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RESEARCH ARTICLE

성남지역 초등학생들의 일상생활 스트레스 정도가 식품섭취패턴에 미치는 영향

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Effects of Daily Stress on Dietary Pattern among Elementary School Children in Seongnam City

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ABSTRACT

Objectives: The study was conducted to investigate the relationship between several stress measures in everyday life, emotional eating behavior, and dietary pattern (snacks, fatty foods, sweet beverages, fruits and vegetables) in school-aged children.

Methods: One hundred and ninety-four students of an elementary school located in Seongnam City participated in the study. The students responded to the survey questionnaire by self-report, which consisted of items regarding general characteristics, height, weight, dietary habits, frequency of consuming healthy (fruits and vegetables) and unhealthy foods (snacks, fatty foods, and sweet beverages), emotional eating behavior, and daily stress. Correlational analysis was performed to examine the relationship between stress, emotional eating behavior, and dietary pattern, and Poisson and logistic regression analyses were conducted to investigate the effects of stress on dietary pattern.

Results: Positive correlations were found between all stress factors and emotional eating behavior and between the friend and personal factor (one of the stress factors) and the consumption of sweet beverages. The frequency of consuming sweet beverages was 2.6 times higher in the high stress group than in the low stress group (95% CI).

Conclusions: Children's daily stress was associated with emotional eating behavior and undesirable dietary pattern such as consumption of sweet beverages.

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KEY WORDS children, stress, emotional eating behavior, dietary pattern

Introduction

School-aged children are in the period of physical and psychological developments while also experiencing tension generated from the gap between parental expectation and their abilities and as they form relationships with school friends. They are sensitive to peer recognition as they move away from parental influence and establish contact with friends, and school life and studying are an important part of their everyday lives. School-aged children experience more stress (e.g., petulance, anxiety, pain, etc.) in everyday life than in any other stage [1].

Stress is a universal life event occurring for anyone in everyday life. People are exposed to stress in all areas of life and experience stress at any age from birth to death. From this perspective, much research has been conducted on stress in not only adults but also children and has found that children experience as much stress as adults do.

Whereas, in the past, children's everyday experiences were largely divided into home life and school life, these days, their everyday routines more or less match their parents' schedules for activities outside home. When the school day is over, many children participate in after-school programs or after-school academies or tutoring. Children experience stress, because they have difficulty finding free time to play with friends and must go to after-school programs or academies. Children's everyday stress affects social maladjustment and problem behavior. Accordingly, it is very important to study stress children experience in everyday life [2]. School-age is a period when the weight of stress is high, but children in this period are not sufficiently capable of recognizing the stress they experience and handling it effectively [3]. Children's stress is a cause of academic underachievement, depression, anxiety, maladjustment to school life, aggression, problem behavior, and others.

Stress has been reported to negatively affect individuals physically and psychologically. It causes psychological issues like anxiety, sleep disorder, decreased attention, depression, and hostility and emotional maladjustment issues like anxiousness, rage, dissatisfaction, and frustration. Consequently, it can cause chronic adult disease [4].

A study conducted by Kim et al. [5] on the relationship between stress and dietary behavior reported that the latter was significantly correlated with the occurrence of depression. Morley et al. [6] demonstrated that stress changes food choices and food intake amounts and that consuming food somewhat reduces stress. Additionally, Michels et al. [7] reported that psychological stress affects dietary pattern, which can lead to unhealthy food choices. The dietary behavior of school-aged children and adolescents is generally known to be influenced by physiological, psychological, and social factors [8]. Particularly, the relationship between emotional state and diet has been reported in some studies [7, 9], and there is evidence that stress in childhood, during which physical development occurs rapidly, affects not only health but also dietary behavior like food choice and consumption via physical processes [10].

Healthy and desirable dietary behavior refers to eating regularly when hunger is felt, which leads to normal physical growth and energy consumption. However, unhealthy dietary behavior, like consuming too much fat or sugar, can engender such unfavorable outcomes as obesity or overweight [7]. Some scholars have argued that stress is associated with unhealthy, emotional eating behavior (that is, eating in response to negative emotions) and imbalanced dietary pattern [11-13]. Michels et al. [7] reported that emotional eating behavior can play a mediating role in the mechanism linking stress and imbalanced dietary pattern.

Several studies have reported the relationship between stress and dietary behavior in Korean school-aged children, including studies investigating the level of stress and dietary behavior, studies investigating stress according to obesity level [14-16], and a study investigating the effect of stress caused by academic performance on sugar consumption pattern [17]. However, the dietary behaviors examined in those studies were limited to general dietary habits such as meal frequency and regularity, eating speed and amount, and skipped meals, and emotional eating behavior was excluded.

