Association between Frequency of Breakfast Eating and Obesity in Korean Adolescents

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Abstract

Background: The purpose of this study was to examine whether the frequency of breakfast eating was related with overweight/obesity in Korean adolescents.

Method: We analyzed the data collected in the 5th KYRBWS, in which 72,399 adolescents participated in 2009. We assessed the association between frequency of breakfast eating and body mass index by using multivariate logistic regression analysis.

Results: A total of 20,962(54.9%) boys and 18,479(54.0%) girls skipped breakfast 7 days(all days) per week at baseline. For boys, the odds ratios(ORs) between being overweight and frequency of breakfast eating were 1.040 for 3–5 times per week, 1.092 for 1–2 time(s) per week, 1.059 for no breakfast per week, compared to 6–7 times per week($p > 0.05$). The ORs between being obese and frequency of breakfast eating were 1.011 for 3–5 times per week, 0.968 for 1–2 time(s) per week, and 0.932 for no breakfast per week, compared to 6–7 times per week($p > 0.05$). For girls, the ORs between being overweight and frequency of breakfast eating were 0.990 for 3–5 times per week, 0.992 for 1–2 time(s) per week, 1.019 for no breakfast per week, compared to 6–7 times per week($p > 0.05$). The ORs between being obese and frequency of breakfast eating were 1.075 for 3–5 times per week, 0.946 for 1–2 time(s) per week, and 0.941 for no breakfast per week, compared to 6–7 times per week($p > 0.05$).

Conclusion: The frequency of breakfast eating has no correlation with overweight/obesity in Korean adolescents.

Keywords: Adolescent, Breakfast, Korea, Youth, Behavior, Web-based Survey, Obesity

Introduction

Excessive weight gain has become a major social and public health problem throughout Korea. According to the Korea National Health and Nutrition Examination Survey-IV (KNHANES-IV) conducted in 2009, 5.0% and 11.3% of adolescents aged 12–18 years are overweight and obese, respectively, and the prevalence of excessive weight gain is continually increasing year after year (1).

Excessive weight gain is known to cause negative health effects such as type-II diabetes, hyperten-sion, stroke, cardiovascular disease, musculoskeletal disorders, and some cancers (2). Furthermore, several studies report that approximately 80% of obese adolescents become obese adults, and hence, prevention of obesity during adolescence is important (3-4).

A sedentary lifestyle and physical inactivity contributes to the increasing prevalence of overweight and obesity in adolescents (5-7). Moreover, excessive energy intake is also an independent risk factor for excessive weight gain (8-9). For this reason,

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many obese people try to reduce energy intake by diet control and program.

Skipping breakfast is a common method for diet control. However, interestingly, even though skipping breakfast reduces energy intake in the morning, it is also related to a high prevalence of overweight and obesity (10-11). A large number of studies have being carried out to determine whether skipping breakfast is associated with obesity and related to variables in western countries (12-14). Moreover, longitudinal cohort studies have confirmed that regularly skipping breakfast is connected with an increased body mass index (BMI) in all age groups (15-18).

On the other hand, in Korea, no study has examined the relationship between skipping breakfast and obesity among adolescents, as well as no nationwide study has focused on this issue. Hence, the purpose of this study was to determine whether the frequency of breakfast eating was related with obesity in Korean adolescents throughout the country.

Materials and Methods

Subject

The 5th Korea Youth Risk Behavior Web-based Survey (KYRBWS-V) is a retrospective *cohort study* that was conducted using a complex sample design, which involved stratification, clustering, and multistage sampling. This nationwide school-based survey was conducted by the Korea Centers for Disease Control and Prevention in order to evaluate the prevalence of health-risk behavior among Korean adolescent students (19). The present study drew on the data from KYRBWS-V for students from 400 middle and 400 high schools to evaluate the association of frequency of breakfast eating with obesity, taking into account potential covariate variables such as age, frequency of smoking, frequency of drinking, the parents' education level, economic status, frequency of vigorous physical activity (PA), frequency of moderate PA, frequency of muscular strength exercises, mental stress, and sleep duration.

For the survey, classroom teachers assigned each participating student a unique identification number, with the help of which the students could access the survey web page. On this web page, the students were first asked about their willingness to participate in the survey. Those willing were given access to a self-administered questionnaire, which they completed anonymously at the school, while those unwilling, could not proceed further. The KYRBWS-V was administered to a nationally representative group, and ethical approval was not required since it did not collect private information. This survey was valid and reliable (20-21).

