

Factors related to Suicidal Ideation in Korean High School Students

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한국 고등학생의 자살생각 관련 요인

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Abstract This study identifies factors related to suicidal ideation such as demographics, health behaviors and subjective perceptions of high school students. This study analysis using the chi-square test and multiple logistic regression to find out the factors related to suicidal ideation using the 2020 youth online health pattern survey of 25,987 Korean high school students. Sociodemographic factors that affected suicidal ideation in these subjects included grade, gender, and housing type. The health behavior characteristics were experiences with drinking, smoking, sex, and drug misuse. Finally, the subjective perception characteristics included health status, happiness status, loneliness, stress level, and depression. Therefore, it is expected that will be used as basic data for strategies to prevent suicide among high school students in Korea in the covid-19 environment.

Key Words : Adolescent health behavior online survey, Health behavior characteristics, Subjective perception characteristics, Suicidal ideation, Korea

요약 본 연구는 고등학생의 인구학적특성, 건강행동, 주관적 인식이 자살생각에 관련 있는 요인인지 파악하는 것이다. 본 연구는 한국 고등학생 2만5987명을 대상으로 한 2020년 청소년 온라인 건강 행태 조사를 이용하여 자살생각과 관련있는 요인을 알아보기 위하여 카이 제곱 검정과 다중 로지스틱 회귀 분석을 사용하여 분석하였다. 자살생각에 영향을 준 인구학적특성 요인에는 성적, 성별, 주거 형태가 포함되었다. 건강 행동에서는 음주, 흡연, 성별, 약물 오남용 경험이었다. 마지막으로 주관적인 인식 특성에서는 건강 상태, 행복 상태, 외로움, 스트레스 수준, 우울이었다. 이에 따라, 본 연구는 코로나-19 상황에서 국내 고등학생들의 자살 예방 전략의 기초 자료로 활용될 것으로 기대된다.

주제어 : 청소년 온라인 건강 행태 조사, 건강행동특성, 주관적 인식 특성, 자살생각, 한국

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Received August 25, 2021

Accepted November 20, 2021

Revised October 12, 2021

Published November 28, 2021

1. Introduction

1.1 The necessity of Research

Suicide by Korean adolescents has emerged as a social problem due to Korea's competition-oriented society, rigid academic form, and lack of psychological protection factors [5].

According to a survey released by the National Statistical Office in September 2021, the suicide rate per 100,000 people in Korea in 2020 decreased by 4.4% from 2019 to 23.5 [1]. However, the suicide rate in major OECD countries still ranks first among 36 countries and is 1.1 times higher than the average [1], indicating that Korea has a serious suicide problem.

In particular, the overall suicide rate in Korea in 2020 decreased compared to 2019, but the teenage suicide rate increased from 5.9 in 2019 to 6.5, an increase of 9.4% compared to last year [1]. The number one cause of teenage death since 2011 is "suicide," a deliberate self-harm. In addition, according to the Online Youth Health Behavior Survey in 2020, 10.9% of students have seriously considered suicide for 12 months, 10.2% in middle school and 11.5% in high school, indicating that high school students have higher suicidal thoughts than middle school students [2]. Through these results, we can understand the severity of suicide among Korean high school students.

High school students are adolescents who experience a period of upheaval [3]. It is a phase of rapid physical, psychological and social growth, a transition period [4] between childhood and adulthood, and a period of identity formation. Some adolescents complain of related confusion and problems adapting [4,5]. In particular, Korean high school students experience excessive college entrance exams and social competition along with adolescence [5].

This change more than ever threatens adolescents' physical and mental health and social well-being [6]. Because high school students have relatively immature judgment and psychological self-regulation skills, when faced with difficulties, they are more likely to feel depression, impulsive behavior, school maladjustment behavior, and suicidal ideation [6].