Accordingly, the present study was conducted to investigate the relationship between stress, emotional eating behavior, and dietary pattern (snacks, fatty foods, sweet beverages, fruits and vegetables) in school-aged children. Specifically, we surveyed elementary school children in Seongnam City to examine the level of everyday stress;

correlations among stress, emotional eating behavior, and dietary pattern; and the effect of individual stress factors on dietary pattern.

Methods

1. Subjects

One hundred and ninety-four male and female elementary school children in Seongnam City were selected using convenience sampling. Students responded to the survey questionnaire by self-report after being told of study purpose and objectives, survey contents, and how to complete the survey between January 2 and 5, 2017. Written informed consent was obtained from parents or guardians for their child's study participation. Of 194 returned surveys, 40 were discarded because of incomplete or missing responses, and a total of 154(boys 28, girls 42 in 5th grade, boys 33, girls 51 in 6th grade) were included in the final data analysis (IRB approval number 10443396-201612-HR-104-01).

2. General characteristics

Age, parents' education level, mother's employment status, sleep hours, daily exercise time, and others were examined. Height and weight were self-recorded in the survey, based on which body mass index (BMI: weight [kg]/square of height [m^2]) was computed. The computed BMI were compared against standardized BMI by age and gender from the 2007 Korean Growth Chart [24]; a BMI under the 5th percentile was categorized as underweight, a BMI between the 5th and 84th percentiles as normal, and a BMI over the 85th percentile as overweight.

3. Dietary habit

Meal frequency and regularity, eating speed, average meal amount, skipping meals, skipped meal time, reasons for skipped meals were examined.

4. Dietary pattern

The food consumption frequency questionnaire was developed based on construct-related evidence of validity [7, 17, 28] in relation to foods children and teenagers commonly consumed. The section in the survey regarding food consumption frequency consisted of a total of 15 items with a format of checking the consumption frequency for each of the following food types. Overall, foods were classified into healthy foods (fruits and vegetables) and unhealthy foods (snacks, fatty foods, and sweet beverages). There were 6 items for snacks (cookies, candies, chocolate, sweet bread, cake, and ice cream), 3 for fatty foods (fried foods, fatty meat, and other fatty foods), 3 for sweet beverages (soft drinks, sweetened beverages, and sweet yogurt and milk), and 3 for fruits and vegetables (fruits, dark green vegetables, and white and yellow vegetables). For the frequency of consuming each food type, subjects checked one of the following response categories: "4 times or more a day," "3 times a day," "2 times a day," "once a day," "4 – 6 times a week," "1 – 3 times a week," "under 3 times a month," and "rarely." The frequency of separate food items was converted to consumption frequency per day and then summed up for each of the food groups (snacks, fatty foods, sweet beverages, and fruits and vegetables).

5. Emotional eating behavior

The Dutch Eating Behavior Questionnaire (DEBQ) measures 3 types of unhealthy dietary behavior, i.e., restrained eating (e.g., limited food intake to control weight), emotional eating (e.g., food intake in response to negative emotion), and external eating (e.g., food intake due to external stimulation) [19]. There have been few research that have examined Korean children to test the reliability and validity of DEBQ. The selected items about emotional eating behavior among all the items of DEBQ were translated to Korean, and reviewed by a professor of English education. The items were rated on a 5-point Likert scale with 1 point assigned to "not at all," 2 to "unlikely," 3 to "on average," 4 to "likely," and 5 to "highly likely." The score for emotional eating behavior was obtained by adding the points assigned to the 13 items. Regarding the reliability of the DEBQ, internal consistency (Cronbach's alpha) of the questionnaire has been reported to be 0.77 – 0.91, and test-retest reliability has been reported to be $r = 0.87 – 0.90$ [20, 21].

6. Stress in everyday life

A scale developed to measure everyday stress in elementary school children [22] was used. The scale consisted of a total of 65 items (total score 260) divided into 5 specific factors, i.e., 17 items for the friend and personal factor, 17 for the parent and family environmental factor, 8 for the academic performance factor, 13 for the teacher and school environmental factor, and 10 for the surrounding environment and social factor. Regarding the reliability of the scale, internal consistency (Cronbach's alpha) has been reported to be 0.961. The response scale was a 4-point scale with 1 point assigned to "not at all stressful," 2 to "not really stressful," 3 to "somewhat stressful," and 4 to "very stressful." The higher the score, the higher the stress level. Stress scores used in the analysis were obtained by adding the scores within each stress factor (friend and personal, parent and family environmental, academic performance, teacher and school environmental, and surrounding environment and social). Subjects at the lower 25th percentile or below were categorized into the "low stress" group, those between 26th and 74th percentiles into the "medium stress" group, and those at the upper 25th percentile or above into the "high stress" group by stress scores.

