

Gender Differences in the Association between Eating Behavior and Depression of Adolescents: Evidence from a National Korean Cross-sectional Survey

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Purpose: The purpose of this study was to determine the relationship between unhealthy eating behavior and depression in adolescents, with confounding variables adjusted. **Methods:** This study is a secondary analysis of the data collected from the 2013 Korean Youth Risk Behavior Web-based Survey (KYRBWS). The analysis included 72,435 participants (36,655 male and 35,780 female). The data were analyzed by χ^2 test, t-test, and logistic regression analysis using SPSS Version 21 by complex samples analysis. **Results:** Compared with male adolescents with healthy eating behavior, those who with unhealthy eating behavior were more likely to suffer depression with other factors controlled (OR=1.37, 1.07~1.75). On the other hand, female adolescents with unhealthy eating behavior were less likely to feel depressed compared with female adolescents with unhealthy eating behavior and with other factors controlled (OR=0.98, 0.64~1.50). However, it was not statistically significant. **Conclusion:** Our findings suggest that healthy eating behavior may be a protective factor against depression in male adolescents, but not in female adolescents. Furthermore, our results suggest that the longitudinal associations between mental health and healthy eating behavior and other lifestyle factors are complex.

Key Words: Adolescents, Eating behavior, Depression, KYRBS

INTRODUCTION

The period of adolescence is a peak time for the onset of depression [1]. Also, depression in adolescence may increase the risk of suicide attempts [2,3]. In particular, adolescent mental health has drawn growing attention in South Korea due to a sustained increase in adolescent depression as well as suicide incidence [4]. Considering the serious consequences of depression, it is especially and extremely important to identify the modifiable risk factors and develop prevention and control strategies [5]. Various studies have investigated the associations between unhealthy behaviors and psychosocial health problems. Depression in adolescence is correlated with unhealthy behaviors such as drinking [6], smoking [6-10], low physical activity [8,11], shorter or longer sleep duration [9,12,13] and is also known to affect suicidal thoughts [4,14] and behav-

iors directly [13,15].

However, fewer studies have demonstrated associations between adolescent eating habits and mental health issues such as depression or stress. A study reported that girls were more likely to skip breakfast than boys and that breakfast-skipping was associated with worse mental health, such as higher levels of mental stress and depression [6,16]. It also reported that adolescents with psychosocial problems had improper health behaviors, such as unhealthy eating habits and improper physical activities [17]. Given that previous studies have limitations that make it not possible to make inferences about relationships [6,17] and only a single question about breakfast consumption is used to determine healthy eating behavior [6,16], it is essential to identify the association between depression and eating habits measured by multiple factors using nationwide representative or longitudinal samples.

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In particular, South Korean adolescents have been found to have relatively poorer eating habits than those in other countries [17,20]. However, to date, little research has placed the focus on the effects of eating habits on mental health in adolescence. Therefore, this study aims to determine the independent association between eating habits, including eating breakfast and consumption of fruits and vegetables, and depression after controlling principal confounding variables comprehensively using samples representative of Korean adolescents nationwide.

The level of depression in adolescence reportedly varies by gender [17,21,22] and the relative influence of relevant factors for the level of depression was also found to vary by gender [6,11,20]. Furthermore, gender differences in associations between healthy behaviors and psychosocial problems have been reported [17]. For this reason, it is necessary to investigate the association between eating habits and depression in both male and female adolescent groups to develop gender-specific prevention and/or intervention strategies.

The purpose of this study is to identify the gender differences in the association between eating behavior and depression in adolescents and its specific objectives were as follows: (a) to compare the level of depression, socio-demographic characteristics, and health-related characteristics between adolescent boys and girls, (b) to identify the differences in eating behavior and sociodemographic and health-related characteristics between those suffering depression and those not according to gender, and (c) to test the association between eating behavior and depression in the subjects after controlling the confounding variables.

METHODS

1. Study Design

This study employed a cross-sectional design to identify gender differences in the association between eating behavior and depression among South Korean adolescents aged 12 to 19 years.

