

# Effect of COVID-19 in Adolescents with Generalized Anxiety Disorder

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**Abstract:** While adolescents have shown a reduced vulnerability to COVID-19 in comparison to adults, the pandemic has exacted a substantial toll on their social and mental well-being. The extensive societal adjustments implemented to mitigate the virus's spread have had adverse repercussions on adolescents' psychological health. This study embarked on an investigation into how the transformative impacts of COVID-19 have influenced the occurrence of Generalized Anxiety Disorder (GAD) within this demographic. To undertake this analysis, data from the 2021 Korean Youth Risk Behavior Web-based Survey was meticulously examined, involving a final analysis sample comprising 54,848 adolescents. A comprehensive array of analytical techniques, including descriptive statistics, t-tests, chi-square tests, and multiple logistic regression, were expertly applied utilizing IBM SPSS 21.0. The study's outcomes illuminate the profound impact of specific factors, such as skipping breakfast, alcohol consumption, and depression, on the heightened risk of GAD in the context of COVID-19-related life changes. These revelatory findings not only underscore the immediate necessity but also emphasize the urgency for meticulously tailored interventions and robust support strategies. These measures are designed to alleviate the adverse consequences wrought by the upheaval in the lives of adolescents due to the pandemic, with a particular focus on mitigating the surging concern surrounding GAD within this susceptible demographic. Prompt attention and proactive action are warranted to address this pressing issue.

**Keywords:** Adolescents, COVID-19, Generalized Anxiety Disorder, Life Changes

## 1. Introduction

COVID-19 has emerged as a worldwide health crisis, significantly affecting various aspects of life and causing significant disruptions and challenges[1]. In addition, changes in daily lifestyles, such as reduced social interaction, reduced participation in exercise, and reduced religious or emotional groups due to COVID-19, caused many restrictions on social activities, resulting in harmful mental, physical, and social effects[2]. Furthermore, the COVID-19 pandemic caused a reduced social interaction, decreased physical activity, disrupted sleep patterns, and unhealthy nutritional habits, leading to an increase in obesity and chronic diseases[3]. Individuals have experienced both physical and psychological changes during the pandemic, including unhealthy eating habits, decreased exercise, sleep disorders, and various mental health challenges like anxiety, depression, and acute stress disorders[4-7]. Moreover, the fear and uncertainty surrounding the disease have led to increased rates of alcohol and tobacco abuse, divorce, and even suicide[8]. While social distancing actions have proven effective in reducing prevalence rates, they have also brought about challenges such as reduced physical activity, productivity, loneliness, and increased rates of depression, anxiety, stress, and panic disorders[9]. These

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consequences require prompt attention and action to address the physical and mental well-being of individuals.

Although adolescents are less susceptible to COVID-19 infection compared to adults, they are not immune to the social and psychological stress associated with the pandemic[10][11]. Studies conducted in various countries have reported negative impacts on adolescents' mental health[11-13]. Additionally, the social changes in life related to COVID-19, such as school closures and disruptions in routine, have contributed to a rise in domestic violence and further exacerbated stress and mental health issues among adolescents[10]. With the aforementioned problems, it is crucial to investigate the characteristics of Korean adolescents, including their demographics and health status, and examine how these changes have influenced the occurrence of Generalized Anxiety Disorder(GAD). Such research is vital for the early identification, prevention, and suitable treatment, and development of strategies to mitigate GAD among Korean adolescents in the context of the COVID-19 pandemic.

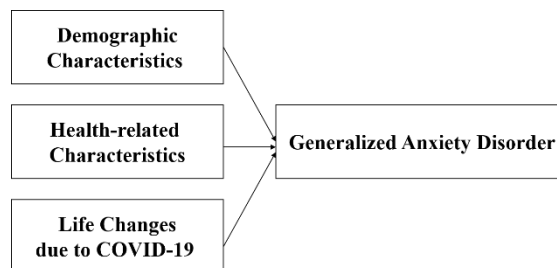
Hence, this study aims to analyze the extent of life alterations experienced by Korean adolescents due to COVID-19 and assess their impact on GAD. By identifying risk factors and understanding the consequences of COVID-19-induced changes, this research can contribute to the development of interventions and support systems to promote the psychological well-being of Korean adolescents after the pandemic. Specifically, this study sought to accomplish the following:

- Examine the existence or absence of GAD in relation to demographics, health-related factors, and COVID-19-related life alterations.
- Analyze the factors that influence GAD due to COVID-19.