7. Statistical analysis

Data were analyzed by using SPSS 23.0 (Statistical Package for the Social Sciences) PC package. Cross-tabulation analysis (Chi-square test and Fisher exact test) was performed to examine gender differences in general characteristics, dietary habits. Stress, emotional eating behavior scores, and daily food consumption frequencies were compared between genders using independent t-test and Wilcoxon rank sum test. Pearson's correlation coefficients were computed to examine correlations between stress factors and emotional eating behavior and Spearman correlation coefficients to examine correlations between stress factors and food consumption frequency. To investigate the effect of stress factors on food consumption frequency, Poisson regression analysis was performed with daily food consumption frequency as the dependent variable and stress factors as independent variables. Poisson regression analysis is also called a generalized linear model in which the dependent variable follows a Poisson distribution, and the link function follows a natural logarithm. Additionally, logistic regression analysis was performed to compute odds ratios of food consumption frequency in response to stress with stress. The four groups (snacks, fatty foods, sweet beverages, and fruits and vegetables) were treated as dependent variables. Low and high frequency groups were created for each food group using the respective median value as the cut-off point. Independent variable (stress) was also dichotomized by low stress (reference category) and high (high, medium).

Results

1. General characteristics

Subjects' general characteristics are shown in Table 1. The mean age was approximately 11.3 years for both boys and girls. BMI was determined as normal in 84.8% of boys and 79.8% of girls. Regarding father's education level, high school education was the most common in both boys (40.5%) and girls (47.1%). Additionally, regarding mother's education level, high school education was the most common both in boys (54.1%) and girls (55.6%).

In total, 72.6% of boys and 63.9% of girls responded that their mother had a job. With respect to the number of sleep hours, 52.5% of boys slept for more than 8 hours and 37.3% for 6 – 7 hours; 49.5% of girls slept for 6 – 7 hours and 47.2% for more than 8 hours.

2. Dietary habits

Subjects' dietary habits are shown in Table 2. Three times a day was the most common meal frequency in both boys (75.4%) and girls (66.6%); 77.1% of boys and 68.8% of girls responded that they tended to have regular meals.

Regarding eating speed, 62.3% of boys said they tended to eat at an average speed (finishing a meal in 10 – 29 minutes), and 32.8% said they tended to eat fast (finishing a meal within 10 minutes). The corresponding proportions for girls were 74.4% and 18.9%, respectively. Regarding the usual amount of food consumption, 86.9% of boys responded that they ate an appropriate amount, and 11.5% responded that they overate; 80.6% girls responded that they ate an appropriate amount, and 10.7% responded that they overate.

The rate of skipping a meal was 33.3% in boys and 48.9% in girls. Although it was higher in girls, the difference was not statistically significant. Ninety percent of

Table 1. General characteristics

		N (%)			
		Boys	Girls	Total	χ^2
Age		11.37 ± 0.73[1)]	11.39 ± 0.71	11.38 ± 0.72	0.8735
BMI[2)]	Underweight	3 (6.5)	7 (10.1)	10 (8.7)	0.8739
	Normal	39 (84.8)	55 (79.8)	94 (81.7)	
	Overweight	4 (8.7)	7 (10.1)	11 (9.6)	
Father's education level	Lower than middle-school	21 (56.8)	23 (45.1)	44 (50.0)	0.4074
	High school	15 (40.5)	24 (47.1)	39 (44.3)	
	College or higher	1 (2.7)	4 (7.8)	5 (5.7)	
Mother's education level	Lower than middle-school	15 (40.5)	22 (40.7)	37 (40.7)	1.0000
	High school	20 (54.1)	30 (55.6)	50 (54.9)	
	College or higher	2 (5.4)	2 (3.7)	4 (4.4)	
Mother's employment	Yes	37 (72.6)	53 (63.9)	90 (67.2)	0.2981
	No	14 (27.4)	30 (36.1)	44 (32.8)	
Sleep hours	Under 3 hrs	3 (5.1)	1 (1.1)	4 (2.6)	0.1821
	4 – 5 hrs	3 (5.1)	2 (2.2)	5 (3.3)	
	6 – 7 hrs	22 (37.3)	46 (49.5)	68 (44.7)	
	8 hrs or more	31 (52.5)	44 (47.2)	75 (49.4)	
Daily exercise time	Less than 30 min	16 (26.7)	44 (47.3)	60 (39.2)	0.0007
	30 min – 1 hr	16 (26.7)	34 (36.6)	50 (32.7)	
	1 – 2 hrs	21 (35.0)	11 (11.8)	32 (20.9)	
	More than 2 hrs	7 (11.6)	4 (4.3)	11 (7.2)	