Suicide is a continuous process from suicidal ideation, suicide plans, and suicide attempts and is a comprehensive concept [7]. Suicidal ideation is a crucial stage before a suicide attempt because it constitutes a story of thoughts and imagination about suicide. In particular, adolescents' lack of self-discipline is more likely due to brain development characteristics [8], so suicide attempts may follow suicidal ideation. Adolescents who attempted suicide are more likely than other adolescents to have had suicidal ideation before [9]. Not all suicidal ideation leads to suicide planning or suicide attempts. However, previous studies demonstrated that suicidal ideation is more likely to lead to suicide attempts [10], and suicidal ideation in adolescents affects adult suicide attempts [3]. Therefore, to prevent the suicide problem of adolescents in advance, it is necessary to identify factors related to adolescent suicidal ideation.

Suicide is related to internal attributes and external factors [11]. According to previous studies, adolescence is cognitively and emotionally immature and impulsive, so there is a risk of impulsive suicide due to depression, stress, and loneliness [3]. Using the 12th Korea Youth Risk Behavior Web-Based Survey in 2016, it was reported that suicidal ideation of Korean adolescents had an effect on the Goo's study [12], which investigated the relationship between drug use experiences and factors affecting adolescent mental health. There have

also been studies on factors affecting the mental health of adolescents, including suicidal ideation[13]. In addition, health risk behaviors such as smoking, sexual activity, and unhealthy eating in adolescence are related to mental health problems and suicidal thoughts [3,14]. In addition, environmental factors such as the economic situation and living conditions of adolescence [15] were found to be factors affecting mental health and suicidal ideation. However, there were a few papers that comprehensively analyzed various factors related to suicidal ideation in high school students.

Therefore, in this research, the factors affecting the suicidal ideation of high school students in Korea are investigated from various angles using the raw data of the 2020 adolescent health behavior online survey. This research Survey consists of 16 areas (subjective health status, eating habits, physical activity, obesity and weight control, mental health, oral health, personal hygiene, injury prevention, violence, drinking, smoking, sexual patterns). In this study, statistical application and missing values were considered in the process of selecting variables that could be research topics. Based on previous studies, it was divided into final demographic characteristics, health behaviors characteristics, and subjective perception characteristics in the most appropriate category format[16-18]. Through this research, this study intends to provide evidence for suicide prevention measures in high school students.

1.2 Purpose of Research

This study identifies the factors that affect suicidal ideation in high school students in Korea. Its specific objectives are as follows:

To examine the relationship between demographic

characteristics, health behavior characteristics, subjective perception characteristics, and suicidal ideation of high school students, and identify factors related to high school students' suicidal ideation.

2. Methods

2.1 Research Design

This study is a secondary analysis that uses statistical data from the 16th (2020) Adolescent Online Health Behavior Survey to identify factors related to suicidal ideation in Korean high school students.

2.2 Research Design

This data is data from the Korea Centers for Disease Control and Prevention, which was surveyed based on the middle and high school students nationwide as of April 2020. We used a stratified cluster sampling method for the raw sampling of the adolescent online health behavior survey. The stratified sampling method was used to sample this data, and in 17 cities and provinces, the primary sampling was handled on a school basis and the secondary sampling on a class basis. For the secondary sampling, 1 class was randomly selected by grade from the selected sample school. We extracted and analyzed 25,987 high school student samples out of 54,948 students from 793 schools. Among the sample schools selected from the raw data, we replaced those with fewer than 50 students and scheduled closures or long-term closures with similar schools geographically close to them. In addition, we selected samples from one class in each of humanities, natural sciences, and vocational training.

2.3 Ethical Consideration

The institution on the Korea Centers for Disease Control and Prevention website approved the use of this study. The publication registration number (11-1460736-000038-10) and statistical approval number (117058) verify the data of this study.