## 2. Research Methodology

### 2.1 Research Design and Sample

This study employed a secondary data analysis design using existing data from the Online Youth Health Behavior Survey in 2021 to analyze the effects of COVID-19-related life changes in adolescents with GAD. The research's conceptual framework is illustrated in [Fig. 1].



[Fig. 1] Conceptual Framework of the Research

The data were obtained from the official website of the Korean Centers for Disease Control and Prevention's website and downloaded after the approval by the relevant institution. The Ministry of Health and Welfare has conducted an online survey on adolescent health behavior since 2005 for middle school and high school students to understand the health behaviors of Korean adolescents in 14 areas, including smoking, drinking, obesity, eating habits, exercise, and psychological and oral health. The sample of the youth health behavior online survey included 400 middle school students and 400 high school students. The stratified colony extraction method was used with the primary sampling unit as the school, while the class as the second extraction unit. The participation rate in the online youth health behavior survey in 2021 was 95.6%, and the data of 54,848 subjects were used for the final analysis of

this study as shown in [Table 1]. This study was only conducted after the approval of the institutional review committee of the affiliated institution(1040117-202212-HR-039-01).

[Table 1] Summary of the Data Set

Classification	Number of subjects	Number of participants	Participation rate (%)
Total	59,066	54,848	92.9

## 2.2 Procedures

### 2.2.1 Subject Characteristics

In this study, subject characteristics refer to demographic characteristics and health-related characteristics. Demographic characteristics included sex, age, school level, school record, household economic level, and changes in economic status after COVID-19. Sex was divided into male and female, and age was used only based on the year of birth and month of birth that respondents responded. To see the difference according to school grades, middle and high school participants were classified into two categories and school record and family economic score were measured on a 5-point Likert scale. When asked, "Do you think the economic status of student families has become more difficult than before due to COVID-19?" the economic status change after COVID-19 was reclassified into two categories: a difficult group (strongly agree, agree) and a not-so-difficult group (disagree, strongly disagree). Health-related characteristics included subjective health status, stress, sleep insufficiency, and suicidal ideation. For subjective health status, the scale was divided into 'very bad (1), bad (2), normal (3), good (4), and very good (5),' in which the higher the score means the better health status. For the stress score, the choices in the scale were divided into 'I feel it very much (4),' 'I feel it a lot (3),' 'I feel it a little (2),' and 'I hardly feel it (1),' in which the higher the score means the higher stress level. Insufficient sleep was measured on a 5-point Likert scale of very sufficient (1), sufficient (2), mediocre (3), not sufficient (4), and not at all sufficient (5), and reclassified as 'sufficient (3 points or less)' and 'insufficient (more than 3 points)'. Suicidal ideation in the past 12 months was divided into 'yes' and 'no'.

### 2.2.2 Life Changes due to COVID-19

In this study, exercise, skipping breakfast, drinking, smoking, and depression were among the lifestyle changes brought about by the pandemic. To get responses on life changes caused by the COVID-19 epidemic, the question, 'How do you compare your lifestyle change before and after COVID-19?' was asked, and the choices in the scale were 'very increased, increased, unchanged, decreased, very decreased,' and reclassified as 'increased, same, and decreased'.