2. KYRBWS and the Study Population

The basis for this investigation lies with The Ninth Korea Youth Risk Behavior Web-based Survey (KYRBWS), which was established in 2013 [23]. This study is a government-approved statistical survey that has been performed annually since 2005 to monitor priority health risks in Korean adolescents behavior by the Korea Centers for Disease Control and Prevention. A stratified multistage cluster-

sampling design was used to obtain a nationally representative sample of middle and high school students for the survey. Students voluntarily completed the anonymous, self-administered web-based survey during a regular class period. This study is comprised of 126 questions assessing demographic characteristics and 14 areas of health-related behaviors, including eating behavior and mental health. A total of 75,149 students from 400 middle schools and 400 high schools were surveyed and the response rate was 96.4 % [23]. Finally, 72,435 eligible participants (36,655 male and 35,780 female) were included in the analysis. We submitted a data use plan and a written pledge on the ninth KYRBWS homepage and received approval to use the data. This survey has been shown to be valid and reliable (valid in self-reported height, weight, and body mass index (BMI) of the KYRBWS questionnaire/ test-retest reliability of questionnaire for the KYRBWS).

3. Variables

The independent variable “healthy eating behavior” was defined as a composite score of having breakfast and eating fruits and vegetables at least five times a week [17], which was assessed through responses to three questions as followed: (a) “How often do you have breakfast per week?”, (b) “How often do you eat fruit each week?”, (c) “How often do you eat vegetables each week?”. The subjects who answered “ ≥ 5 days” to all questions were categorized in the healthy eating behavior group.

The dependent variable depression was assessed through responses to the question “During the last 12 months, have you ever felt so sad or hopeless almost every day for 2 weeks in a row that you stopped doing some of your usual activities?” Answering yes or no to the single question was coded as a dichotomous variable. This question may apply for screening depression in primary healthcare [6] and be generally used to measure depression as the outcome variable [6,7,24]. The subject characteristics examined were age, sex, whether the family lives together, school performance, and socioeconomic status as covariates. A measure of socioeconomic status was obtained through a five-point scale measuring family economic level ranging from 1 (high) to 5 (low) [7]. The items concerning smoking, alcohol intake, physical activity, sleep duration, BMI, and body weight perception among the health-related characteristics were analyzed. The subjects who answered “ ≥ 1 day” to the question “How many days did you smoke at least one cigarette in the last 30 days?” were categorized as smokers [7], and those who answered “ ≥ 1 day” to the question “How many days did you drink at least one glass

of alcohol for the last 30 days?" were categorized as drinkers. Current smoking and drinking behaviors were classified using a dichotomous categorical variable coded as 0 (no) or 1 (yes). The number of days for moderate and intense physical activities was analyzed using those items concerning the number of days for doing physical activities enough to generate a heart rate higher than the normal level or to be out of breath for ≥ 60 minutes and the number of days for doing intense physical activities enough to be out of breath or to sweat for ≥ 20 minutes for the last 7 days [17]. The mean sleep time was estimated on the basis of the time for going to bed and for getting up during the past weekdays (Monday-Friday). Obesity was determined on the basis of height and weight reported by adolescents themselves. From the standard growth chart for children and adolescents in 2007, $<5\%$ were categorized as underweight, 5~85% as normal, 85~95% as overweight, and ≥ 95 or ≥ 25 kg/m² as obese. As for body weight perception, the subjects were asked to answer the question "what do you think of your body?" by choosing among very underweight, slightly underweight, average, slightly overweight, and very overweight classified into three groups: underweight (very underweight and slightly underweight), average, and overweight (very overweight and slightly overweight) [25].

4. Statistical Analysis

Complex sample analysis was conducted with SAS software ver. 9.3 (SAS Institute Inc., Cary, NC, USA) using a survey procedure reflecting the sample design and sampling weights. A χ^2 test was used to estimate the difference in the relationship between depression and sociodemographic and health-related characteristics by gender. Multiple logistic regression analysis was performed to identify the association between eating behavior and depression adjusted for covariates that showed a significant difference in the χ^2 test and t-test. The adjusted OR and corresponding 95% CIs were calculated.

