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ORIGINAL RESEARCH

Association Between Breakfast Consumption and Suicidal Attempts in Adolescents

Hwanjin Park[1], Kounseok Lee[2]

[1]Department of Occupational & Environmental Medicine, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea; [2]Department of Psychiatry, Hanyang University Medical Center, Seoul, Republic of Korea

Correspondence: Kounseok Lee, Tel +82-2-2290-8423, Fax +82-2-2298-2055, Email dual@hanyang.ac.kr

Purpose: It has been previously reported that skipping breakfast is positively associated with increased depression, anxiety, stress, and psychological distress. This study examined the effects of breakfast consumption on suicide attempts among adolescents.

Patients and Methods: The Korean Youth Risk Behavior Web-based Survey (KYRBWS) is an anonymous self-report survey conducted with middle- and high-school students to understand the health behavior of Korean adolescents. Variables related to suicide risk such as suicide attempts, breakfast frequency, depression, anxiety, and violence were analyzed using multivariate logistic regression analysis. The class selected as the sample class was surveyed for all students and the number of youths selected as the sample in 2020 was 57,925 students from 800 schools (400 middle schools and 400 high schools) in 17 cities and provinces nationwide. Among them, the dataset for this study was 54,948 completed adolescent health behavior surveys.

Results: Adolescents who attempted suicide often skipped breakfast and had high stress levels. In the regression analysis, those who ate breakfast less than once a week had a stronger association with suicide attempts than the group of six or seven times a week (OR = 2.186; 95% CI = 1.873–2.552). In the group of feeling sadness or hopeless for more than two weeks in the past year, those who ate breakfast zero or once a week (OR = 1.269; 95% CI = 1.044–1.542), or two or three times (OR = 1.300; 95% CI = 1.043–1.619), showed a stronger correlation with suicide attempts than the group of six or seven times a week.

Conclusion: Breakfast can affect adolescents' emotions. Helping adolescents regularly eat breakfasts might be a suicide prevention strategy.

Keywords: breakfast, suicide, depression, risk factors, adolescents

Introduction

Suicide is defined as the voluntary act of taking one's life of one's own free will. Suicide has been the number one cause of death among adolescents in Korea for 10 consecutive years,[1] and it has been reported that suicidal thoughts are sharply increasing, especially among those aged 12–14 years.[2]

Among possible adolescent suicide prevention strategies, the most important is the early detection of high-risk adolescents. According to previous studies related to suicide factors in adolescents, about 20% of all adolescents experience severe depression and suicidal thoughts due to complex stress factors such as school violence, bullying, academic stress, mental problem, and family problems.[3–6] In recent years, the COVID-19 pandemic situation is negatively affecting the mental health of adolescents, either directly or indirectly.[7] In addition, national education policies can also be a risk factor for adolescent suicide.[8,9]

When adolescents experience rapid physical growth, they require large amounts of energy and nutrition to support their growth, vigorous physical activity, academic performance, and hormonal actions triggering sexual maturity. A balanced intake of various nutrients at regular intervals is essential to maintain proper growth and health during adolescence. In particular, breakfast is the most important meal of the day as it supplies the necessary nutrients and energy for body's metabolic processes after fasting overnight.[10]

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Among children and adolescents, since the brain's metabolic demand for glucose use is higher than that of adults, skipping breakfast can lead to decreased cognitive function and academic performance. A lack of glucose during these life periods may cause hormonal abnormalities that can increase the risk of adult metabolic diseases.[11,12]

According to previous studies, while disorders in eating habits negatively impact life satisfaction, healthy eating habits are essential for maintaining health and are also mentioned as factors that increase life satisfaction because they are related to positive family relationships.[13] Furthermore, in the case of those who regularly eat breakfast, previous studies have reported that their chronic stress levels were low and breakfast had a stress-buffering effect.[12] Breakfast had an important role in the relationship between stress and quality of life in adolescents.

In a large study of college students from 28 countries, skipping breakfast was associated with problems such as depression, low euphoria, sleep problems, and poor grades.[14] Skipping breakfast in adolescents is known to increase the risk of suicidal thoughts and suicide plans.[15,16] It is possible that these processes were mediated by depressive symptoms.[15] A meta-analysis of the relationship between breakfast and depression found that skipping breakfast was associated with a higher risk of depression and anxiety (OR = 1.39; 95% CI = 1.34–1.44, OR = 1.51; 95% CI = 1.25–1.77); however, it had nothing to do with stress.[17] Skipping breakfast was positively associated with increased depression, anxiety, stress, smartphone abuse, and psychological distress.[17,18]

As such, breakfast is associated with several emotional states. However, no studies have used large-scale data to explore the association between breakfast and suicide in Eastern adolescents. The purpose of this study was to examine the relationship between breakfast and suicide attempts among adolescents.