2.4 Research Variable

2.4.1 Independent variable

We selected independent variables representing students' demographics, health, and subjective perceptions. We used seven variables to assess the demographic characteristics: school grade (1st, 2nd, 3rd), gender (Male, Female), grade (High, Middle, Low), economic status (High, Average, Low), residential form (Family, Relatives, Dormitory), father's education background (below high school, University and above, Unknown) mother's education background (below high school, University and above, Unknown). We assessed the health behavior characteristics using six variables: number of breakfasts per week (From Starvation to Everyday), drinking experience (Yes, No), smoking experience (Yes, No), sleep state (Enough, Moderate, Insufficient), sexual intercourse experience (Yes, No), and drug misuse experience (Yes, No). We used six variables to assess the subjective perception characteristics: subjective health (Good, Moderate, Bad), happiness (Happy, Moderate, Non-happy), loneliness (A little, Moderate, Much), stress level (A little, Moderate, Much), sadness, and despair (Yes, No).

2.4.2 Dependent variable

In this study, we selected the occurrence of suicidal ideation as the dependent variable, and specifically, to the question "Have you ever seriously considered suicide in the past 12

months?" We selected the answers "not in the last 12 months" and "have in the last 12 months."

2.5 Data analysis

As of April 2020, the Korea Centers for Disease Control and Prevention presented samples representing 25,987 high school students by applying weights to 1,305,365 high school students nationwide. We analyzed the 2020 Adolescent Online Health Behavior Survey by applying the composite sample design method and specifically divided the population into 39 local groups and school classes during the stratification phase. In the online health behavior survey, we applied the stratified direct sampling method for sampling. First, we set the primary extraction unit as a school and the second extraction unit as a class. Next, we applied a proportional distribution method in the sample distribution stage, considering sample size, then we selected the population composition ratio and sample composition ratio to match. Lastly, the weights for the data presented by the Centers for Disease Control and Prevention were applied by multiplying the extract rate reciprocal by the response rate reciprocal by the weighted post-calibration rate. In this study, weighted sample was used for estimating properties, means, and odds ratios according to the data analysis guidelines presented.

We used SPSS/WIN 23.0 to conduct data analysis as follows: To confirm the difference in suicidal ideation according to the subjects' general characteristics, we calculated the frequency and percentage and performed cross-analysis using a χ^2 -test. We performed complex sample logistic regression analysis to identify factors that affect the subjects' suicidal ideation.

3. Results

3.1 Demographic characteristics according to the presence or absence of suicidal ideation

The study subjects included 52.0% males and 48% females, of which 34.3% were 1st and 2nd graders, and 21.4% were 3rd graders. A total of 50.4% of subjects answered that their economic status was average, and 92.5% stated that they live with their family. Regarding the characteristics of each grade according to the presence or absence of suicidal ideation, the proportions of those in grades 1, 2, and 3 who answered that they did not have suicidal ideation were high (89.6%, 87.6%, and 88.3%), and by gender, males answered that they did not have suicidal ideation more than females. The ratio was high ($\chi^2 = 239.654, p = .001$).

In terms of grades, the respondents answered that they had suicidal ideation in the order of 'low' and 'high' rather than 'middle' ($\chi^2 = 80.178, p = .001$). For housing type, 24.7% indicated that

they lived with relatives. The rate of suicidal ideation was high and statistically significant ($\chi^2 = 46.127, p = .001$) as shown in Table 1.

3.2 Health behavior characteristics according to the presence or absence of suicidal ideation

In health behavior-related variables, we found a difference between eating breakfast, and suicidal ideation ($\chi^2 = 60.257, p = .001$): 26.5% of subjects ate breakfast every day, 26.1% ate 1 to 3 times a week, and 25.9% ate 4 to 6 times a week, and 21.5% in starvation. Of the total, 45.4% indicated experience with drinking ($\chi^2 = 245.124, p = .001$), and 15.6% answered that they had smoking experience ($\chi^2 = 195.253, p = .001$). In the case of sleep state, the rate of suicidal ideation was high in subjects with lack of sleep ($\chi^2 = 404.210, p = .001$), sexual experience ($\chi^2 = 233.166, p = .001$) and drug misuse ($\chi^2 = 214.850, p = .001$) as shown in Table 2.