Students who were absent for long periods and students with dyslexia or dysgraphia were excluded from this study; the response rate was 97.6% (N = 75,066). The study sample comprised 72,399 students after excluding 2,667 students who did not meet the sample requirements or were absent. Table 1 shows the characteristics of subjects.

Dependent variables

The adolescent students were asked to self-record their height and weight and then the BMI (kg/m^2) was calculated for each student. According to the World Health Organization (WHO) Asia-Pacific standard of obesity, people with BMIs of <23, ≥23–<25, and ≥25 kg/m^2 were classified into normal, overweight, and obesity groups, respectively (22).

Independent variables

Frequency of breakfast eating was evaluated for each adolescent student by asking one question: (Q1) "Usually, how many days did you have breakfast per week?" The available responses were [1] 1–2 day (s), [2] 3–5 days, [3] 6–7 days, and [4] no breakfast. Then, these responses were classified into the following 4 groups: First group, 6–7 times per week (reference group); second group, 3–5 times per week; third group, 1–2 time (s) per week; and fourth group, no breakfast per week (worst condition group).

Table 1: The characteristics of subjects (Mean ± SD)

Variables		Boys (n = 38,152)	Girls (n = 34,247)	t (P) or F (P)	Total (n = 72,399)
Age (years)		15.00 ± 1.73	15.12 ± 1.77	-9.425 (***)	15.06 ± 1.75
Height (cm)		169.58 ± 8.19	160.08 ± 5.39	185.053 (***)	165.09 ± 8.46
Weight (kg)		60.14 ± 11.72	51.47 ± 7.67	118.834 (***)	56.04 ± 10.91
Body mass index (kg/m²)		20.80 ± 3.21	20.05 ± 2.58	35.002 (***)	20.45 ± 2.95
Weight state N (%)	Normal weight (BMI < 23)	29,404 (77.1)	29,674 (86.6)		59,078 (81.6)
	Over weight (23 ≤ BMI < 25)	4,385 (11.5)	2,961 (8.7)	1337.15 (***)	7,346 (10.2)
	Obese (25 ≤ BMI)	4,363 (11.4)	1,612 (4.7)		5,975 (8.3)
City size N (%)	Large cities	20,252 (53.1)	17,708 (51.7)		37,960 (52.4)
	Middle-sized cities	13,303 (34.9)	12,153 (35.5)	16.826 (***)	25,456 (35.2)
	Small-sized cities	4,597 (12.0)	4,386 (12.8)		8,983 (12.4)
Frequency of breakfast eating	6 -7 days per week	6,616 (17.3)	6,966 (20.3)		13,582 (18.8)
	3 – 5 days per week	6,627 (17.4)	5,460 (15.9)		12,087 (16.7)
	1 – 2 days per week	3,947 (10.3)	3,342 (09.8)	117.944 (***)	7,289 (10.1)
	No breakfast per week	20,962 (54.9)	18,479 (54.0)		39,441 (54.5)
Economic status N (%)	Very rich	2,691 (7.1)	1,337 (03.9)		4,028 (5.6)
	Rich	8,768 (23.0)	6,719 (19.6)		15,487 (21.4)
	Average	17,229 (45.2)	17,259 (50.4)	564.176 (***)	34,488 (47.6)
	Poor	6,890 (18.1)	6,825 (19.9)		13,715 (18.9)
	Very poor	2,574 (6.7)	2,107 (6.2)		4,681 (6.5)
Grade N (%)	1st grade middle-school	6,711 (17.6)	5,615 (16.4)		12,326 (17.0)
	2nd grade middle-school	6,722 (17.6)	5,727 (16.7)		12,449 (17.2)
	3rd grade middle-school	6,767 (17.7)	5,615 (16.4)	222.657 (***)	12,382 (17.1)
	1st grade high-school	6,626 (17.4)	5,369 (15.7)		11,995 (16.6)
	2nd grade high-school	5,889 (15.4)	6,102 (17.8)		11,991 (16.6)
	3rd grade high-school	5,437 (14.3)	5,819 (17.0)		11,256 (15.5)

*$P < 0.05$ **$P < 0.01$ ***$P < 0.001$, tested by independent t-test or Chi-square analysis

Covariate variables

Age: the adolescents' ages defined by the KYRBWS-V data were used without any alteration.

Frequency of smoking: This parameter was evaluated by asking the question "In the last month, how often have you smoked more than 1 cigarette per week?," for which the response options ranged from [1] no to [7] every day.