Materials and Methods

Study Population

The Korean Youth Risk Behavior Web-based Survey (KYRBWS) is an anonymous self-report survey conducted with middle- and high-school students to understand the health behavior of Korean adolescents. The Korea Youth Risk Behavior Web-based Survey (KYRBWS) is a national approval statistic (approval number 117058) implemented the Ministry of Education, the Ministry of Health and Welfare, and the Korean Centers for Disease Control and Prevention (KCDC) in accordance with the Bioethics Act. The Institutional Review Board of Kangbuk Samsung Hospital in Seoul, Korea (KBSMC 2022-07-002) approved this study, and the requirement for written informed consent was waived because the data was obtained from public government sources.

This study used data from the 2020 KYRBWS. The survey created a sample with a target group of middle- and high-school students nationwide as of April 2020. Using a stratified extraction method with permanent random numbers, sample schools were first extracted for each region and school type. Second, after identifying characteristics such as the number of classes and the number of students per class at the sample schools that agreed to participate in the survey, one class per grade was randomly selected as a sample class and three classes per school were investigated. The class selected as the sample class was surveyed for all students and the number of youths selected as the sample in 2020 was 57,925 students from 800 schools (400 middle schools and 400 high schools) in 17 cities and provinces nationwide. Among them, 54,948 adolescents participated, indicating a 94.9% participation rate. The data were collected under unique numbers without personal information and the subjects' anonymity was thoroughly guaranteed. In this study, all collected data from 54,948 adolescents were used for the analysis.

Measures

Suicide Attempts

Suicidal attempts were assessed by binary question whether they had ever attempted suicide during the past 12 months.[19,20]

Frequency of Breakfast

Subjects were asked "On how many of the past seven days did you eat breakfast?" to which they responded with a number in the range 0–7. In the questionnaire, information was presented that bread, porridge, cereal, etc. were included in the meal except for those who only consumed milk or juice.

Demographic Variables

The demographic characteristics were gender, body mass index (BMI), school division, academic performance in the past year, and family economic status. Gender was divided into male and female and schools were divided into middle and high schools. Individual academic performance and family economic status for the past 12 months were investigated in five stages.

Mental Health-Related Variables

Mental health-related variables include subjective health status, subjective body type, usual stress level, feelings of sadness or hopelessness strong enough to stop daily activities that lasted for two or more weeks within the past year, violence against friends, seniors, or adults in the last year, subjective health status, subjective body type perception, and usual stress level were investigated with multiple-choice questions. The Korean version of the Generalized Anxiety Disorder-7 (GAD-7) was used to evaluate anxiety.[21]

Health-Related Behavior

Data such as physical activity, drinking, smoking, drug abuse, and sexual experience were used as health-related behavioral variables. Physical activity was investigated as the number of days on which the respondent's heart rate was increased over the past seven days or when they did physical activities that resulted in shortness of breath for more than 60 minutes a day. Respondents were asked about drinking and smoking. Substance abuse was investigated as Yes or No regarding whether they habitually used any drugs or substances, except for those required for therapeutic purposes.

Statistical Analysis

Respondents were classified into two groups according to whether they had attempted suicide and each group's characteristics were analyzed. The *t*-test was used for continuous variables and the chi-square test was used for categorical variables. Multiple logistic regression analysis was performed to analyze the association between each variable and suicide attempts. Subjects were divided into two groups according to whether they had experienced depressive symptoms in the past year (whether they had felt sad or hopeless for more than two weeks). After adjusting for stress level, violent victimization, subjective health status, alcohol, smoking, academic performance, drug abuse, subjective body shape, BMI, GAD-7 score, and socioeconomic status, the tested variable was the frequency of breakfast. All statistical analyses were performed using SPSS v27 (IBM Inc., NY, USA). Statistical significance was set to <0.05 for a two-sided test.