RESULTS

1. Variations in Depression and Sociodemographic and Health-related Characteristics by Gender for South Korean Adolescents

The comparison of depression and the general and health-related characteristics by gender for South Korean adolescents is presented in Table 1. There were statistically significant gender differences in depression: 37.1% of the

girls were depressed and 25.2% of the boys were depressed ($p < .001$). Living with family ($p = .028$), economic level ($p < .001$), and academic performance ($p < .001$), among the demographic characteristics, varied significantly by gender. Smoking ($p < .001$), drinking ($p < .001$), moderate ($p < .001$) or intense physical activity ($p < .001$), sleep duration ($p < .001$), BMI ($p < .001$), and subjective body image ($p < .001$) were among the health-related characteristics varying by gender. There was no significant gender difference in healthy eating habits: 18.3% for girls and 18.0% for boys ($p = .409$).

Male adolescents' depression significantly varied statistically in terms of living with family ($p < .001$), economic level ($p < .001$), smoking ($p < .001$), drinking ($p < .001$), moderate and intense physical activity ($p < .001$), sleep duration ($p < .001$), BMI ($p < .001$), subjective body image ($p < .001$), and healthy eating behavior ($p < .001$) (Table 2). Female adolescents' depression significantly varied statistically in terms of living with family ($p < .001$), economic level ($p < .001$), academic performance ($p < .001$), smoking ($p < .001$), drinking ($p < .001$), moderate or intense physical activity ($p < .001$), sleep duration ($p < .001$), subjective body image ($p < .001$), and healthy eating behavior ($p < .001$) (Table 2). BMI was a determinant of the level of depression for boys, not for girls. Academic performance was a determinant of the level of depression for boys, but not for girls.

2. Associations between Eating Behavior and Depression

The association between healthy eating behavior and depression was examined after controlling various variables (living with family, economic level, academic performance, smoking, drinking, moderate and vigorous physical activity, sleep duration, BMI, and perceived weight status), which have been identified as confounding variables affecting depression in boys; as a result, perceived weight status, BMI, sleep duration, living with family, and drinking had controlling effects and boys with unhealthy eating behavior had a statistically significantly higher odds ratio (OR=1.37) of depression (95% CI, 1.07~1.75) than those having healthy eating behavior. In contrast, the association between healthy eating behavior and depression was examined after controlling various variables (living with family, economic level, academic performance, smoking, drinking, moderate and vigorous physical activity, sleep duration, and perceived weight status), which have been identified as confounding variables affecting depression in girls; as a result, girls with unhealthy eating behav-

Table 1. Comparison of Characteristics between Boys and Girls (% [SE] or M±SE[†])