1) Mean ± SD
2) BMI=Weight (kg)/Height (m^2)

Table 2. Dietary habits

		N (%)			
		Boys	Girls	Total	χ^2
Meal frequency	1	2 (3.3)	2 (2.2)	4 (2.6)	0.4615
	2	13 (21.3)	29 (31.2)	42 (27.3)	
	3	46 (75.4)	62 (66.6)	108 (70.1)	
Regularity of meals	Regular	47 (77.1)	64 (68.8)	111 (72.1)	0.2654
	Irregular	14 (22.9)	29 (31.2)	43 (27.9)	
Usual meal amount	Overeat	7 (11.5)	10 (10.7)	17 (11.0)	0.4422
	Eat an appropriate amount	53 (86.9)	75 (80.6)	128 (83.1)	
	Eat an insufficient amount	1 (1.6)	6 (6.5)	7 (4.6)	
	Eat a very small amount	0 (0.0)	2 (2.2)	2 (1.3)	
Skipping meal	Yes	20 (33.3)	45 (48.9)	65 (42.8)	0.0577
	No	40 (66.7)	47 (51.1)	87 (57.2)	
Skipped meal	Breakfast	18 (90.0)	38 (90.4)	56 (90.3)	0.6310*
	Lunch	0 (0.0)	2 (4.8)	2 (3.2)	
	Dinner	2 (10.0)	2 (4.8)	4 (6.5)	
Reasons for skipping meal	Loss of appetite	3 (15.8)	4 (9.8)	7 (11.7)	0.8554
	By habit	2 (10.5)	8 (19.5)	10 (16.7)	
	Lack of time	12 (63.2)	21 (51.2)	33 (55.0)	
	Stress	0 (0.0)	1 (2.4)	1 (1.6)	
	Weight control	0 (0.0)	2 (4.9)	2 (3.3)	
	Indigestion	2 (01.5)	5 (12.2)	7 (11.7)	

*: $p<0.05$

students who had missed a meal skipped breakfast. The most common reason for skipping a meal among boys was lack of time (63.2%) followed by loss of appetite (15.8%) and out of habit (10.5%). Among girls, the most common reason was also lack of time (51.2%), and out of habit (19.5%) was the second most common followed by loss of appetite (9.8%).

3. Relationships between stress, emotional eating behavior, and dietary pattern

Scores for individual stress factors and emotional behavior and daily consumption frequency for each food group are shown in Table 3. Regarding scores for individual stress factors, boys scored 33.97 and girls 37.03 on the friend and personal factor. The score for the parent and family environmental factor was higher in girls (28.19) than in boys (24.98), but the difference was not statistically significant. The score for the academic performance factor was 13.28 in boys and 15.14 girls, and girls were more stressed by academic performance than were boys ($p < 0.05$). The score for the teacher and school environmental factor was 18.33 in boys and 20.19 in girls. Finally, girls (21.66) scored higher than boys (19.13) on the surrounding environment and social factor ($p < 0.05$). The score for emotional eating behavior was 25.43 in boys and 27.56 in girls, and the difference was not statistically significant. Daily consumption frequency for each food group by gender was as follows: 2.72 in boys and 2.83 in girls for snacks, 1.10 in boys and 0.92 in girls for fatty foods, 1.58 in boys and 1.31 in girls for sweet beverages, and 3.13 in boys and 3.70 in girls for fruits and vegetables. There was no significant between gender difference in daily consumption frequency for any of the food groups.

Table 4 shows the results of correlational analysis conducted on stress factors with emotional eating behavior and consumption frequencies of each food group. Emotional eating behavior was positively correlated with all stress factors at a statistically significant level: $r = 0.300$ ($p < 0.001$) with the friend and personal factor, $r = 0.350$ ($p < 0.001$) with the parent and family environmental factor, $r = 0.356$ ($p < 0.001$) with the academic performance factor, $r = 0.352$ ($p < 0.001$) with the teacher and school environmental factor, and $r = 0.288$ ($p < 0.001$) with the surrounding environment and social factor.