### 2.2.3 Generalized Anxiety Disorder

The Generalized Anxiety Disorder-7 (GAD-7) scale was employed in this study as a self-reported measurement tool for the severity of anxiety symptoms. It consists of seven items that measure anxiety-related experiences on a scale ranging from 0 (not disturbed at all) to 3 (almost daily). The total score on the GAD-7 can range from 0 to 21, with scores of 0-4 indicating minimal anxiety, 5-9 indicating mild anxiety, 10-14 indicating moderate anxiety, and 15-21 indicating severe GAD[14]. The internal consistency of the GAD-7 in the original scale was reported as 0.89, while in this study, it was found to be 0.90. To classify individuals based on their anxiety levels, the total score for each participant was used, and two groups were defined: those with GAD (GAD-7 total score of 5 or higher) and those without GAD (GAD-7 total score below 5)

## 2.3 Statistical Analysis

In the statistical analysis, we employed IBM SPSS Statistics 21.0 software. We conducted independent t-tests and chi-square tests to assess the study participants' characteristics and ascertain the presence or absence of Generalized Anxiety Disorder (GAD) in relation to COVID-19-induced life changes. The reliability of the GAD-7 tool was determined using Cronbach's  $\alpha$  coefficient. Furthermore, we conducted multiple logistic regression analyses to identify factors influencing GAD concerning COVID-19-related life changes. As the data collected from the youth health behavior survey utilized a complex sample design, individual weights were applied to estimate population characteristics.

## 3. Results

The study included 54,848 subjects, with an average age of 15.23 years. The gender distribution was relatively balanced, with 51.7% males and 48.3% females. Regarding school level, 51.0% were from middle schools, and 48.3% were from high schools. The mean school record score was 3.38 points, and the average family economic score was also 3.38 points. Notably, 29.4% experienced economic changes at home due to COVID-19. The mean subjective health score was 3.77, and the mean stress score was 3.18. Sufficient sleep was reported by 55.5% of the participants, while 12.7% experienced suicidal ideation. Based on analysis, 35.3% of the subjects were found to have GAD based on the GAD-7 scores. Regarding life changes due to COVID-19, for exercise, 49.4% answered “reduce”, 31.8% answered “similar”, and 18.8% answered “raise”. For skipping breakfast, 73.2% answered “similar”, 13.8% for “raise”, and 13.0% for “reduce”. For drinking, 82.9% answered “similar”, 15.0% for “reduce”, and 2.1% for “raise”. For smoking, 84.0% answered “similar”, 15.0% “reduce”, and 1.0% for “raise”. Finally, for depression, 54.0% answered “similar”, 36.3% for “raise”, and 9.7% for “reduce” as shown in [Table 2].

[Table 2] Characteristics of the Participants

Characteristics	Classification		wt%	Mean±SE
Demographic characteristic	Age(years)		15.23±0.03	15.23±0.03
	Sex	Male	51.7	
		Female	48.3	
	School level	Middle school	51.0	
		High school	49.0	
	School record		2.05±0.01	2.05±0.01
	Family economic score		3.38±0.01	3.38±0.01
Changes in economic status after COVID-19	yes	29.6		
	no	70.4		
Health related characteristics	Subjective health status score		3.77±0.01	3.77±0.01
	Stress score		3.18±0.01	3.18±0.01
	Sleep insufficiency	Sufficient	55.5	
		Insufficient	44.5	
	Suicide ideation	yes	12.7	
no		87.3		
Life changes related to COVID-19	Exercise	raise	18.8	
		similar	31.8	
		reduce	49.4	
	Skipping breakfast	raise	13.8	
		similar	73.2	
		reduce	13.0	
	Drinking	raise	2.1	
		similar	82.9	
		reduce	15.0	
	Smoking	raise	1.0	
		similar	84.0	
		reduce	15.0	

	Depression	reduce raise similar reduce	15.0 36.3 54.0 9.7	
Generalized anxiety disorder	GAD-7	yes( $\geq 5$ ) no( $< 5$ )	35.3 64.7	4.16 $\pm$ 0.03