Table 1. Demographic characteristics according to the presence or absence of suicidal ideation

(N = 25,987)

Variable	Classification	Suicidal ideation, n (%)			χ^2 (p)
		No	Yes	Total	
Grade	1st	7,981 (89.6)	926 (10.4)	8,907(34.3)	14.905 (.001)
	2nd	7,822 (87.8)	1,085 (12.2)	8,907(34.3)	
	3rd	7,218 (88.3)	955 (11.7)	8,173(31.4)	
Gender	Male	12,376 (91.5)	1,147 (8.5)	13,523(52.0)	239.654 (.001)
	Female	10,645 (85.4)	1,819 (14.6)	12,464(48.0)	
Grade	High	6,918 (89.5)	812 (10.5)	7,730(29.7)	80.178 (.001)
	Middle	7,366 (90.4)	781 (9.6)	8,147(31.4)	
	Low	8,737 (86.4)	1,373 (13.6)	10,110(38.9)	
Economic status	High	7,796 (89.6)	905 (10.4)	8,701(33.5)	167.162 (.001)
	Average	11,762 (89.8)	1,340 (10.2)	13,102(50.4)	
	Low	3,463 (82.8)	721 (17.2)	4,184(16.1)	
Housing type	Family	21,374 (88.9)	2,678 (11.1)	24,052(92.5)	46.127 (.001)
	Relatives	149 (75.3)	49 (24.7)	198(0.8)	
	Dormitory and Facilities	1,498 (86.2)	239 (13.8)	1,737(6.7)	
Father's education	Less than High school	4,807 (88.6)	621 (11.4)	5,428(20.9)	3.142 (.208)
	Higher than University	8,858 (88.2)	1,186 (11.8)	10,044(38.7)	
	Unknown	9,356 (89.0)	1,159 (11.0)	10,515(40.4)	
Mother's education	≤High school	5509 (88.2)	736 (11.8)	6,245(24.1)	2.886 (.236)
	≥University	8,580 (88.4)	1,126 (11.6)	9,706(37.3)	
	Unknown	8,932 (89.0)	1,104 (11.0)	10,036(38.6)	

Table 2. Health behavior characteristics according to the presence or absence of suicidal ideation

(N = 25,987)

Variable	Classification	Suicidal ideation, n (%)			χ^2 (p)
		No	Yes	Total	
Breakfasts (Per week)	Starvation	4,862 (87.0)	726 (13.0)	5,588(21.5)	60.257 (.001)
	1-3 day	5,930 (87.5)	848 (12.5)	6,778(26.1)	
	4-6 day	5,969 (88.6)	770 (11.4)	6,739(25.9)	
	Everyday	6,260 (91.0)	622 (9.0)	6,882(26.5)	
Drinking experience	No	12,970 (91.4)	1,220 (8.6)	14,190(54.6)	245.124 (.001)
	Yes	10,051 (85.2)	1,746 (14.8)	11,797(45.4)	
Smoking experience	No	19,681 (89.8)	2,242 (10.2)	21,923(84.4)	195.253 (.001)
	Yes	3,340 (82.2)	724 (17.8)	4,064(15.6)	
Sleep state	Enough	6,055 (93.6)	416 (6.4)	6,471(24.9)	404.210 (.001)
	Moderate	7,887 (90.4)	833 (9.6)	8,720(33.6)	
	Insufficient	9,079 (84.1)	1,717 (15.9)	10,796(41.5)	
Sexual experience	No	21,514 (89.4)	2,540 (10.6)	24,054(92.6)	233.166 (.001)
	Yes	1,507 (78.0)	426 (22.0)	1,933(7.4)	
Drug misuse	No	22,881 (88.9)	2,867 (11.1)	25,748(99.1)	214.850 (.001)
	Yes	140 (58.6)	99 (41.4)	239(0.9)	