Table 3. Stress scores according to stress factor, emotional eating behavior, and dietary pattern

	Stress factors	Boys	Girls	p-value
Stress [2]	Friend and personal	33.97 ± 9.91 [1]	37.03 ± 11.03	0.0814
	Parent and family environmental	24.98 ± 9.99	28.19 ± 10.00	0.0532
	Academic performance	13.28 ± 5.39	15.14 ± 4.96	0.0293*
	Teacher and school environmental	18.33 ± 6.64	20.19 ± 7.94	0.1307
	Surrounding environment and social	19.13 ± 6.51	21.66 ± 7.01	0.0261*
Emotional eating behavior [3]		25.43 ± 9.99	27.56 ± 11.11	0.2275
Food consumption frequency (times/day)	Snacks	2.72 ± 2.70	2.83 ± 2.91	0.7675
	Fatty foods	1.10 ± 1.31	0.92 ± 1.18	0.4087
	Sweet beverages	1.58 ± 1.52	1.31 ± 1.48	0.1060
	Fruits and vegetables	3.13 ± 2.51	3.70 ± 2.70	0.1565

1) Mean ± SD
2) Note: Total score of stress is 260; friend and personal (score 68), parent and family environmental (score 68), academic performance (score 32), teacher and school environmental (score 52), surrounding environment and social (score 40)
3) Note: Emotional eating behavior is defined as a tendency using food to cope with negative emotion. Emotional eating behavior included 13 items (e.g., "Do you have a desire to eat when you are irritated?") rated on a 5-point Likert scale. Total score is 65.
*: $p<0.05$

Table 4. Correlations between stress factors, emotional eating behavior, and dietary pattern

		Stress factors				
		Friend and personal	Parent and family environmental	Academic performance	Teacher and school environmental	Surrounding environment and social
Emotional eating behavior		0.300***	0.350***	0.356***	0.352***	0.288***
food consumption frequency	Snacks	0.069	–0.040	–0.020	–0.098	0.038
	Fatty foods	0.034	–0.071	–0.078	–0.114	–0.019
	Sweet beverages	0.170*	0.091	0.113	–0.082	0.026
	Fruits and vegetables	–0.006	–0.139	–0.140	–0.114	–0.039

*: $p<0.05$, ***: $p<0.001$

Regarding correlations between stress factors and food consumption frequencies, only the friend and personal factor among the stress factors had a very low positive correlation with the consumption frequency of sweet beverages ($r = 0.170$, $p < 0.05$). None of other pairs of stress factors and consumption frequencies showed a significant correlation. Additionally, correlations between emotional eating behavior and food consumption frequencies were not significant (data not presented).

4. The effect of stress on dietary pattern

Poisson regression analysis was conducted to investigate the effect of individual stress factors on dietary pattern, and the results are presented in Table 5. The present findings showed that the frequency of consuming sweet beverages increased by exp (0.0222), i.e., 1.0222 times, for a 1-unit increase in the score of the friend and personal factor among the stress factors. Thus, the consumption of sweet beverages increased by 1.02 times as stress increased, which was statistically significant ($p < 0.05$). Other stress factors did not have significant effects on food consumption frequency.

Table 6 shows the results of logistic regression analysis conducted to investigate the relationship between stress and dietary pattern. Of the food types, snacks were consumed by the high stress group 1.727 times more compared to the low stress group, but the difference was not significant. The consumption frequency of fatty foods was slightly higher (by 1.056) in the high stress group than in the lower stress group, but, the difference was insignificant. The frequency of consuming sweet beverages increased 2.613 times in the high stress group compared to the low stress group, and the difference was statistically significant (95% CI: 1.003 – 6.809). The frequency of consuming fruits and vegetables also increased in the high stress group compared to the low stress group (1.678 times), but the difference was not significant.

