


Health-Related Behaviors and Psychological Status of Adolescent Patients with Atopic Dermatitis: The 2019 Korea Youth Risk Behavior Web-Based Survey

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Objective: Atopic dermatitis (AD) is one of the common chronic diseases that occur in children and adolescents as a chronic relapsing pruritic inflammatory skin disease. This study investigated how AD is associated with stress and depressive symptoms in a large representative sample of adolescents in South Korea.

Methods: The Korea Youth Risk Behavior Web-based Survey 2019 was used in this study ($n = 57,069$, weighted national estimates = 2,672,170). Multivariate logistic regression was used to determine significant associations between AD and mental health, measured by stress and depressive symptoms. Sub-group analysis was also conducted using various socio-economic variables.

Results: Among the present sample, 6.5% of adolescents ($n = 173,909$) were diagnosed with AD in the past 12 months. After adjusting for other variables, AD diagnosis was associated with significantly higher odds of experiencing stress ($OR = 1.43$) and depressive symptoms ($OR = 1.32$) as compared to adolescents without AD. A similar trend is found in subgroup model analysis using socio-economic variables (ie, education levels, parent's income levels, and residence area). Specifically, female adolescents with AD, adolescents of low socio-economic status, those reporting smoking and drinking experience, and who do not participate in regular physical activity are more vulnerable to stress and depressive symptoms.

Conclusion: This is a noteworthy finding because it denotes that AD may lead to negative outcomes, like depressive symptoms or stress, which could be prevented if suspected early.

Keywords: adolescent, atopic dermatitis, stress, depressive symptoms

Background

Atopic dermatitis (AD) is a chronic relapsing pruritic inflammatory skin disease characterized

by dysfunctions in skin barrier function, allergen sensitization, and recurrent skin infections that often have cycles of exacerbation and improvement of itchy eczema.¹⁻³ AD commonly presents as itching and hypersensitivity to external stimuli and allergens, worsening in adolescence.⁴ The cause of AD is unclear, but current research investigates links between genetic, immunological, and environmental factors and skin barrier dysfunctions.⁵

AD is one of the most common chronic diseases for adolescents.² Although AD may have differences between countries and ethnic groups,⁶ it affects more than 5–20% of children and adolescents worldwide, and previous studies have commonly observed that children and adolescents have a higher prevalence of AD than adults.^{7,8} Currently, in South Korea, the incidence of AD in children and adolescents is 13.5% and counting.^{3,9} Developing countries have also seen an increase in AD cases,⁹ but the cause of the increased AD prevalence is unclear. Some reports propose that

environmental factors may be critical in the expression and aggravation of AD.^{10,11} Further, small family size, education, increased income, migration from rural to urban environments, and increased use of antibiotics may be associated with the increased prevalence of AD.^{12,13}

The quality of life for patients with AD is severely affected by sleep disturbances, emotional and mental health problems, and issues with social functioning.¹⁴ In addition, adolescents struggling with body image may develop low perceived happiness and increased stress as chronic and repeat inflammatory reactions cause esthetic and functional skin changes.¹⁵ The negative social and psychological changes experienced by adolescents can lead to depression and anxiety.^{16,17} Past research has found that adolescents with AD have increased suicidal ideation rates (44%) and suicide attempts (36%) compared to those without AD.¹⁸ A previous study using the Korea Youth Risk Behavior WebBased Survey (KYRBWS) VI reported that 46% of adolescents with high-stress levels and 21% with moderate stress levels suffer from AD.¹⁹ These past studies imply that stress may be an inducer and effect of AD.¹⁶ Therefore, managing stress levels in youths with AD may be essential to improve patients' mental health.

Even though there have been concerns about adolescent mental health problems, very few studies have attempted to examine the association between AD and psychiatric symptoms (stress and depression) in the adolescent population.^{16,17} Until now, few studies have documented the association between AD and psychiatric symptoms. Therefore, this study aimed to examine the association between psychiatric symptoms (stress and depressive symptoms) with the prevalence of AD in adolescents in South Korea using Korean Youth Risk Behavior Web-based Survey.