Table 3. Subjective perception characteristics according to the presence or absence of suicidal ideation

(N = 25,987)

Variable	Classification	Suicidal ideation, n (%)			χ^2 (p)
		No	Yes	Total	
Subjective health status	Good health	16,214 (91.7)	1,466 (8.3)	17,680(68.0)	845.969 (.001)
	Moderate	5,068 (85.9)	833 (14.1)	5901(22.7)	
	Bad health	1,739 (72.3)	667 (27.7)	2,406(9.3)	
Subjective state of happiness	Happy	15,052 (95.0)	787 (5.0)	15,839(60.9)	3487.616 (.001)
	Moderate	6,568 (86.3)	1,042 (13.7)	7,610(29.3)	
	Non-happy	1,401 (55.2)	1,137 (44.8)	2,538(9.8)	
Subjective loneliness	A little	12,156 (96.6)	433 (3.4)	12,589(48.4)	3327.195 (.001)
	Moderate	8,322 (88.7)	1,060 (11.3)	9,382(36.1)	
	Much	2,543 (63.3)	1,473 (36.7)	4,016(15.5)	
Stress level	Much	7,500 (76.8)	2,263 (23.2)	9,763(37.6)	2183.818 (.001)
	Moderate	10,709 (94.6)	612 (5.4)	11,321(43.6)	
	A little	4,812 (98.1)	91 (1.9)	4,903(18.9)	
Depression	No	18,123 (96.0)	764 (4.0)	18,887(72.7)	3712.026 (.001)
	Yes	4,898 (69.0)	2,202 (31.0)	7,100(27.3)	

3.3 Subjective perception characteristics according to the presence or absence of suicidal ideation

Subjects' subjective health status was the highest, with 68.0% of those who answered that they were healthy, followed by those who responded that they were in an intermediate state and not healthy. In the subjective health status according to suicidal ideation, the more healthy, the higher the rate of not having suicidal ideation ($\chi^2 = 845.969$, $p = .001$). As for the subjective state of happiness, 60.9% of the

subjects indicated that they were happy. Thus, we confirmed that the subjects perceiving happiness had a high rate of not having suicidal ideation ($\chi^2 = 3487.616$, $p = .001$). Subjective loneliness showed a high rate of suicidal ideation ($\chi^2 = 3,327.195$, $p = .001$). Still, in the degree of stress, the rate of suicidal ideation after occasionally feeling stress was low ($\chi^2 = 2,183.818$, $p = .001$). In the absence of depression, we confirmed that the ratio of not having suicidal ideation was high ($\chi^2 = 3,712.026$, $p = .001$) as shown in Table 3.

Table 4. Suicidal ideation factors

(N = 25,987)

Variable	Classification	Suicidal ideation		
		OR	95%CI	χ^2 (p)
Grade	1st	1		
	2nd	1.196	1.089-1.312	.001
	3rd	1.140	1.036-1.255	.007
Gender	Male	1		
	Female	1.374	1.249-1.511	.001
Grade	High	1		
	Middle	1.072	0.958-1.200	.226
	Low	0.923	0.828-1.030	.155
Economic status	High	1		
	Average	0.933	0.839-1.038	.203
	Low	1.068	0.938-1.217	.320
Housing type	Dormitory and Facilities	1		
	Relatives	1.260	1.063-1.494	.008
	Family	2.126	1.431-3.157	.001
Breakfasts (Per week)	Starvation	1		
	1-3 day	0.949	0.837-1.076	.412
	4-6 day	0.922	0.777-1.095	.356
	Everyday	0.994	0.880-1.124	.928
Drinking experience	No	1		
	Yes	1.281	1.160-1.414	.001
Smoking experience	No	1		
	Yes	1.175	1.035-1.333	.013
Sleep state	Enough	1		
	Moderate	1.135	0.987-1.305	.076
	Insufficient	1.098	0.963-1.252	.161
Sexual experience	No	1		
	Yes	1.368	1.176-1.591	.001
Drug misuse	No	1		
	Yes	2.256	1.612-3.156	.001
Subjective health status	Good health	1		
	Moderate	0.948	0.851-1.056	.331
	Bad health	1.272	1.116-1.451	.001
Subjective state of Happiness	Happy	1		
	Moderate	1.570	1.406-1.753	.001
	Non-happy	3.682	3.223-4.207	.001
Subjective loneliness	A little	1		
	Moderate	1.651	1.456-1.874	.001
	Much	3.236	2.826-3.706	.001
Stress level	A little	1		
	Moderate	1.475	1.169-1.861	.001
	Much	2.646	2.096-3.341	.001
Depression	No	1		
	Yes	4.187	3.793-4.622	.001