Table 5. Poisson Regression Analysis: The effect of individual stress factors on dietary pattern

		Snacks			Sweet beverages			High-fat foods			Fruits and vegetables		
		β	w	p	β	w	p	β	w	p	β	w	p
Stress factors	Friend and personal	0.0106	1.32	0.2513	0.0222	3.90	0.0484*	0.0152	1.28	0.2585	0.0083	1.17	0.2798
	Parent and family environmental	–0.0219	1.57	0.2103	–0.0055	0.07	0.7904	–0.0105	0.16	0.6907	–0.0125	0.76	0.3826
	Academic performance	0.0183	0.30	0.5855	0.0431	1.26	0.2621	–0.0154	0.10	0.7563	–0.0168	0.36	0.5483
	Teacher and school environmental	–0.0214	2.28	0.1312	–0.0366	4.41	0.0557	–0.0302	1.84	0.1745	–0.0044	0.15	0.6981
	Surrounding environment and social	0.0124	0.56	0.4549	–0.0169	0.72	0.3948	–0.0115	0.21	0.6459	0.0071	0.27	0.6026

1) In the statistical analysis, covariates variables such as age, sex, excise time, and BMI were included in the model for each stress factor.
*: $p<0.05$

Table 6. Odds ratios for food consumption frequency associated with stress among subjects

Food item	Adjusted OR	95% CI	p-value
Snacks	1.727	0.643 – 4.640	0.2786
High-fat foods	1.056	0.421 – 2.646	0.9074
Sweet beverages	2.613	1.003 – 6.809	0.0493*
Fruits and vegetables	1.678	0.598 – 4.713	0.3257

1) In the logistic regression analysis, the data were adjusted for age, sex, exercise time, and BMI
2) Each food group was dichotomized into two groups for the frequency of intake cut-off median value/day
3) CI=confidence interval; OR=odds ratio
*: $p<0.05$

Discussion

The stress experienced by elementary school children in everyday life causes psychological, physiological, and behavioral reactions like tension and feelings of conflict and pressure as they become aware that they do not have resources to appropriately cope with internal or external needs arising in various everyday life situations (e.g., parents and family environment, teachers and school environment, friends and personal environment, surrounding environment and everyday life, and academic problem) [22].

When an individual is under stress, meal choice may change, and food consumption amount may increase or decrease [23, 24]. Food consumption sometimes reduces stress [6]. Dietary behavior refers to a wide range of behavior dealing with foods-that is, eating and the executive ability related to eating-and is determined by how one consumes foods (i.e., in what manner one consumes foods). Of dietary behavior, emotional eating behavior is the behavior of consuming foods in response to negative emotion [11-13] and the desire to eat when the individual is emotionally upset with anger, lonely, anxious, or bored. It has been suggested that emotional eating behavior plays a mediating role leading to imbalanced dietary pattern affected by stress [7], but clear evidence has yet to be provided. In the present study, the results of correlational analysis conducted on the relationship of stress factors with emotional eating behavior and dietary pattern showed that all tested stress factors (i.e., friend and personal, parent and family environmental, academic performance, teacher and school environmental, and surrounding environ- ment and social) were positively correlated with emotional eating behavior ($p < 0.001$). However, of the stress factors, only the friend and personal factor was correlated with the consumption of sweet beverages, and the correlation was very low in the positive direction. Additionally, there was no significant correlation between emotional eating behavior and dietary pattern. In a study with 437 Belgian children [7], stress was associated with emotional eating behavior and also positively correlated with consumption amounts of sugary and fatty foods, but emotional eating behavior was not correlated with dietary pattern. In adolescents, some researchers also found more sweet food consumption in emotional eaters [29], while others not [30]. Further studies should examine whether the emotional eating behavior mediate the stress-diet relation.

DEBQ has been widely used as a tool measuring emotional eating behavior [19, 23, 24, 25]. However, a study [26] using a questionnaire other than the DEBQ reported that emotional eating behavior was associated with sweet food but not with fatty food whereas a study [27] using the parental-report DEBQ reported that emotional eating behavior was associated with both sweet and fatty foods. Thus, results differed depending on the measurement tool used in the study.

Food consumption by elementary school children is largely influenced by their parents, and, particularly, food consumption of young school children can be controlled by the parents to a certain degree. van Strien and Bazelier [23] argued that, if the parent of a 7- to 9-year-old child does not allow the child to have certain food, emotional eating behavior can be inhibited, and Michels et al. [7] argued in a study with older elementary school children (12-year-olds) that children's food consumption is influenced more by their emotional eating behavior than by their parents. Accordingly, it can be speculated that parental influence on the emotional eating behavior of the present study's subjects (11-year-olds) may have been somewhat precluded.

Stress is known to be linked to imbalanced dietary pattern. For example, when stressed, individuals eat more high-fat, sugary, or snack foods according to personal preference to relieve stress. A study with school-age children [27] reported that, with higher perceived stress, children ate more high-fat foods or snacks and fewer fruits and vegetables; this is interpreted as meaning that children eat fatty or sweet foods as “comfort food” to escape stress or that fatty and sweet foods are associated with stress reduction and the psychological reward system [11, 12].