Characteristics	Categories	All subjects	Girls	Boys	χ^2 or t	p
Depression	No	69.1 (0.24)	62.9 (0.31)	74.8 (0.30)	1,201.07	< .001
	Yes	30.9 (0.24)	37.1 (0.31)	25.2 (0.30)		
Living with family	No	3.9 (0.17)	3.5 (0.23)	4.3 (0.24)	26.29	.028
	Yes	96.1 (0.17)	96.5 (0.23)	95.7 (0.24)		
Economic level	Very rich	7.5 (0.16)	5.1 (0.18)	9.7 (0.24)	695.36	< .001
	Rich	24.9 (0.24)	23.7 (0.36)	25.9 (0.32)		
	Medium	47.4 (0.23)	50.4 (0.33)	44.7 (0.32)		
	Poor	15.8 (0.21)	16.5 (0.31)	15.1 (0.29)		
	Very poor	4.5 (0.10)	4.2 (0.14)	4.7 (0.14)		
School performance	Very high	10.9 (0.14)	9.4 (0.18)	12.3 (0.21)	223.49	< .001
	High	23.7 (0.18)	24.4 (0.26)	23.1 (0.26)		
	Medium	28.1 (0.18)	28.8 (0.27)	27.4 (0.23)		
	Low	24.9 (0.19)	25.8 (0.25)	24.1 (0.27)		
	Very low	12.4 (0.15)	11.6 (0.20)	13.1 (0.22)		
Smoke	Non-smoke	54.4 (0.61)	62.7 (1.01)	51.3 (0.73)	163.60	< .001
	Smoke	45.6 (0.61)	37.3 (1.01)	48.7 (0.73)		
Drink	No	42.2 (0.59)	50.1 (0.86)	37.4 (0.76)	184.49	< .001
	Yes	57.8 (0.59)	49.9 (0.86)	62.6 (0.76)		
Moderate physical activities (day)	Never	34.9 (0.29)	43.1 (0.38)	27.3 (0.31)	3,873.11	< .001
	1	17.5 (0.17)	19.7 (0.24)	15.4 (0.24)		
	2	15.6 (0.18)	15.0 (0.23)	16.1 (0.26)		
	3	12.9 (0.15)	10.8 (0.19)	14.8 (0.21)		
	4	6.7 (0.12)	4.6 (0.13)	8.6 (0.16)		
	≥5	12.6 (0.18)	6.9 (0.16)	17.8 (0.26)		
Vigorous physical activities (day)	Never	23.8 (0.31)	34.2 (0.44)	14.2 (0.26)	6,663.08	< .001
	1	20.8 (0.20)	23.9 (0.29)	18.0 (0.25)		
	2	19.5 (0.20)	18.4 (0.26)	20.5 (0.30)		
	3	15.3 (0.17)	12.1 (0.24)	18.2 (0.22)		
	4	7.0 (0.12)	4.6 (0.14)	9.3 (0.16)		
	≥5	13.6 (0.20)	6.7 (0.16)	19.8 (0.310)		
Sleep duration (hour/day)	< 4	1.8 (0.07)	1.9 (0.10)	1.6 (0.09)	1,138.88	< .001
	4	8.0 (0.20)	9.2 (0.29)	6.9 (0.28)		
	5	19.3 (0.32)	20.8 (0.44)	17.8 (0.47)		
	6	26.2 (0.23)	26.8 (0.31)	25.6 (0.35)		
	7	25.4 (0.31)	24.3 (0.41)	26.5 (0.47)		
	≥8	19.3 (0.36)	17.0 (0.47)	21.5 (0.54)		
BMI (percentile)	Underweight	5.6 (0.13)	6.9 (0.20)	4.5 (0.16)	6,280.57	< .001
	Normal	80.0 (0.26)	89.5 (0.20)	71.3 (0.31)		
	Overweight	9.1 (0.18)	3.3 (0.10)	14.4 (0.25)		
	Obese	5.3 (0.15)	0.3 (0.03)	9.8 (0.22)		
Perceived weight status	Underweight	27.6 (0.20)	19.7 (0.22)	34.7 (0.24)	2,123.36	< .001
	Normal	33.7 (0.19)	35.9 (0.28)	31.8 (0.25)		
	Overweight	38.7 (0.20)	44.4 (0.28)	33.5 (0.25)		
Healthy eating behavior	No	81.9 (0.22)	81.7 (0.32)	82.0 (0.29)	1.31	.409
	Yes	18.1 (0.22)	18.3 (0.32)	18.0 (0.29)		

BMI=body mass index; SE=standard error; [†] Values are presented as weighted % (SE) or Mean±SE unless otherwise indicated.

ior had a lower odds ratio (OR=0.98) of depression, showing no statistically significant difference from those having healthy eating behavior (Table 3). In other words, boys with unhealthy eating habits were more likely to be depressed than those with healthy eating habits while performing healthy eating behavior was not significantly as-

sociated with the likelihood of depression in girls.

DISCUSSION

The present results suggest a gender-specific association between depression and eating behavior in Korean

Table 2. Characteristics of the Study Sample according to Depression by Gender (% [SE] or Mean±SE[†])