Methods

Data Collection

This study was performed with data derived from the 2019 Korean Youth Risk Behavior Webbased Survey (KYRBWS). KYRBWS is a multi-year cross-sectional study conducted annually by the Korea Centers for Disease Control and Prevention (KCDC) since 2005. This government-approved statistical survey examines health behaviors, including AD/asthma diagnosis, tobacco/alcohol use, obesity, physical activity, sexual behaviors, substance use, Internet use, and mental health.²⁰ The target population is nationally representative middle- and high-school students aged 12 to 18 years old in

Korea, sampled from 400 middle and 400 high schools every year. A total of 57,303 out of 60,100 (95.3%) participants completed the KYRBWS-15, and the final data of 57,069 participants were used in this study after deleting missing variables. During the data collection, KCDC delivered the full instructions of the purpose and methods of the study given to the students by trained teachers and written informed consent was obtained from the students. Students who agreed to participate completed the anonymous questionnaire presented on a computer. The KCDC's Institutional Review Board has approved the protocols for KYRBWS. The raw data were gathered from the KCDC website after submitting an application outlining the purpose and plan of use and obtaining approval. KYRBWS is a government published and publicly available secondary dataset with de-identified information. Therefore, IRB approval was not required. Our original sample was used to validate the findings from the data.

Variables

The primary outcome of this study was to investigate if AD is associated with stress and

depressive symptoms. AD diagnosis was measured by asking, "Have you ever been diagnosed with AD by a physician?". Adolescents who answered "No" to this question were categorized as having "No diagnosis". An additional question was asked to those who answered "Yes" to the previous question, "Have you been diagnosed with AD by a physician during the past 12 months?". Participants were then categorized into "Diagnosis within one year" and "Diagnosis during the lifetime".

Stress was measured by asking, "How do you feel stress in your everyday life?". Participants could respond "extremely high", "high", "some", "low", or "none". From these response options, participants were then categorized as the "stress" group for those who answered "extremely high", "high", or "some" and "low stress" group for those who

answered “low” or “none”. Depressive symptoms were measured by asking, “Have you felt any sadness or despair enough to suspend your daily life in the past 12 months?”. Responses were dichotomous for yes and no.

In this study, we adjusted various socio-economic and health behavior confounders measured

by questionnaire. Socio-economic variables included age, sex, grade (middle or high school), subjective parent’s economic status (high, middle, and low), and residence area (metropolitan, city, and rural). Health behavior variables included lifetime smoking (cigarette or electronic)/drinking and physical activities (More than 4 days a week, 1–3 days a week, and none).

Statistical Analysis

First, sampling weights were used for all statistical analyses to represent the entire national wide adolescents. We first examined the general characteristics of the sample dataset. Then we investigated sample characteristics by stress and depressive symptoms. The sample characteristics were presented as weighted frequency (percentage) or means (Standard Deviation). Finally, to examine group differences (whether having stress and/or depressive symptoms), Rao-Scott Chi-Square tests were used for categorical variables.

The odds ratios (ORs) and 95% confidence interval (95% CI) for having stress and depressive symptoms were calculated using multivariate logistic regression analysis. We also tested sub-group analysis for socio-economic covariates. All analyses were conducted using SAS statistical software (version 9.4; SAS Institute Inc., Cary, NC, USA). All statistical tests were two-sided, and statistical significance was determined at $p < 0.05$.

Results

Characteristics and Descriptive Statistics of Sample

A total of 57,069 adolescents sample were identified in the 2019 KYRBWS (weighted $n = 2,672,170$). Among them, 173,909 (6.5%) had an AD diagnosis within one year, and 426,216 (16.0%) had a lifetime diagnosis. 80.9% and 28.1% of adolescents had experience stress and depressive symptoms during the past 12 months, respectively. See [Table 1](#) for descriptive statistics for the full sample. [Table 2](#) displays the descriptive statistics of the sample divided by mental health responses. Adolescents with AD diagnosis (with one year and lifetime diagnosis) showed more stress and depression experience compared to the no diagnosis group ($p < 0.001$). Stress was also more frequently present in participants who were female (87.4%), in high school (83.5%), low economic status (87.4%), history of smoking/drinking (83.2% and 83.8%), and reported none physical activity groups (82.6%). The frequency of depressive symptoms had a similar trend as stress, except there were no differences based on the frequency of physical activity.