Michels et al. [7] performed regression analyses to examine the effect of stress on dietary pattern and found that stress was associated with unhealthier diet pattern (higher frequency of consuming fatty and sweet foods and lower frequency of consuming fruit and vegetables). In the present study, the consumption frequency for sweet beverages increased 1.02 times with increased stress due to the friend and personal factor among various stress factors, but a significant correlation was not found in the consumption of fatty foods, fruits, or vegetables. School-age children experience stress due to the friend and personal factor (e.g., appearance, health, friend, personality, obsession, etc.) in specific situations [22]. The present study showed that, of the stress factors, the friend and personal stress factor was particularly correlated with the consumption of sweet beverages. The issue of which specific stress factor is associated with which dietary pattern should be further investigated.

The logistic regression analysis conducted to examine the relationship between stress level and dietary pattern showed that the consumption of sweet beverages increased 2.6 times in the high stress group compared to the low stress group, which was statistically significant. In Yang [17] as well, the consumption of candies, chocolates, sweet bread, and drinks was more frequent as stress due to academic performance was higher in high school students. Additionally, according to the results of a survey by the Ministry of Food and Drug Safety [27], adolescents consumed an excessive amount of sugar through drinks compared to younger children. Excessive consumption of sugar is reported to cause cavities, obesity, atherosclerosis, diabetes, and so on as well as attention problem and impulsive behavior [28]. Individuals under chronic daily stress generally do not avoid food consumption and increase the consumption of foods with high fat or high sugar content, which can cause a gradual weight increase and obesity [11].

A limitation of the present study is that the sample was a convenience sample, and the survey area was limited to a certain area in Kyunggi Province, Seongnam City, so the study findings may not be generalizable to the general population. Another limitation is that, because study subjects self-administered the survey of stress, emotional eating behavior, and food consumption frequency, filling out the survey may have been some burden to the elementary school students, and some data may have lacked objectivity. In addition, the information on parental control or parental dietary behavior, which could influence the dietary behavior or food choice of children, was not considered. The food consumption patterns examined in the present study in association with stress were limited by the qualitative measurement method in which the surveyed food consumption frequency did not reflect the quantity of consumed foods. Consequently, it did not suggest detailed validity values, such as correlation coefficient between 24-hour recall data and food consumption frequency data. In addition, as it collected data only once using the questionnaire on food consumption frequency, it was not possible to produce reliability values from repeated measures. Because stress sometimes changes food consumption amount [16], the possibility cannot be excluded that the effect of stress on dietary pattern was not clearly identified because the amount of food consumption was not measured.

Conclusion

It was found in the present study that stress is related with emotional eating behavior and undesirable dietary patterns such as consumption of sweet beverages. It is of note that the consumption of sweet beverages was higher in the high stress group than in the low stress group. Not only are an excessive amount of studying and anxiety toward college entrance exams problems faced by adolescents, but also, they may weigh down even elementary school children and threaten their health. Particularly, the findings that the consumption of sweet foods is frequent under stress and can lead to pediatric obesity have already been reported in numerous studies. Therefore, daily stress of elementary school children should be reduced, and the family and school should coordinate to provide education on desirable nutritional behavior so that children can form balanced dietary habits and choose healthy foods.

References

1. Min HY. The influence of the perceived controllability of stress situation and locus of control on children's coping behaviors with hassles [dissertation]. Seoul National University; 1998.
2. Rowlison RT, Felner RD. Major life events, hassles, and adaptation in adolescence: confounding in the conceptualization and measurement of life stress and adjustment revisited. J Pers Soc Psychol 1988; 55(3): 432-444.
3. Jewett J, Peterson K. Stress and young children. ERIC Digest. Champaign, IL: ERIC Clearinghouse on Elementary and Early Childhood Education; 2002. p. 1-9.
4. Axelrod J, Reisine TD. Stress hormones: their interaction and