[Table 3] Generalized Anxiety Disorder by the Characteristics of Participants

Characteristics	Classification		Generalized anxiety disorder wt% or M $\pm$ SE		$\chi^2$ or t	p
			Presence	Absence		
Demographic characteristic	Age(years)		15.31 $\pm$ 0.03	15.18 $\pm$ 0.03	-5.50	< .001
	Sex	Male	43.0	56.4	904.80	< .001
		Female	57.0	43.6		
	School level	Middle school	49.4	51.8	27.29	.001
		High school	50.6	48.2		
	School record		1.99 $\pm$ 0.01	2.09 $\pm$ 0.01	11.30	< .001
	Family economic score		3.29 $\pm$ 0.01	3.43 $\pm$ 0.01	15.52	< .001
Changes in economic status after COVID-19	yes	35.6	26.8	470.98	< .001	
	no	64.4	73.2		< .001	
Health related characteristics	Subjective health status score		3.45 $\pm$ 0.01	3.45 $\pm$ 0.01	55.29	< .001
	Stress score		3.89 $\pm$ 0.01	3.89 $\pm$ 0.01	-119.95	< .001
	Sleep insufficiency	Sufficient	40.7	40.7	2600.20	< .001
		Insufficient	59.3	59.3		
	Suicide ideation	yes	27.1	27.1	5594.34	< .001
no		72.9	72.9			
Life changes related to COVID-19	Exercise	raise	17.9	20.2	485.31	< .001
		similar	26.3	34.1		
		reduce	55.3	45.7		
	Skipping breakfast	raise	17.3	12.7	381.30	< .001
		similar	67.6	75.3		
		reduce	15.1	12.0		
	Drinking	raise	4.2	2.1	279.88	< .001
		similar	79.2	83.7		
		reduce	16.5	14.2		
	Smoking	raise	1.6	0.7	140.19	< .001
		similar	82.0	85.0		
		reduce	16.4	14.3		
	Depression	raise	61.8	23.3	7980.25	< .001
similar		32.0	65.1			
reduce		6.1	11.6			

[Table 3] shows the results of the analysis of the presence and absence of GAD according to the subject's characteristics. The result of the comparison according to age showed that, the average age of those with GAD was 15.31 years, which was significantly higher ( $t=-5.50$ ,  $p<.001$ ). Female ( $\chi^2=904.80$ ,  $p<.001$ ), high school ( $\chi^2=27.29$ ,  $p=.001$ ), family economic change due to COVID-19 ( $\chi^2=470.98$   $p<.001$ ), insufficient sleep ( $\chi^2=2600.20$ ,  $p<.001$ ) and suicidal ideation ( $\chi^2=5594.34$ ,  $p<.001$ ) had a statistically significant increase in GAD. In the case of GAD, the average school record score ( $t=11.30$ ,  $p<.001$ ), family economic score ( $t=15.52$ ,  $p<.001$ ), and subjective health score ( $t=55.29$ ,  $p<.001$ ) were statistically significantly lower and the mean of the stress score ( $t=-119.95$ ,  $p<.001$ ) was significantly higher. GAD was significantly higher for the following life changes related to COVID-19 including reduce exercise ( $F=485.31$ ,  $p<.001$ ), raise or reduce skipping breakfast ( $F=381.30$ ,  $p<.001$ ), and raise or

reduce drinking ( $F=279.88$ ,  $p<.001$ ), smoking raise or reduce ( $F=140.19$ ,  $p<.001$ ), and raise depression ( $F=7980.25$ ,  $p<.001$ ).

[Table 4] Logistic Regression of Factors Affecting Generalized Anxiety Disorder

Classification	Classification		OR(95%CI)	<i>p</i>
Demographic characteristic	Age(years)		1.04(1.02-1.07)	.002
	Sex	Male	1.00	
		Female	1.06(1.01-1.12)	.023
	School level	Middle school	1.00	
		High school	0.80(0.73-0.88)	<.001
	School record		0.93(0.91-0.96)	<.001
	Family economic score		1.00(0.97-1.03)	.806
Changes in economic status after COVID-19	yes		1.14(1.08-1.20)	<.001
	no		1.00	
Health related characteristics	Subjective health status score		0.74(0.72-0.77)	<.001
	Stress score		2.64(2.56-2.73)	<.001
	Sleep insufficiency	Sufficient	1.00	
		Insufficient	1.37(1.30-1.44)	<.001
	Suicide ideation	yes		2.70(2.48-2.93)
no			1.00	<.001
Life changes related to COVID-19	Exercise	raise	1.03(0.96-1.11)	.452
		similar	1.00	
		reduce	0.97(0.92-1.03)	.353
	Skipping breakfast	raise	1.15(1.07-1.23)	<.001
		similar	1.00	
		reduce	1.10(1.02-1.19)	.003
	Drinking	raise	1.31(1.09-1.56)	<.001
		similar	1.00	
		reduce	1.41(1.17-1.70)	<.001
	Smoking	raise	1.08(0.83-1.40)	.563
		similar	1.00	
		reduce	0.85(0.70-1.03)	.090
	Depression	raise	2.77(2.62-2.93)	<.001
similar		1.00		
reduce		0.87(0.78-0.97)	0.12	
Wald F			473.43	
Cox and Snell's R <sup>2</sup>			.29	
Nagelkerke R <sup>2</sup>			.40	