Results

General Characteristics by Suicidal Attempt

Among the total 54,948 subjects, 1121 (2.0%) had attempted suicide in the past year and 53,827 (98.0%) had not. Among the suicide attempt group, 39.8% ate breakfast less than once a week, which was significantly higher than among the no suicide attempts group (28.3%) ($p < 0.001$). The proportion of female students in the suicide attempt group was 65.9%, which was higher than that of the no suicide attempts group (48.0%) ($p < 0.001$), but there was no difference in suicide attempts between middle- and high-school students ($p = 0.944$). The rate of feeling sadness or hopelessness for two or more weeks within the past year was 80.7% in the suicide attempt group, which was higher than the 24.0% in the no suicide attempt group ($p < 0.001$). In the suicide attempt group, the rate of answering that they felt severe stress in their daily life (at level 4 or 5) in their daily life was 77.8%, which was higher than that of the group without suicide attempts (33.0%) ($p < 0.001$). The rate of receiving treatment due to physical or psychological violence was significantly higher in the suicide attempt group ($p < 0.001$) at 11.9% and 1.1% in the no suicide attempt group. The GAD-7 score was 10.25 ± 6.31 in the suicide attempt group and 3.77 ± 4.22 in the no suicide attempts group, significantly higher in the suicide attempt group ($p < 0.001$), and there was no significant difference in BMI between the two groups ($p = 0.317$). In the suicidal ideation group, 23.6% perceived their subjective health as bad or very bad, which was significantly higher than that of the group without suicidal ideation (7.2%) ($p < 0.001$). The rate of such thoughts was 48.1%, which was higher than that of the no suicide attempts group (39.5%) ($p < 0.001$).

There was no difference in the number of times spent in physical activity for more than 60 minutes in the past seven days between the suicide attempt group and the no suicide attempts group ($p = 0.068$) but the rate of drinking more than six days a month was higher in the suicide attempt group ($p < 0.001$). In addition, the rate of not smoking in the no suicide attempts group

(83.1%) was lower than in the suicide attempt group (95.8%). The rate of frequent cases was high ($p < 0.001$). The rate of sexual experiences in the suicide attempt group (18.5%) was significantly higher ($p < 0.001$), as was the substance abuse rate (7.2%) compared to the no suicide attempts group (0.6%) ($p < 0.001$). In the suicide attempt group, the rate of low-to-medium or low academic performance was 47.3%, which was higher than that of the no suicide attempts group (32.8%) ($p < 0.001$, Table 1).

Suicidal Attempts by Study Variables

The regression analysis showed that those who ate breakfast less than once a week had a stronger association with suicide attempts than those who ate breakfast six or seven times a week (OR = 2.186; 95% CI = 1.873–2.552) and

Table 1 General Characteristics of the Subject by Suicidal Attempt

	Total		Suicidal Attempt				P value
			Yes		No		
Frequency of Breakfast (Times a Week)	**N**	**(%)**	**N**	**(%)**	**N**	**(%)**	
0~1	15,675	28.5	446	39.8	15,229	28.3	<0.001
2~3	9708	17.7	238	21.2	9470	17.6	
4~5	9970	18.1	178	15.9	9792	18.2	
6~7	19,595	18.1	259	23.1	19,336	35.9	
Gender							
Male	28,353	51.6	382	34.1	27,971	52.0	<0.001
Female	26,595	48.4	739	65.9	25,856	48.0	
Grade of school							
Middle school	28,961	52.7	592	52.8	28,369	52.7	0.944
High school	25,987	47.3	529	47.2	25,458	47.3	
Sadness or hopelessness over 2 weeks							
No	41,108	74.8	216	19.1	40,892	76.0	<0.001
Yes	13,840	25.2	905	80.7	12,935	24.0	
Perceived stress level in daily life							
Extremely	4603	8.4	455	40.6	4148	7.7	<0.001
Stressful	14,059	25.6	417	37.2	13,642	25.3	
Moderately	24,379	44.4	211	18.8	24,168	44.9	
Minimally	9889	18.0	23	2.1	9866	18.3	
Not at all	2018	3.7	15	1.3	2003	3.7	
Violent victimization							
No	54,229	98.7	988	88.1	53,241	98.9	<0.001
Yes	719	11.3	133	11.9	586	1.1	
GAD-7 score	3.91±4.37		10.25±6.31		3.77±4.22		<0.001
Body Mass Index	21.53±3.66		21.47±3.73		21.53±3.66		0.317

(*Continued*)

Table 1 (Continued).