regulation. Science 1984; 224(4648): 452-459.
5. Kim JH, Lee MJ, Moon SJ, Shin SC, Kim MK. Ecological analysis of food behavior and lifestyle affecting the prevalence of depression in Korea. Korean J Nutr 1993; 26(9): 1129-1137.
6. Morley JE, Levine AS, Rowland NE. Stress induced eating. Life Sci 1983; 32(19): 2169-2182.
7. Michels N, Sioen I, Braet C, Eiben G, Hebestreit A, Huybrechts I et al. Stress, emotional eating behaviour and dietary patterns in children. Appetite 2012; 59(3): 762-769.
8. Grimm ER, Steinle NI. Genetics of eating behavior: established and emerging concepts. Nutr Rev 2011; 69(1): 52-60.
9. Forrester-Knauss C, Perren S, Alaska FD. Does body mass index in childhood predict restraint eating in early adolescence? Appetite 2012; 59(3): 921-926.
10. Wallis DJ, Hetherington MM. Emotions and eating. Self-reported and experimentally induced changes in food intake under stress. Appetite 2009; 52(2): 355-362.
11. Adam TC, Epel ES. Stress, eating and the reward system. Physiol Behav 2007; 91(4): 449-458.
12. Dallman MF, Pecoraro N, Akana SF, La Fleur SE, Gomez F, Houshyar H et al. Chronic stress and obesity: a new view of "comfort food". Proceedings of the National Academy of Sciences of the United States of America; 2003 Jul 28; New York, NY: 11696-11701.
13. Macht M. How emotions affect eating: a five-way model. Appetite 2008; 50(1): 1-11.
14. Kim JH, Moon BK. Obesity stress, eating behavior and eating habits of elementary school students. J East Asian Soc Diet Life 2010; 20(3): 352-362.
15. Kim EK, Park TS, Kim KK. A study on the obesity and stress of elementary school children in the Kangnung area. Korean J Community Nutr 2001; 6(5): 715-725.
16. Park JE, Kim SJ, Choue RW. Study on stress, depression, binge eating, and food behavior of high school girls based on their BMI. Korean J Community Nutr 2009; 14(2): 175-181.
17. Yang HY. The impact of the academic stress level on sugar food consumption patterns for high school students in Gyeonggi area [master's thesis]. Kyunghee University; 2012.
18. Korea Centers for Disease Control and Prevention. 2007 Korean National Growth Charts [Internet]. Korea Centers for Disease Control and Prevention; 2007 [cited 2017 Jul 28]. Available from: http://cdc.go.kr/.
19. van Strien T, Frijters JER, Bergers GPA, Defares PB. The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional and external eating behavior. Int J Eat Disord 1986; 5(2): 295-315.
20. Braet C, Claus L, Goossens L, Moens E, Van Vlierberghe L, Soetens B. Differences in eating style between overweight and normal-weight youngsters. J Health Psychol 2008; 13(6): 733-743.
21. Braet C, Soetens B, Moens E, Mels S, Goossens L, Van Vlierberghe L. Are two informants better than one? Parent-child agreement on the eating styles of children who are overweight. Eur Eat Disord Rev 2007; 15(6): 410-417.
22. Kim KS. The development of children's daily stress scale [master's thesis]. Seoul National University of Education; 2009.
23. van Strien T, Bazelier FG. Perceived parental control of food intake is related to external, restrained and emotional eating in 7-12-year-old boys and girls. Appetite 2007; 49(3): 618-625.
24. Flament MF, Hill EM, Buchholz A, Henderson K, Tasca GA, Goldfield G. Internalization of the thin and muscular body ideal and disordered eating in adolescence: The mediation effects of body esteem. Body Image 2012; 9(1): 68-75.
25. Goossens L, Braet C, Van Vlierberghe L, Mels S. Loss of control over eating in overweight youngsters: The role of anxiety, depression and emotional eating. Eur Eat Disord Rev 2009; 17(1): 68-78.
26. Striegel-Moore RH, Morrison JA, Schreiber G, Schumann BC, Crawford PB, Obarzanek E. Emotion-induced eating and sucrose intake in children: The NHLBI growth and health study. Int J Eat Disord 1999; 25(4): 389-398.
27. Braet C, van Strien T. Assessment of emotional, externally induced and restrained eating behaviour in nine to twelve-year-old obese and non-obese children. Behav Res Ther 1997; 35(9): 863-873.
28. Korea Health Industry Development Institute. In-depth analysis on the dietary intake survey of infant, children and adolescents: Winter survey. Ministry of Food and Drug Safety; 2008 Nov. Report No. Policy-Nutrition-2008-98.
29. Nguyen-Michel ST, Unger JB, Spruijt-Metz D. Dietary correlates of emotional eating in adolescence. Appetite 2007; 49(2): 494-499.
30. Wardle J, Marsland L, Sheikh Y, Quinn M, Fedoroff I, Ogden J. Eating style and eating behavior in adolescents. Appetite 1992; 18(3): 167-183.