Association of Atopic Dermatitis with Health-Related Behaviors and Psychological Status

The odds ratios of having stress and depressive symptoms from the multivariate logistic regression model are shown in [Table 3](#). After controlling for all other variables, adolescents who have been diagnosed with AD within one year were significantly more likely to experience stress (OR = 1.43) and depressive symptoms (OR = 1.33) when compared to adolescents without a diagnosis. Adolescents who were diagnosed over one year ago were also significantly more likely to experience stress (OR = 1.11) and depressive symptoms (OR = 1.08) compared to those with no diagnosis. For other variables, females (OR = 2.32 and OR = 2.19) with low economic status (OR = 1.81 and OR = 1.36), smoking (OR = 1.11 and OR = 1.47) and drinking groups (OR = 1.29 and OR = 1.67) were significantly more likely to report stress and depressive symptoms. Physical activity showed only a significant likelihood of stress (OR = 1.10).

Discussion

This study investigated if AD is related to stress and depressive symptoms in Korean adolescents. The data used in this study included a total of 57,069 adolescent samples, whose average age was 14.97 ± 1.78 , showing 2,672,170 weighted samples. Among them, 173,909 adolescents (6.5%) were diagnosed with AD within a year, and 426,216 adolescents (16.0%) were diagnosed throughout their lives. The study found that female adolescent AD patients, patients with low

Table I General Characteristics of Patient Sample

	Total	
	N	%
Unweighted N	57,069	
Weighted N (National estimates)	2,672,170	
Stress		
Yes	2,162,238	80.9%
No	509,932	19.1%
Depression		
Yes	751,144	28.1%
No	1,921,026	71.9%
Atopic dermatitis Diagnosis		
Yes-Past 12 months	173,909	6.5%
Yes-Life time	426,216	16.0%
No	2,072,045	77.5%
Sex		
Female	1,284,690	48.1%
Male	1,387,479	51.9%
Age*	14.97	1.78
Grade		
Middle School	1,280,465	47.9%
High School	1,391,705	52.1%
Economic Status		
High	1,059,651	39.7%
Middle	1,278,710	47.9%
Low	333,810	12.5%
Residence Area		
Metropolitan	1,136,155	42.5%
City	1,386,961	51.9%
Rural	149,054	5.6%
Smoking Experience		
Yes	347,182	13.0%
No	2,324,988	87.0%
Drinking Experience		
Yes	1,050,868	39.3%
No	1,621,302	60.7%
Physical Activity		
More than 4 days a week	569,727	21.3%
1–3 days a week	1,153,932	43.2%
None	948,512	35.5%

Note: *Mean/Standard Deviation.

socio-economic status, smoking and drinking experience, and who do not participate in regular physical activity are more vulnerable to stress and depressive symptoms.

AD was associated with gender, as female adolescents were more than twice as likely to report stress and depressive symptoms as male adolescents. A similar observation has been found in previous studies that women who were diagnosed with AD experienced high stress, anxiety, and depression more frequently than men.^{21–23} The predominance of these factors in females may be because females are more concerned about their physical appearance than males, which can lead to emotional disturbance.²⁴ In addition, female adolescents experience new hormonal changes during the menstrual cycle in adolescence. One study found that AD symptoms were aggravated in female adolescents who