	Total		Suicidal Attempt				P value
			Yes		No		
Frequency of Breakfast (Times a Week)	**N**	**(%)**	**N**	**(%)**	**N**	**(%)**	
Subjective health status							
Very good	15,150	27.6	158	14.1	14,992	27.9	<0.001
Good	23,294	42.4	347	31.0	22,947	42.6	
Fair	12,342	22.5	351	31.3	11,991	22.3	
Poor	3891	7.1	213	19.0	3678	6.8	
Very poor	271	0.5	52	4.6	219	0.4	
Subjective body image							
Very thin	2281	4.2	68	6.1	2213	4.1	<0.001
Slightly thin	11,043	20.1	190	16.9	10,853	20.2	
Moderate	19,849	36.1	324	28.9	19,525	36.3	
Slightly obese	17,821	32.4	393	35.1	17,428	32.4	
Very obese	3954	7.2	146	13.0	3808	7.1	
Physical activity (last week)							
None	21,111	38.4	408	36.4	20,703	38.5	0.068
1 day	8432	15.3	161	14.4	8271	15.4	
2 days	7698	14.0	159	14.2	7539	14.0	
3 days	6328	11.5	134	12.0	6194	11.5	
4 days	3248	5.9	69	6.2	3179	5.9	
5 days	3517	6.4	71	6.3	3446	6.4	
6 days	1185	2.2	22	2.0	1163	2.2	
Everyday	3429	6.2	97	8.7	3332	6.2	
Alcohol consumption (month)							
No drinker	49,056	89.3	796	71.0	48,260	89.7	<0.001
2 days	3495	6.4	139	12.4	3356	6.2	
3~4 days	1059	1.9	49	4.4	1010	1.9	
6 days or more	1338	2.4	137	12.2	1201	2.2	
Smoking (month)							
Non-smoker	52,478	95.5	931	83.1	51,547	95.8	<0.001
1~9 days	1168	2.1	86	7.7	1082	2.0	
10 days or more	1302	2.4	104	9.3	1198	2.2	

(*Continued*)

Table 1 (Continued).

	Total		Suicidal Attempt				P value
			Yes		No		
Frequency of Breakfast (Times a Week)	**N**	**(%)**	**N**	**(%)**	**N**	**(%)**	
Sexual experience							
No	52,461	95.5	914	81.5	51,547	95.8	<0.001
Yes	2487	4.5	207	18.5	2280	4.2	
Drug abuse							
No	54,543	99.3	1040	92.8	53,503	99.4	<0.001
Yes	405	0.7	81	7.2	324	0.6	
Academic performance							
High	6736	12.3	108	9.6	6628	12.3	<0.001
Medium high	13,410	24.4	211	18.8	13,199	24.5	
Medium	16,585	30.2	271	24.2	16,314	30.3	
Medium low	12,684	23.1	292	26.0	12,392	23.0	
Low	5533	10.1	239	21.3	5294	9.8	
Socioeconomic status							
High	6039	11.0	112	10.0	5927	11.0	<0.001
Medium high	15,300	27.8	270	24.1	15,030	27.9	
Medium	26,397	48.0	447	39.9	25,950	48.2	
Medium low	5937	10.8	203	18.1	5734	10.7	
Low	1275	2.3	89	7.9	1186	2.2	

those who ate breakfast two or three times a week (OR = 1.876; 95% CI = 1.571–2.241) and four or five times a week (OR = 1.357; 95% CI = 1.120–1.645) also had a stronger association with suicide attempts than those who ate breakfast six or seven times a week. Compared to male adolescents, female adolescents had a higher association with suicide attempts (OR = 2.093; 95% CI = 1.848–2.371), and when the perception of stress in daily life was extreme (OR = 14.647; 95% CI = 8.734–24.566), the stressed respondents (OR = 4.082; 95% CI = 2.433–6.847) had a higher association with suicide attempts than those without stress. Compared to those who had not been involved in physical or mental violence with a friend or adult in the past year (OR = 12.230; 95% CI = 10.029–14.916), the association with suicide attempts was stronger and the subjective health status was very poor.