Frequency of drinking: This parameter was evaluated by asking the question "In the last month, how often did you consume more than 1 glass of alcohol per week?," for which the response options ranged from [1] no to [7] every day.

Parents' education level: This parameter was evaluated by asking 2 questions, that is, "What is your mother's education level?" and "What is your father's education level?"; the response options ranged from [1] middle school or lower to [3] college or higher.

Economic status: This parameter was evaluated by asking the question "What is your parents' economic status?," for which the response options ranged from [1] very rich to [5] very poor.

Frequency of vigorous PA, such as digging, aerobics, heavy lifting, or fast cycling during the week: the response options ranged from [1] no to [6] over 5 days.

Frequency of moderate PA, such as bicycling at a regular pace, carrying light loads, or playing doubles tennis during the week: the response options ranged from [1] no to [6] over 5 days.

Frequency of muscular strength exercises, such as sit-ups, push-ups, and weight lifting or weight training, during the week: the response options ranged from [1] no to [6] over 5 days.

Mental stress: This parameter was evaluated by asking the question "What is the degree of mental stress that you experienced in the last month?," for which the response options ranged from [1] very high to [5] none.

Sleep duration: This parameter was evaluated by asking the question "What was the daily sleep duration during the last month?," for which the response options ranged from [1] ≤4 h/day to [6] ≥8 h/day.

Statistical analysis

All results from this study are presented in terms of mean and standard deviation. Multivariate logistic regression analyses were conducted to determine whether frequency of breakfast eating was related to overweight/obesity after adjusting for covariate variables. Statistical significance was set at $P < 0.05$, and all analyses were performed using SPSS Complex Sample™ version 18.0 (SPSS, Chicago, IL, USA).

Results

The multivariate logistic regression analyses

The multivariate logistic regression analyses of frequency of breakfast eating for overweight and normal-weight groups and for obese and normal-weight, groups of Korean adolescents are shown in Table 2 and 3, respectively. The results presented in the tables show the prevalence of overweight and obesity in Korean adolescents after adjusting for covariate variables such as age, frequency of smoking, frequency of drinking, parents' education level, economic status, frequency of vigorous PA, frequency of moderate PA, frequency of muscular strength exercises, mental stress, and sleep duration, and spanning a range of frequency per week from "6–7 times per week" to "no breakfast per week". A total of 20,962 (54.9%) boys and 18,479 (54.0%) girls skipped breakfast 7 days (all days) per week at the baseline (ORs between normal-weight and overweight individuals, 18,625 boys and 17,667 girls; ORs between normal-weight and overweight individuals, 18,506 boys and 16,885 girls).

For boys, the odds ratios (ORs) [confidence interval (CI) 95%] between being overweight and frequency of breakfast eating were 1.040 (range, 0.951–1.162; $P = 0.482$) for 3–5 times per week, 1.092 (range, 0.963–1.239; $P = 0.170$) for 1–2 time (s) per week, 1.059 (range, 0.968–1.159; $P = 0.208$) for no breakfast per week, compared to 6–7 times per week (Table 2). The ORs (CI 95%) between being obese and frequency of breakfast eating were 1.011 (range, 0.908–1.126; $P = 0.843$) for 3–5 times per week, 0.968 (range, 0.854–1.097; $P = 0.611$) for 1–2 time (s) per week, and 0.932 (range, 0.854–1.018; $P = 0.120$) for no breakfast per week, compared to 6–7 times per week (Table 3).

For girls, the ORs (CI 95%) between being overweight and frequency of breakfast eating were 0.990 (range, 0.872–1.123; $P = 0.871$) for 3–5 times per week, 0.992 (range, 0.794–1.071; $P = 0.286$) for 1–2 time (s) per week, 1.019 (range, 0.992–1.125; $P = 0.714$) for no breakfast per week, compared to 6–7 times per week (Table 2). The ORs (CI 95%) between being obese and frequency of breakfast eating were 1.075 (range, 0.914–1.264; $P = 0.382$) for 3–5 times per week, 0.946 (range, 0.780–1.148; $P = 0.575$) for 1–2 time (s) per week, and 0.941 (range, 0.824–1.073; $P = 0.363$) for no breakfast per week, compared to 6–7 times per week (Table 3).