3.4 Factors related to suicidal ideation

The purpose of this study was to identify factors related to suicidal ideation in high school students. We set up the analysis as a composite sample logistic regression model of

the univariate odds ratios of variables associated with the low suicidal incidence of thoughts.

The final analyzed regression model had Cox and Snell $R^2=0.159$, and Nagelkerke $R^2=0.314$.

According to the analysis, as the student's grade increased, suicidal ideation increased by 1.196 to 1.140 times, statistically significant. In addition, suicidal ideation was 1.374 times more common in women than in men, and the difference was significant. Test grades and economic status did not have statistically significant effects in this study. One item of interest is that suicidal ideation was 1.260~2.126 times higher in students living with relatives and family than in a dormitory; the difference was statistically significant. This study determined that the number of breakfasts per week did not have a statistically significant effect on the occurrence of suicidal ideation and that the probability of suicidal ideation was 1.281 times higher in students who had drinking experience than in those who did not. The probability of suicidal ideation was about 1.175 times higher in the group with smoking experience; the difference was statistically significant. However, sleep state did not have a statistically significant effect. Those who had sexual intercourse were 1.368 times more likely to have suicidal ideation than those who did not have this experience. Those who had misused drugs were 2.256 times more likely to have suicidal ideation than those who did not have this experience.

Subjective health status was associated with an increase in suicidal ideation by 1.272 times only in unhealthy cases but was not statistically significant overall. Students who reported that they were frequently 'Unhappy' and 'Frequently feel' subjective loneliness were 3.682 times and 3.236 times more likely to have suicidal ideation than the other students; the differences were statistically significant. Lastly, students who reported 'I often feel' sadness and 'I have despair' were 2.646 times and 4.187 times more likely to have suicidal ideation, respectively,

than the others. We identified depression as the variable with the highest odds ratios and statistically significant as shown in Table 4.

4. Discussion

Suicidal ideation is a precursor to suicide attempts and is emerging as a social issue beyond an individual problem. In addition to these characteristics, suicidal ideation in high school students is a critical indicator for health promotion and successful transition to adulthood. Therefore, in this study, we analyzed the factors related to high school students' suicidal ideation.

In the demographic characteristics of high school students, we found grade, gender, and housing type to be factors related to suicidal ideation. In detail, 2nd graders were 1.196 times more likely to have suicidal ideation than 1st graders. This result is consistent with a previous study of high school students in four schools randomly selected in urban and rural areas [19]. Female students were 1.374 times more likely to have suicidal ideation than male; this result is consistent with previous reports [19,20]. High school students living with their families were 2.126 times more likely to have suicidal ideation than high school students living in dormitories or facilities. This result is different from the findings of a previous study that used data from the 2019 Adolescent Health Behavior Survey, which found that adolescent suicidal ideation was more common in students who cannot live with their families than in students who do live with their families [5]. Due to school closures and restrictions because of COVID-19, adolescents spent more time with their families than previously, so conflicts between parents and children increased by 70.0% compared to the year before COVID-19 [21]. The COVID-19 pandemic has also been

shown to jeopardize relationships with families [22]. Since suicide is affected by the interaction of internal and external factors [10], future studies are necessary to identify the factors affecting high school students' suicidal ideation by considering the degree of crisis with the family as well as whether or not they live together with the family.