Characteristics	Categories	Boys				Girls			
		Normal	Depression	χ^2 or t	p	Normal	Depression	χ^2 or t	p
Depression		14.9±0.04	15.2±0.04	-1.03	.303	14.88±0.04	15.05±0.04	-1.68	.093
Living with family	No	67.8 (1.31)	32.3 (1.31)	43.58	< .001	56.3 (1.60)	43.7 (1.60)	24.89	< .001
	Yes	75.1 (0.30)	24.9 (0.30)			63.2 (0.32)	36.9 (0.32)		
Economic level	Very rich	75.7 (0.71)	24.3 (0.71)	374.11	< .001	64.3 (1.17)	35.7 (1.17)	483.62	< .001
	Rich	77.4 (0.50)	22.6 (0.50)			66.5 (0.56)	33.5 (0.56)		
	Medium	76.7 (0.39)	23.3 (0.39)			65.2 (0.42)	34.9 (0.42)		
	Poor	68.7 (0.73)	31.3 (0.73)			55.6 (0.65)	44.4 (0.65)		
	Very poor	60.1 (1.16)	39.9 (1.16)			42.9 (1.27)	57.2 (1.27)		
School performance	Very high	79.6 (0.63)	20.4 (0.63)	231.88	< .001	70.4 (0.79)	29.6 (0.79)	586.80	< .001
	High	77.3 (0.51)	22.7 (0.51)			67.9 (0.52)	32.1 (0.52)		
	Medium	76.0 (0.46)	24.0 (0.46)			65.5 (0.52)	34.6 (0.52)		
	Low	72.2 (0.55)	27.8 (0.55)			58.6 (0.56)	41.4 (0.56)		
	Very low	68.3 (0.69)	31.7 (0.69)			49.7 (0.81)	50.3 (0.81)		
Smoke	Non-smoke	69.9 (0.65)	30.1 (0.65)	98.35	< .001	49.3 (1.01)	50.7 (1.01)	100.71	< .001
	Smoke	60.9 (0.69)	39.1 (0.69)			34.1 (1.10)	65.9 (1.10)		
Drink	No	69.8 (0.92)	30.2 (0.92)	63.20	< .001	49.6 (1.07)	50.4 (1.07)	32.14	< .001
	Yes	60.4 (0.76)	39.6 (0.76)			41.5 (1.01)	58.5 (1.01)		
Moderate physical activities (day)	Never	78.9 (0.44)	21.0 (0.44)	136.45	< .001	65.8 (0.43)	34.3 (0.43)	105.22	< .001
	1	73.6 (0.65)	26.4 (0.65)			61.7 (0.61)	38.3 (0.61)		
	2	73.7 (0.67)	26.3 (0.67)			61.1 (0.76)	38.9 (0.76)		
	3	73.8 (0.63)	26.2 (0.63)			60.7 (0.88)	39.3 (0.88)		
	4	73.9 (0.75)	26.1 (0.75)			58.2 (1.18)	41.8 (1.18)		
	≥5	71.8 (0.59)	28.3 (0.59)			59.0 (0.95)	41.0 (0.95)		
Vigorous physical activities (day)	Never	77.5 (0.59)	22.5 (0.59)	48.63	< .001	64.0 (0.45)	36.0 (0.45)	25.60	< .001
	1	76.2 (0.52)	23.8 (0.52)			63.7 (0.57)	36.4 (0.57)		
	2	75.1 (0.57)	24.9 (0.57)			62.3 (0.62)	37.7 (0.62)		
	3	74.0 (0.61)	26.1 (0.61)			62.0 (0.82)	38.0 (0.82)		
	4	73.0 (0.83)	27.0 (0.83)			61.2 (1.24)	38.8 (1.24)		
	≥5	72.9 (0.53)	27.1 (0.53)			59.4 (1.00)	40.6 (1.00)		
Sleep duration (hour/day)	<4	56.8 (2.47)	43.2 (2.47)	373.92	< .001	43.7 (1.79)	56.3 (1.79)	381.76	< .001
	4	66.4 (1.11)	33.6 (1.11)			54.8 (0.94)	45.2 (0.94)		
	5	70.8 (0.74)	29.2 (0.74)			59.6 (0.67)	40.4 (0.67)		
	6	75.1 (0.55)	24.9 (0.55)			63.6 (0.56)	36.4 (0.56)		
	7	78.3 (0.49)	21.7 (0.49)			66.7 (0.61)	33.3 (0.61)		
	≥8	81.2 (0.56)	19.0 (0.56)			71.4 (0.72)	28.6 (0.72)		
BMI (percentile)	Underweight	80.7 (1.05)	19.3 (1.05)	40.40	< .001	65.0 (1.03)	35.0 (1.03)	7.71	.054
	Normal	75.3 (0.34)	24.7 (0.34)			63.1 (0.32)	36.9 (0.32)		
	Overweight	73.4 (0.62)	26.6 (0.62)			61.4 (1.47)	38.6 (1.47)		
	Obese	73.5 (0.76)	26.5 (0.76)			55.7 (4.53)	44.3 (4.53)		
Perceived weight status	Underweight	73.8 (0.44)	26.2 (0.44)	17.87	< .001	62.8 (0.62)	37.2 (0.62)	72.12	< .001
	Normal	76.2 (0.43)	23.9 (0.43)			65.6 (0.43)	34.4 (0.43)		
	Overweight	74.6 (0.41)	25.4 (0.41)			60.8 (0.46)	39.2 (0.46)		
Healthy eating behavior	No	74.9 (0.34)	25.1 (0.34)	42.04	< .001	62.0 (0.33)	38.0 (0.33)	67.33	< .001
	Yes	76.2 (0.63)	23.8 (0.63)			67.9 (0.65)	32.1 (0.65)		