The results of the analysis of the influencing factors of GAD revealed that the explanatory power and fit of the model were found to be significant as Nagelkerke R<sup>2</sup>=0.40 and Wald F=473.43 ( $p<.001$ ), respectively. Age (95% CI, 1.02-1.07), females (95% CI, 1.01-1.12), economic changes due to COVID-19 (95% CI, 1.08-1.20), stress (95% CI, 2.56-2.73), sleep deprivation (95% CI, 2.56-2.73), suicidal ideation (95% CI, 2.48-2.93), breakfast skipping raise (95% CI, 1.07-1.23) and reduce (95% CI, 1.02-1.19), drinking raise (95% CI, 1.09-1.56 and reduce (95% CI, 1.17-1.70), and raise depression (95% CI, 2.62-2.93) were all identified as significant risk factors for GAD. Conversely, being in high school (95% CI, 0.73-0.88), higher school record scores (95% CI, 0.91-0.96), higher subjective health scores (95% CI, 0.72-0.77), and a reduce in depression due to COVID-19 (95% CI, 0.78-0.97) were associated with a lower risk of GAD [Table 4].

#### 4. Discussion

This study sought to identify the impact of the COVID-19 pandemic and the severity of GAD in Korean adolescents, and the factors affecting those variables. It is crucial to maintain the psychological health of adolescents since mental health problems are not only difficult to recover from once they occur, but can also turn to serious social problems[15]. Psychological health is directly related to the quality of an individual's entire life. In particular, various changes in life to take measures to mitigate the transmission of COVID-19 that occurred in 2019 have several negative effects on psychological health, and the effectiveness and risks of the COVID-19 pandemic situation on GAD in adolescent factors are reported in a previous study[16].

First, 35.3% of adolescents were found to be mild or higher-level pan-anxiety disorders, which was found to be psychologically difficult for Korean adolescents in a similar context as 37% of foreign adolescents complained of anxiety symptoms in a study by Zhou et al.[17], which is one of the secondary data analyzed in this study. The average score for GAD was higher than that of the previous study [16]. This result calls for the need of an active psychological prevention and intervention for adolescent anxiety, and a continued assessment and management of GAD among adolescents.

Furthermore, with factors contributing to GAD in adolescents, such as target characteristics and daily life changes, the results revealed that females develop GAD more easily as they age than males do. In the United States, the female population was known to be 55-60 % of the individuals with GAD. This proves that GAD often occur in female[18]. Factors predicting the poor prognosis of GAD include increased age, chronic disease, and low social class[19]. Previous studies show that females had higher prevalence, the female had higher prevalence of GAD than males, those with lower economic status had times higher than those in a higher economic level, and those with changes in economic status after the COVID-19 pandemic had higher prevalence than those with no changes in economic status after the COVID-19 pandemic.

However, the comorbidity between GAD and other mental disorders has been shown in numerous studies. It is said that patients with GAD experience other mental health problems at some point in their lives, and suffer from comorbidity[20]. The most frequent comorbidity is depression, with patients with GAD experiencing unipolar depression and other types of mental health problems[21]. In addition, anxiety disorders, including GAD, were also associated with symptoms of various physical ailments, such as heart disease, high blood pressure, and gastrointestinal disorders[22]. According to the analysis of this study, the occurrence of GAD among Korean adolescents was higher stress, insufficient sleep, and suicidal ideation whereas the occurrence of GAD was lower higher subjective health score.