Those who attempted suicide included both those who answered that they were very skinny (OR = 1.852; 95% CI = 1.420–2.414) and those who said they were very fat (OR = 2.310; 95% CI = 1.895–2.818). Both drinking and smoking at least once had a significantly stronger association with suicide attempts than those who never smoked; the use of these two substances was highly correlated. Those with a history of substance abuse (OR = 12.861; 95% CI = 10.005–16.532) had a stronger association with suicide attempts than those who did not. The socioeconomic status of households had a significantly stronger association with suicide attempts in the low-middle class (OR = 1.874; 95% CI = 1.483–2.366) and the low-income group (OR = 3.971; 95% CI = 2.986–5.282) than in the high-income group (Table 2).

Table 2 Variables Associated with Suicidal Attempt

	Suicidal Attempt		P value
	Odds Ratio	**95% CI**	
Frequency of breakfast (times a week)			
0~1	2.186	1.873–2.552	<0.001
2~3	1.876	1.571–2.241	<0.001
4~5	1.357	1.120–1.645	0.002
6~7	Reference		
Gender			
Male	Reference		
Female	2.093	1.848–2.371	<0.001
Sadness or hopelessness over 2 weeks			
No	Reference		
Yes	13.245	11.404–15.385	<0.001
Perceived stress level in daily life			
Extremely	14.647	8.734–24.566	<0.001
Stressful	4.082	2.433–6.847	<0.001
Moderately	1.166	0.689–1.972	0.567
Minimally	0.311	0.162–0.598	<0.001
Not at all	Reference		
Violent victimization			
No	Reference		
Yes	12.230	10.029–14.916	<0.001
Subjective health status			
Very good	Reference		
Good	1.435	1.187–1.734	<0.001
Fair	2.778	2.298–3.356	<0.001
Poor	5.495	4.459–6.772	<0.001
Very poor	22.530	16.027–31.671	<0.001
Subjective body image			
Very thin	1.852	1.420–2.414	<0.001
Slightly thin	1.055	0.881–1.264	0.561
Moderate	Reference		
Slightly obese	1.359	1.171–1.576	<0.001
Very obese	2.310	1.895–2.818	<0.001

(*Continued*)

Table 2 (Continued).

	Suicidal Attempt		P value
	Odds Ratio	**95% CI**	
Alcohol consumption (month)			
No drinker	Reference		
2 days	2.511	2.090–3.017	<0.001
3~4 days	2.941	2.190–3.951	<0.001
6 days or more	6.916	5.719–8.364	<0.001
Smoking			
Non-smoker	Reference		
1~9 days	4.401	3.500–5.533	<0.001
10 days or more	4.807	3.894–5.933	<0.001
Sexual experience			
No	Reference		
Yes	5.120	4.378–5.988	<0.001
Drug abuse			
No	Reference		
Yes	12.861	10.005–16.532	<0.001
Academic performance			
High	Reference		
Medium high	0.981	0.777–1.239	0.873
Medium	1.019	0.814–1.276	0.867
Medium low	1.446	1.157–1.807	0.001
Low	2.771	2.201–3.487	<0.001
Socioeconomic status			
High	Reference		
Medium high	0.951	0.761–1.187	0.656
Medium	0.912	0.740–1.123	0.385
Medium low	1.874	1.483–2.366	<0.001
Low	3.971	2.986–5.282	<0.001

Note: *P* value calculated by logistic regression model.

Frequency of Breakfast and Suicidal Attempt According to Socioeconomic Status

The relationship between the number of breakfasts and suicide attempts according to the economic level was analyzed by stratifying the household economic level. The subjects were divided into three groups according to economic level (high, medium, and low). In the previous analysis, variables associated with suicide attempts were stress level, violent victimization, subjective health status, alcohol, smoking, academic performance, drug abuse,

Table 3 Association of Breakfast and Suicidal Attempt According to Socioeconomic Status

	Suicidal Attempt								
	Socioeconomic Status (High)			Socioeconomic Status (Medium)			Socioeconomic Status (Low)		
	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	*P* value
Frequency of breakfast (times a week)									
0~1	1.181	0.879–1.588	0.270	1.360	1.043–1.774	0.023	1.198	0.828–1.732	0.338
2~3	1.369	0.990–1.892	0.057	1.172	0.864–1.590	0.308	1.271	0.834–1.936	0.265
4~5	1.277	0.913–1.786	0.153	0.952	0.686–1.319	0.766	0.950	0.597–1.510	0.827
6~7	Reference			Reference			Reference		