BMI=body mass index; SE=standard error; a Values are presented as weighted % (SE) or M±SE unless otherwise indicated.

adolescents. To our knowledge, this is the first study to assess the association between eating behavior and depression in a nationally representative sample of Korean adolescents. Healthy eating behavior is inversely associated with depression among male adolescents, whereas there is

no relationship for female adolescents.

Having breakfast ≥ 5 times a week and consuming fruits and vegetables ≥ 5 times a week are defined as a healthy eating habit. In this study, 18.3% of the girls and 18.0% of the boys showed a healthy eating habits, with no sig-

Table 3. Association between Healthy Eating Behavior and Depression

Characteristics	Categories	Boys [†]			Girls [†]		
		OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Eating behavior	Non-healthy eating behavior	1.37	1.07~1.75	.013	0.98	0.64~1.50	.933
	Healthy eating behavior	1.00			1.00		

BMI=body mass index OR=odds ratio; CI=confidence interval; [†] Calculated by complex sample multi-logistic regression analysis, adjusted for family live together, economic status, academic performance, smoking, alcohol use, exercise habits, sleep duration, perceived weight status, BMI; [‡] Calculated by complex sample multi- logistic regression analysis, adjusted for family live together, economic status, academic performance, smoking, alcohol use, exercise habits, sleep duration, perceived weight status.

nificant gender difference. In contrast, a study in Dutch adolescents reported that 44.1% had healthy eating habits [17]. A study on the association between depression and eating habits in eleventh-grade boys and girls residing in a South Korean city found that 46.6% skipped breakfast [20]. The unhealthy eating habits of skipping breakfast or consuming fruits and vegetables irregularly seem to be a universal health problem for adolescents around the globe and multilateral efforts should be made to promote healthy eating habits for adolescents.

There were statistically significant gender differences in the level of depression: 37.1% for girls and 25.2% for boys. This is consistent with the result that the level of depression varied by gender for adolescents: girls showed more mental health problems including depression than boys [10,17,21,22]. Univariate analysis was performed to determine the association between depression and the variables related to depression, as presented by previous research; as a result, living with family, economic level, and academic performance (among the general characteristics) and such health behaviors as alcohol intake, smoking, physical activity, sleep time, subjective body image, and unhealthy eating habits were associated with depression for both male and female adolescents, whereas BMI was associated with depression for male adolescents but had no association with depression for female ones.

Such health behaviors as smoking, drinking, sleep duration and physical activity are strongly tied to depression. A study on the association between the level of depression and health behaviors for 929 high school students found that 53.5% were at a clinical level of depression [20]. Korean adolescents experience clinically significant levels of depression and show high levels of health-threatening behavior. In particular, the high school students who were female, whose academic performance was at a low level, who consumed alcohol, or who skipped breakfast were more likely to be depressed [20]. This result supports the finding that smoking and drinking were more strongly associated with a depressed disposition for both boys and girls. Also, a

