-218.

Hong YJ (1999). A Study on the relation of eating behaviors and food intakes to the obesity index of adolescents. *Korean Journal of Dietetic Culture* 143:535-554.

Jang YA, Kim HY, Oh SY, Han SS, Lee HS, Won HS, Kim SH, Kim WK & Cho SS (2000). A study for dietary attitudes and food behaviors of elementary, middle and high school students of Korea. *Journal of Korean Home Economics Association* 38:85-97.

Joo EJ & Park ES (1998). Effect of gender and obese index on breakfast and snack intakes in elementary school students. *Korean Journal of Dietetic Culture* 13:487-496.

Joo NM, Kim SH, Park HN, Lee SY, Kim MJ & Jung KS (2006). The effect of snack intake of preschoolers on ADHD. *Korean Journal of Dietetic Culture* 21:193-201.

Kang SA, Lee JW, Kim KE, Koo JO & Park DY (2004). A study of the frequency of food purchase for snacking and its related ecological factors on elementary school children. *Korean Journal of Community Nutrition* 9:453-463.

Kim DM (2003). Eating attitude, self-esteem and perceived stress among middle school girls. Master’s Thesis, Korea University of Korea.

Kim EJ (2001). Stress degree and dietary practices of high school students in Ulsan area. Master’s Thesis, Korea University of Korea.

Kim EY & Park HH (2004). A study on eating habits of elementary school students in higher grades. *Korean Journal of Food and Nutrition* 17:393-404.

Kim MK, Shin DS & Wang SK (1995). Effect of the nutrient intakes on psycho-social stress. *Korean Journal of Dietetic Culture* 10:405-417.

Kim MR, Hong KJ & Yang SN (2002). High school student's stress and their coping styles. *The Korean Journal of Youth* 10:107-125.

Kim SY (2000). A study on the factors of stress and the stress coping styles of middle school students. Master’s Thesis, Chonbuk National University of Korea.
Koo JO, Lee JW, Choi YS, Kim JH & Lee JH (2006). Nutrition throughout the life cycle. Hyoui Publishing Co., Seoul. Republic of Korea.

Kwon SY (2005). A study of dietary patterns and analysis of the factors that influence snack intake of the middle school students in Seoul. Master’s Thesis, Sookmyung Woman’s University of Korea.

Lee KS & Park SY (2000). A study on the perceived stress and social supports of adolescents. Korean Home Economics Association 38:93-106.

Lee SW, Son KH & Lee YM (1985). A study on the eating attitudes of male and female middle school students. Master’s Thesis, Yonsei University of Korea.

Lee YM & Han MS (1996). Nutritional knowledge and eating behaviors of high school students in Sungnam area. Korean Journal of Dietetic Culture 11:305-316.

McCann BS, Warnick GR & Knopp RH (1999). Changes in plasma lipids and dietary intake accompanying shifts in perceived workload and stress. Psychosom Med 52:97-108.

Michard CI, Kahn JP, Musse N, Burlet C, Nicolas JP & Mejean J (1990). Relationships between a critical life event and eating behaviors in high school students. Stress Med 6:57-64.

Moon SJ & Lee MH (1987). An effect of children's food attitudes on nutritional status and personality. Korean Journal of Nutrition 20:258-271.

Nam HJ, Lee SM & Park HR (2002). An ecological study on dietary behaviors by the degree of stress among female college students in Suwon. Korean Journal of Health education and promotion 19:199-212.

National Rural Living Science Institute, Rural Development Administration (2002). Food Composition Tables for Consumers, Seoul. Republic of Korea.

Oliver G & Wardle J (1999). Perceived effects of stress on food choices. Physiol Behav 66:511-515.

Park MS, Hong KJ, Cho YS & Lee JW (2007). A study on the promotion of adolescent milk consumption (2)-Relationships of adolescent milk intake frequency with food attitude, snacking frequency, physical activity and school vending facilities. Journal of the Korean Dietetic Association 13:73-83.

Park SJ (2002). Survey on the fatness extents of middle school in Seoul on their habits and their tendencies. Master’s Thesis, Sejong University of Korea.

Park YS (2003). Intake of snacks by the Elementary School Children in Hansan-do area. Korean Journal of Food and Cookery Science 19:96-106.

Park HY & Kim KN (1995). Relationships among snacks, unbalanced diets, and eating behaviors of middle school students. Journal of Korean Home Economics Education Association 7:79-89.

Parraga IM (1990). Determinants of consumption. J Am Diet Assoc 90:661-663.

Sin EK & Lee YK (2005). Menu development and evaluation through eating behaviors and food preferences of preschool children in Day-Care Centers. Korean Journal of Dietetic Culture 20:1-14.

The Korean Dietetic Association (1999). Guide to portion size estimation with food pictures, Seoul. Republic of Korea.

The Korean Nutrition Society (2000). Recommended dietary allowances for Koreans, 7th Revision, Seoul. Republic of Korea.

The Korean Nutrition Society (2005). Dietary Reference Intakes for Koreans. Kookjin Publishing Co., Seoul. Republic of Korea.

Wardle J, Steptoe A, Oliver G & Lipsey Z (2000). Stress, dietary restraint and food intake. J Psychosom Res 48:195-202.

Yeom HJ (2001). A relation of the stress status on the food ecology and health behaviors in elementary school children. Master’s Thesis, Ewha Woman’s University of Korea.

Yoo AJ & Han MH (1995). Development of Daily Hassles Scale for Children in Korea. Journal of Korean Home Economics Association 33:49-64.

Yoo SY, Song YI, Joung HJ & Paik HY (2004). Dietary assessment using dietary pattern analysis of middle school students in Seoul. Korean Journal of Nutrition 37:373-384.