Table 2: The multivariable logistic regression analyses of frequency of breakfast eating for the overweight and normal-weight groups in Korean adolescents

Frequency of breakfast eating		Overweight Vs. normal-weight			
		Case	OR	95% CI	*P*-value
Boys	6-7 times per week	5,835	Ref		
	3-5 times per week	5,850	1.040	0.931-1.162	0.482
	1-2 time(s) per week	3,481	1.092	0.963-1.239	0.170
	No breakfast per week	18,625	1.059	0.968-1.159	0.208
Girls	6-7 times per week	6,624	Ref		
	3-5 times per week	5,167	0.990	0.872-1.123	0.871
	1-2 time(s) per week	3,177	0.992	0.794-1.071	0.286
	No breakfast per week	17,667	1.019	0.992-1.125	0.714

S.E; Standard Error, OR; Odd Ratio, CI; Confidence Interval
Tested by multivariable logistic regression analysis (adjusting for covariate variables such as age, frequency of smoking, frequency of drinking, the parents' education level, economic status, frequency of vigorous physical activity (PA), frequency of moderate PA, frequency of muscular strength exercises, mental stress, and sleep duration)

Table 3: The multivariable logistic regression analyses of frequency of breakfast eating for the obese and normal-weight groups in Korean adolescents

Category		Obese Vs. normal-weight			
		Case	OR	95% CI	*P*-value
Boys	6-7 times per week	5,892	Ref		
	3-5 times per week	5,893	1.011	0.908-1.126	0.843
	1-2 time(s) per week	3,476	0.968	0.854-1.097	0.611
	No breakfast per week	18,506	0.932	0.854-1.018	0.120
	6-7 times per week	6,356	Ref		
Girls	3-5 times per week	4,984	1.075	0.914-1.264	0.382
	1-2 time(s) per week	3,061	0.946	0.780-1.148	0.575
	No breakfast per week	16,885	0.941	0.824-1.073	0.363

S.E; Standard Error, OR; Odd Ratio, CI; Confidence Interval
Tested by multivariable logistic regression analysis (adjusting for covariate variables such as age, frequency of smoking, frequency of drinking, the parents' education level, economic status, frequency of vigorous physical activity (PA), frequency of moderate PA, frequency of muscular strength exercises, mental stress, and sleep duration)

Discussion

Skipping breakfast is closely associated with weight gain, overeating in the evenings, and increased appetite during the entire day (23-24). Therefore, we might expect to find a positive association between increasing frequency of skipping breakfast and overweight/obesity in Korean adolescents. This study indicated that an increasing frequency of skipping breakfast had no correlation with overweight/obesity adolescents even after controlling for covariate variables related to overweight/obesity.

Many studies have found an association between breakfast skipping and increased BMI or overweight/obesity (12-18), while several other studies have found no association between breakfast skipping and BMI (25-27) or overweight/obesity (28-

29). In our study, no association was found between breakfast skipping and obesity in Korean adolescents.

The adolescent period is a phase of rapid physical growth, culminating in sexual maturity, increased hormone levels, and psychological change (30-31). We believe that no association was found between increased skipping breakfast frequency and weight status in adolescent students because the rates of basal metabolic rate, fat metabolism, fat oxidation, and substrate oxidation during adolescence are higher than those during adulthood (32-34). Therefore, we think that even though adolescents have an increased skipping breakfast frequency (increased overeating and appetite during the day), there is no effect to their weight status because of the rates of metabolism, fat oxidation, substrate oxidation, and increased hormone levels that are the highest during their adolescent phase compared to the rest of their life (32-34). Nevertheless, further well-designed studies should be performed in the future to determine the effects of skipping breakfast on Korean adolescents.

This study has several limitations. First, it did not include the amount and quality of food eaten and the variety of food eaten. Second, the study did not examine the effects of skipping breakfast frequency on overeating and appetite. For this reason, we did not have any information on how skipping breakfast affected overeating and appetite. Third, the adolescents reported their height and weight via online methods; these variables were not directly measured. The prevalence of obesity might be lower because during this growth phase adolescents tend to increase in height and decrease in weight (21). Fourth, information regarding the economic status was obtained from the adolescent students, not from their parents, and thus their perceptions could have been inaccurate. Fifth, because the survey was a retrospective *cohort study,* we did not provide the cause and effect but only assessed the interrelationship between increased skipping breakfast frequency and overweight/obesity. However, we studied 72,399 adolescents from all over Korea. Therefore, our study has an enormous strength that is representa-tive of the relationship between frequency of breakfast eating and obesity in Korean adolescents. In conclusion, the frequency of breakfast eating has no correlation with overweight/obesity in Korean adolescents.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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