A previous study showed a positive correlation between the stress level of adolescents and the degree of generalized anxiety, and in particular, among the sub-factors of stress, friend and academic factors showed the strongest correlation with generalized anxiety[23]. According to a study examining the characteristics of people with GAD based on how they cope with stress, people with GAD have low positive coping skills, indicating that they are more adaptable. It can be thought to be characteristic of people with GAD showing an avoidant attitude, vaguely wishing for a solution while worrying and agonizing alone rather than asking for help from others when they have a reason or concern[24]. Based on these results, adolescents who are highly aware of stress are encouraged to use more active coping methods, such as speaking more often to someone who can help them deal with their stress. Using of methods such as examining the real part of the problem and giving advice to respond more realistically and positively can be more effective than waiting for the problem to be resolved.

In this study, the risk of GAD increased when there was an increase or decrease in skipping breakfast, an increase or decrease in alcohol consumption, and depression due to the COVID-19 pandemic. In a study by Ammar et al.[25], mainly in West Asia, East Africa, and Europe, unhealthy dietary consumption patterns such as binge eating and snack consumption increased, and alcohol consumption decreased in most countries as a result of confirming the effect of the COVID-19 pandemic on individual lifestyles. Mental health factors such as anxiety and depression that may occur during COVID-19 period can

aggravate various mental health problems[26], not only economic problems but also psychological problems such as social isolation, anxiety about infectious diseases, and stress occurred as European countries implemented social distancing policies[27]. In a study that analyzed how the mental health factors caused by COVID-19 affected the alcohol consumption of adults, females consumed more alcohol than males[28]. Therefore, there may be some classes that need alcohol reduction support in line with COVID-19 situation and goals, and if a period due to other infectious diseases occurs, support for the alcohol-vulnerable class may be important[29]. In addition, repeated studies on the causal relationship of GAD to increased and decreased alcohol consumption will be needed. In the case of depression, a previous study found that depression and anxiety were positively correlated, and students who experienced depression experienced more anxiety[30]. Therefore, in the era of living with COVID-19, it is necessary to grasp the psychological health status of adolescents continuously such as depression and stress, such as depression and stress and mental health management by strengthening the support system.

## 5. Conclusions

The primary objective of this study was to investigate how the life changes brought about by COVID-19 influenced the prevalence of GAD among adolescents. The study's outcomes demonstrated a noteworthy impact of COVID-19-induced life changes on the occurrence of GAD in adolescents. These results underscore the significance of enhancing social support networks and implementing pertinent policies to address the pandemic-related life alterations that contribute to GAD. Furthermore, the results of this study can be utilized in medical practice to provide targeted interventions for youth during future outbreaks of new infectious diseases. By developing customized manuals that consider the unique characteristics of adolescents, strategies and support measures can be implemented to reduce the prevalence of GAD. This study has several limitations. First, the study was cross-sectional, which makes it challenging to establish a causal relationship between COVID-19-induced life changes and GAD. The use of data from an online youth health behavior survey also introduces limitations. The survey relies on self-reporting, which may be subject to biases and inaccuracies. Respondents tend to provide socially desirable responses or may not accurately recall or report certain information, such as school records, economic status, or substance use. Second, the survey's anonymous nature limits the ability to validate or verify the data provided by participants. Future research should consider incorporating more robust data collection methods, such as structured interviews or objective measures, to gather specific and reliable information on health-related behaviors and lifestyles. Longitudinal studies can provide more insights into the temporal relationship between life changes and GAD. Despite these limitations, this study provides an understanding of the general trends in daily life changes, the prevalence of GAD, and the factors that influence it, by conducting a large-scale data analysis. Further research and investigations are warranted to build upon these findings and address the aforementioned limitations. Despite its limitations, this study contributes valuable insights into the general trends in daily life changes, the prevalence of GAD, and the factors influencing it through a large-scale data analysis. Further research and investigations are warranted to refine our understanding and address the aforementioned limitations, ultimately advancing our knowledge of the complex interplay between life changes and adolescent mental health.

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