Note: *P* value by multiple logistic regression model adjusted by stress level, violent victimization, subjective health status, alcohol, smoking, academic performance, drug abuse, subjective body shape, BMI, GAD-7 score and sadness or hopelessness over 2 weeks.

subjective body shape, BMI, GAD-7 score, and sadness or hopelessness for more than two weeks. After adjusting for these variables, multiple logistic regression analysis was performed to determine the correlation between the number of breakfasts and suicide attempts for each of the three groups divided by economic level. First, there was no significant difference in suicide attempts between the reference group who ate breakfast six or seven times a week and the other groups or between the group with high or low family economic status and the group with low or medium economic status. In the group in economic condition, the group who ate breakfast zero or once a week (OR = 1.360; 95% CI = 1.043–1.774) showed a significantly stronger association with suicide attempts than the group who ate breakfast six or seven times per week (Table 3).

Frequency of Breakfast and Suicidal Attempt According to Sadness or Hopeless

There was no difference in suicide attempts according to the number of breakfasts among those who had not felt sad or hopeless for more than two weeks in the past year. If they had felt sad or hopeless for more than two weeks in the past year, breakfast was eaten zero or once a week (OR = 1.269; 95% CI = 1.044–1.542), or two or three times (OR = 1.300; 95% CI = 1.043–1.619), showed a stronger correlation with suicide attempts than six or seven times (Table 4).

Table 4 Association of Breakfast and Suicidal Attempt According to Sadness or Hopeless Symptoms

	Suicidal Attempt					
	Sadness or Hopelessness Over 2 Weeks (-)			Sadness or Hopelessness Over 2 Weeks (+)		
	Odds Ratio	95% CI	P value	Odds Ratio	95% CI	P value
Frequency of breakfast (times a week)						
0~1	1.200	0.828–1.740	0.335	1.269	1.044–1.542	0.017
2~3	1.083	0.701–1.674	0.718	1.300	1.044–1.619	0.019
4~5	1.192	0.780–1.822	0.416	1.041	0.821–1.321	0.738
6~7	Reference			Reference		

Notes: *P* value calculated by multiple logistic regression model. It adjusted by stress level, violent victimization, subjective health status, alcohol, smoking, academic performance, drug abuse, subjective body shape, BMI, GAD-7 score and socioeconomic status.

Discussion

This study investigated the correlation between adolescent suicidal ideation and breakfast. Although suicidal ideation has different properties from suicide in the strict sense, it can be logically viewed as the starting point of a continuous process that precedes suicide attempts or suicidal behavior. In fact, suicidal behavior occurs more often in people who have experienced suicide attempts and suicide attempts occur more often in people who experience suicidal thoughts frequently.[22] Adolescent suicidal ideation is not caused by a single factor such as an individual's psychological dimension or a specific social structure but by complex interactions including personal psychological characteristics and family, school, and social factors.

Previous study has shown that depression and weight gain are mediated to affect suicide risk such as suicidal ideation and suicide plan.[15] However, in our study, not only emotional factors but also non-emotional factors such as grades and socioeconomic status were considered. In particular, we have confirmed that there was a significant difference in suicide attempts according to socioeconomic status.

In the univariate analysis, the suicide attempt group had significantly higher levels of depression, anxiety, stress, and breakfast skipping and had an increased history of physical and mental violence. Previous studies have also suggested that adolescents who are victims of school violence are more likely to commit suicide, which is consistent with the results of this study.[23] Regression analysis also confirmed that skipping breakfast was significantly associated with the risk of suicide. After incorporating economic status, it was found that skipping breakfast was significantly associated with suicide attempts among those in the middle economic status group. In a study involving the adult group, it is known that low household income is more negatively affected by skipping breakfast.[24] This result is probably because in the case of low socioeconomic group, emotional risk factors are greater than breakfast skipping.

In the group analysis, there was no difference between breakfast skipping and suicide attempts in the non-depressed group. It was confirmed that skipping breakfast was associated with a high suicide risk in depressed students. These fatigue, physical activity, and skipping breakfast are involved, but the relationships among them have not yet been revealed.[25] A previous study analyzing the relationship between breakfast and emotions found that breakfast helps to encourage positive emotions when facing difficulties such as insomnia.[26] One effect of skipping breakfast may be increased fatigue. In a previous study addressing the relationship between skipping breakfast and chronic fatigue in medical students, skipping breakfast and irregular eating were correlative factors with chronic fatigue.[27] Taken together, breakfast might help relieve fatigue.