As the 4th step of social distancing was applied in the metropolitan area, all non-face-to-face classes were recommended, and about 44.8% of high school students hardly went outside during the COVID-19 period. And it was found that about 47.8% of them took distance classes for more than 4 hours a day [23]. In this study, the grade was not statistically significant, but as non-face-to-face classes were lengthened, the academic achievement gap widened and the students were drawn to the lower ranks [24]. It is necessary to consider the relationship between non-face-to-face classes and achievement in the future. Although economic status did not appear statistically significant in this study, a previous study [25] found that the deterioration of the home economy due to COVID-19 was closely related to the deterioration of the mental health of adolescents. The more severe the deterioration of the home economy, the higher the suicidal ideation was about 1.14 times. In future studies, it will be necessary to examine the relationship between economic factors such as household hardship variables and suicidal ideation.

In the health behavior characteristics of high school students, we found experiences with drinking, smoking, sex, and drug misuse to be variables related to suicidal ideation. In detail, those who respond to drinking experience with 'yes' were 1.281 times more likely to have suicidal ideation than those with 'no'. Those who respond to smoking experience with 'yes'

were 1.175 times more likely to have suicidal ideation than those with 'no'. Those who respond to sexual experience with 'yes' were 1.368 times more likely to have suicidal ideation than those with 'no'. And those who respond to drug misuse with 'yes' 2.256 times more likely to have suicidal ideation than those with 'no'. Previous studies based on the 2010 to 2014 and 2019 Adolescent Health Behavior Surveys also found that smoking, drinking, drug misuse, and sexual intercourse experience act as related factors for suicidal ideation increase [26]. Smoking, drinking, and drug misuse are predictors of impulsiveness and known high-risk factors for suicidal ideation and behavior [19,27]. In particular, drug misuse is common to start weakly and then to increase. It tends to increase impulsivity by damaging the brain's self-regulation system due to its strong addiction and tolerance. Drug misuse is a high-risk factor for suicidal ideation [7], as determined in this study. However, Korea currently regulates smoking, drinking, and drugs among adolescents, so they may not respond honestly and voluntarily. Therefore, the government should develop a strategy to remove the stigma of smoking, drinking, and drug misuse among adolescents. Furthermore, health behaviors such as smoking, drinking, and drug misuse experience are related factors for suicidal ideation. In addition, Korea needs a suicide-prevention program that focuses on lifestyle improvement and concurrent construction of a social environment safety net.

In the subjective perception characteristics of high school students, we found a relationship between suicide ideation and subjective health status, subjective happiness status, subjective loneliness, stress level, and depression experience. Those who respond to subjective health status with 'bad health' were 1.272 times

more likely to have suicidal ideation than those with 'good health' and the results of this study are consistent with those of previous studies [5,28]. These results indicate a need for an integrated program to promote physical and psychological health for adolescents in schools and communities.

Those who respond to stress level with 'much' was 2.646 times more likely to have suicidal ideation than those with 'a little'. Thus, the stress in adolescence can threaten individual well-being by exceeding individual resources, and severe stress can lead to suicidal ideation as a way of escaping from reality in adolescents who cannot find an appropriate coping method [29]. Moreover, stress can also exacerbate psychological and emotional problems such as depression in adolescents [30]. Therefore, as a preemptive measure to prevent suicide risk among high school students, we recommend implementing an intervention in the educational field that includes an early screening of high school students complaining of high stress.