study on Japanese adolescents found that girls sleeping <7 hours were at lower levels of mental health than those sleeping 7~9 hours, and that short or long sleep was associated with low levels of mental health for boys [9]. Adolescents with socio-psychological problems reportedly show improper health behaviors, such as insufficient exercise [17]. Body weight perceptions are associated with depression in adolescence. Overweight adolescents are at higher risk of a sense of depression and depression disorder [26, 27] and showed lower body satisfaction, the effects thereof on psychological discomfort, such as depression and anxiety, are mediated by self-esteem [26]. In particular, adolescents have wrong awareness of their actual weight [17], and both boys and girls have wrong recognition of themselves as being overweight, which is associated with a higher level of depression [24]. It is therefore necessary not only to emphasize the attempt to promote a healthy lifestyle in pursuit of depression control for adolescents but also to take interest in adolescent depression and give priority to depression assessment and management so that they make greater efforts to maintain health-related habits [20]. Since there is strong correlation between health behavior and depression, it is necessary to make efforts to promote health behavior in adolescents.

Lastly, the effects of healthy eating habits on depression were analyzed after controlling the variables related to depression; as a result, boys with unhealthy eating habits were statistically significantly more likely to be depressed than those with healthy eating habits but healthy eating habits were not significantly associated with the likelihood of depression in girls. In the case of female adolescents, univariate analysis showed the differences of eating habits between the depressed and mentally healthy groups. On the other hand, multivariate analysis showed that healthy eating habits did not significantly influence depression. Without gender division, eleventh-graders in a South Korean city who skipped breakfast were 1.74 times more likely to be depressed than those having breakfast (95% CI, 1.09~1.98) [20]. However, other previous study reported

that boys with psychosocial problems were statistically significantly more likely to have healthy eating habits unlike girls [17]. This difference is difficult to explain clearly, because previous studies, including this study, did not investigate the causal relationships. More health-related behaviors were associated with psychosocial problems in girls than in boys, and which may be due to the difference in what is considered risk-taking behaviors in girls and boys [17]. Also, relations between fruit/vegetable intake and other health-related behaviors with depression are complex. Behaviors such as smoking, physical activity may have a more important impact on depression than fruit and vegetable intake [18]. In one example, the research on the associations among mental health, dietary attitude, and eating habits in US high school students (N=2,287) showed that dietary attitude affected mental health for girls, not for boys [29]. In the association between diet and depression, it seems to be difficult to rule out the tendency that dietary restrictions, including skipping breakfast, are somewhat standardized for female adolescents. To identify the gender differences of eating behaviors on mental health, further studies that can explain causal relationships considering diverse variables are necessary.

Although the present study involved a nationwide survey of approximately 72,435 students, there are some limitations that must be addressed. First, because this was a cross-sectional survey, causal relationships could not be determined. To examine causal relationships, a future longitudinal study or randomized control trials of diets will be required. Second, measurement of 'depression' was based on the use of self-reports through only one question and it may result in the possibility of information bias. Thirds, not all possible confounding variables related to depression were not controlled. Depression in adolescence is not only associated with personal factors but also with family ones [22], and the frequency of family meals among the dietary factors positively affects depression [28]. Despite these limitations, this study can favorably be generalized because it used data at the national level and is significant in that it determined the independent association between healthy eating habits and depression after controlling diverse variables related to depression. In terms of poor generalization due to the differences in the cultural characteristics of health-related factors [1], this study is significant in that it was conducted to determine the association between healthy eating behavior and depression for South Korean adolescents. It is necessary to conduct longitudinal research for strict analysis of the effects of performing healthy eating habits, such as avoidance of skipping breakfast and fruit and vegetable intake,

as an area of health behaviors on depression and interventional research for determining the effects.

CONCLUSION

Identifying modifiable behavioral factors that may contribute to adolescent mental health is crucial to planning effective interventions [18]. A healthy diet, including eating breakfast regularly and consumption of whole fruits and vegetables, is one behavioral factor that has been associated with lower risk of depression in adolescents, especially in females. Hence, a gender-specific approach in a healthy diet program is necessary for the prevention and intervention of depression. Furthermore, our results suggest that the longitudinal associations between mental health and healthy eating behavior, such as regular breakfast consumption and/or fruit/vegetable intake, and other lifestyle factors are complex.

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