There is no well-defined mechanism to explain why skipping breakfast might negatively affect mental health. The effect of skipping breakfast on emotions differs between adolescents and adults.[17] This difference is probably due to differences in hormone levels in adolescence.[28] Although skipping breakfast does not directly affect suicide, it seems to affect mood in the long term, affecting emotional problems such as suicide. From an endocrine perspective, this can be explained by the effect of growth hormones on mood. Blood levels associated with growth hormones affect dopamine and may be associated with mood changes.[29,30] In patients with depression, dopamine-related disorders can be ameliorated by antidepressant treatment, which can be explained by possibly affecting dopaminergic function by acting on serotonergic or noradrenergic circuits.[31] Therefore, it can be inferred that proper nutrition—especially breakfast—occupies an important place in adolescents' emotions. Reducing breakfast skipping can be an educational and administrative approach at the government level. This will be an effective model if it can improve and support adolescent's mental health.

The group with past suicide attempts also had lower grades. First, skipping breakfast can adversely affect students' academic performance. Children who skipped breakfast had a higher error rate on the Matching Familiar Figures Test (MFFT).[32] In particular, among children with poor nutritional status, the relationship between academic performance and skipping breakfast showed a more significant relationship.[33] Nourished children out-performed malnourished children on the Sternberg Memory Search test (SMST) and Stimulus discrimination test (SDT), assigned after breakfast; when the malnourished children skipped breakfast, their verbal fluency and coding tests had lower scores.[34] Meanwhile, when malnourished children were given school breakfasts, their academic performances improved significantly. In a study

comparing academic performance within 30 minutes of having breakfast at home and having breakfast at school, the group who ate breakfast at school showed higher academic performance.[35]

However, the current study confirmed that skipping breakfast significantly increased suicide attempts in the middle socioeconomic status group after accounting for emotional factors and grades. It is likely that—rather than having a direct effect on grades—factors such as skipping breakfast, socioeconomic status, and emotional status act in complex ways and all contribute to suicide risk.

The limitations of this study are as follows. First, the cross-sectional design using a self-reported test did not evaluate the long-term effects of breakfast. Second, the quality of the meal could not be evaluated. Besides skipping breakfast, the quality of breakfast is another factor that could affect mental health. Previous studies have found that people who skip breakfast have a better quality of life and lower levels of stress and depression than those who eat low quality or very low quality breakfasts.[36] Therefore, future research should evaluate meal quality in the cohort group. Third, only whether suicide was attempted in the past year was evaluated rather than the severity of the attempts. Suicidal ideation may occur accidentally, transiently, or passively, and may widely vary in severity with active and persistent characteristics. However, the presence or absence of suicidal ideation itself may be more important when assessing the risk of suicide than the severity of suicidal ideation.[37] Although this study only evaluated suicide attempts, it can be said that suicide was evaluated more directly by evaluating suicide attempts over the past year rather than suicidal ideation.

This study is an analysis with the largest number of samples for a single cohort related to breakfast in east Asia. In addition, the relationship between breakfast and suicide was analyzed by correcting for many variables related to the behavioral characteristics of adolescents and suicide. Existing depression, anxiety, stress, drinking, and smoking all had effects on suicide. We have confirmed that skipping breakfast was not correlated with suicide risk in the absence of depressive symptoms, but it was correlated with suicide risk in the group with depressive symptoms. A future study should examine the causal relationship of current risk factors through prospective data collection that targets various groups.

Conclusion

Breakfast is necessary for adolescents' development and emotional stability. Although it is related to depression and anxiety, as has been previously revealed, in this study, it was confirmed that skipping breakfast was strongly associated with suicide. Although many complex factors contribute to suicide, practical and direct interventions can help prevent suicide. Given the importance of suicide prevention from a public health perspective, helping adolescents have regular breakfasts might be a potential prevention strategy.

Data Sharing Statement

The datasets used to analyze in this study are available from the corresponding author on reasonable request.

Ethics Approval and Informed Consent

The study was conducted in accordance with the Declaration of Helsinki, and this study was not involving humans or animals so not applicable for Institutional Review Board.

Consent for Publication

All authors agreed with the publication of this manuscript.

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Disclosure

All authors had full access to the data and take full responsibility for the integrity of the data and the accuracy of the analyses. No authors declare conflicts of interest, financial, or otherwise.

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