Those who respond to depression experience with 'yes' were 4.187 times more likely to have suicidal ideation than those with 'no', and this was the variable most related to increased suicide risk in subjective cognitive characteristics. As can be easily seen from the fact that suicidal ideation and suicidal behaviors are criteria for diagnosis of depression, depression is the most dangerous factor for suicide [28]. Furthermore, adolescents often select suicidal ideation and suicide attempts as extreme means of expressing depression and sadness [31]. This selection is because adolescents are in an emotionally unstable period, reflected in their suicidal ideation due to the dynamics of emotional factors such as depressed mood and sadness

and frustration. Therefore, to prevent suicide, which results from a combination of internal and external factors, depression in high school students should be looked at as a suicide-related variable. Therefore, it is necessary to evaluate suicide risk in adolescents who complain of depression.

We found those who respond to subjective loneliness with 'much' 3.236 times more likely to have suicidal ideation than those with 'a little'. This finding is consistent with the results of previous studies [5,32]. Adolescence is a psychologically immature period, so it is easy to feel negative perceptions or loneliness about interpersonal relationships or problems caused by the environment [33]. For example, high school students in Korea may experience a lack of relationships due to competition-oriented educational culture and lack of communication and support systems. Although this deficiency is a feeling that anyone can experience in life, as the degree of loneliness increases, it can cause mental and physical problems [34], so social intervention is needed to convert it into psychological stability without considering it a temporary negative expression.

Those who respond to subjective state of happiness with 'non happy' were 3.682 times more likely to have suicidal ideation than those with 'happy', which is consistent with the results of previous studies [5,28]. Happiness is a feeling of psychological well-being often expressed as a sense of peace, and it also means a state of positive emotion that feels satisfying and amusing [35]. This feeling of happiness is a subjective evaluation, and it can be different depending on the interpretation of the situation and the personality type. As the feeling of happiness increases, a person's problem-solving ability and stress coping ability increase. These changes improve the ability to

adapt to life after adolescence and reduce suicidal ideation [35]. However, Korea ranks 20th out of 22 OECD countries on the subjective happiness index of children and adolescents and is steadily decreasing [36]. Therefore, as a strategy for adaptive suicide prevention among adolescents, Korea should develop a program to strengthen positive emotions, increase happiness, and reduce or remove negative factors. Although grade and economic status did not appear statistically significant in this study, they are considered to be sufficiently related to suicidal ideation. In future research, it will be necessary to select realistic variables that can affect suicidal ideation and apply them to suicide prevention education. And the subjective perception characteristics of high school students who experience the transitional stage of growth into adulthood can act as a complex factor not only for health status but also for suicide risk.

This study comprehensively analyzed demographic characteristics, health behavior characteristics, subjective cognitive characteristics, and related variables of suicidal ideation. Suicidal ideation is a social problem influenced by various factors, including psychological factors. Therefore, this study is meaningful in providing essential data for reducing the risk of suicidal ideation by comprehensively analyzing internal and external factors, which are variables related to suicidal ideation.

5. Conclusion

This study used raw data from the 16th Adolescent Health Behavior Survey in 2020 to comprehensively analyze demographic characteristics, health behavior characteristics, and subjective perception characteristics that affect suicidal ideation of 25,987 high school

students. This study intends to provide basic data for an educational program that can prevent suicide among Korean high school students in the future based on variables that affect suicidal ideation.

This study has the following limitations. First, it is a cross-sectional study, so it cannot identify causality, which requires future longitudinal research. Second, it uses data from a self-report questionnaire, which can record subjective tendency, and the respondent may not respond honestly. Despite these limitations, this study has the following academic significance.

First, it provides basic data for measures to prevent suicide by identifying comprehensive factors that affect high school students' suicidal ideation.

Second, it provides basic data for an integrated suicide prevention policy to reduce the risk of suicidal ideation. We comprehensively analyzed data, including behavioral health characteristics and psychosocial characteristics of suicidal ideation.

Lastly, this results could guide the development of evidence-based approach strategies for suicide prevention and community policies, but further progress on these fronts requires future longitudinal research.

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