Table 2 Descriptive Statistics of Sample by Stress and Depression

	Stress					Depression				
	Yes (N=2,162,238)		No (N=509,932)		P	Yes (N=751,144)		No (N=1,921,026)		P
	N	%	N	%		N	%	N	%	
Atopic Dermatitis Diagnosis										
Yes-Past 12 months	150,285	86.4%	23,623	13.6%	<0.0001	61,551	35.4%	112,357	64.6%	<0.0001
Yes-Life time	354,163	83.1%	72,054	16.9%		127,552	29.9%	298,664	70.1%	
No	1,657,790	80.0%	414,255	20.0%		562,040	27.1%	1,510,004	72.9%	
Sex										
Female	1,123,023	87.4%	161,667	12.6%	<0.0001	444,532	34.6%	840,158	65.4%	<0.0001
Male	1,039,215	74.9%	348,264	25.1%		306,612	22.1%	1,080,868	77.9%	
Age*	15.04	1.77	14.69	1.79	0.121	15.10	1.75	14.92	1.78	0.007
Grade										
Middle School	999,706	78.1%	280,759	21.9%	<0.0001	343,442	26.8%	937,023	73.2%	<0.0001
High School	1,162,532	83.5%	229,173	16.5%		407,702	29.3%	984,003	70.7%	
Economic Status										
High	813,115	76.7%	246,535	23.3%	<0.0001	278,781	26.3%	780,870	73.7%	<0.0001
Middle	1,057,334	82.7%	221,376	17.3%		343,392	26.9%	935,318	73.1%	
Low	291,789	87.4%	42,021	12.6%		128,972	38.6%	204,838	61.4%	
Residence Area										
Metropolitan	916,040	80.6%	220,115	19.4%	0.626	312,301	27.5%	823,854	72.5%	0.179
City	1,125,579	81.2%	261,382	18.8%		396,791	28.6%	990,169	71.4%	
Rural	120,620	80.9%	28,435	19.1%		42,052	28.2%	107,003	71.8%	
Smoking Experience										
Yes	289,004	83.2%	58,178	16.8%	<0.0001	139,159	40.1%	208,023	59.9%	<0.0001
No	1,873,234	80.6%	451,754	19.4%		611,985	26.3%	1,713,003	73.7%	
Drinking Experience										
Yes	880,538	83.8%	170,330	16.2%	<0.0001	378,520	36.0%	672,348	64.0%	<0.0001
No	1,281,700	79.1%	339,602	20.9%		372,624	23.0%	1,248,678	77.0%	
Physical Activity										
More than 4 days a week	429,960	75.5%	139,767	24.5%	<0.0001	156,555	27.5%	413,172	72.5%	0.052
1–3 days a week	949,155	82.3%	204,777	17.7%		330,768	28.7%	823,163	71.3%	
None	783,123	82.6%	165,388	17.4%		263,821	27.8%	684,691	72.2%	

Note: *Mean/Standard Deviation.

experienced premenstrual or ovulatory phase²⁵ and reported that female sex hormones affect the expression of AD symptoms.²⁶ These differences in physiology, such as hormones between genders, may have reported significant differences in stress and depressive symptoms.

Results also demonstrated that AD adolescent patients with low socio-economic status were more vulnerable to high stress and depressive symptoms than adolescents from families of middle- and high socio-economic status. There are several studies that show low SES is linked to higher stress and increased cortisol.^{27–29} This is consistent with one study that the frequent occurrence of another itchy dermatitis, fungal infections, and urticaria was more common in the low socio-economic status group.³⁰ Adolescents from families of low socio-economic status tend to have a low awareness of AD symptoms and delay reporting them; in particular, they have limited access to the medical care in which AD can be diagnosed and treated.²⁸ Also, since they may be exposed to respiratory and dermatological symptoms frequently, abnormal skin symptoms such as AD may be taken these symptoms lightly. If dermatological symptoms are under-reported constantly, adolescents are likely to be exposed to high stress and depressive symptoms due to AD symptoms.

Furthermore, smoking and drinking experiences were closely related to stress and depressive symptoms in adolescents diagnosed with AD. Smoking stimulates the surface of immune cells in the body, increasing the total number of

Table 3 Results of Survey Logistic Regression: Odds of Having Stress and Depression Among Adolescents

	Stress			Depression		
	Odds Ratio	95% CIs		Odds Ratio	95% CIs	
Atopic Dermatitis Diagnosis						
Yes-Past 12 months	1.107	1.030	1.190	1.077	1.019	1.138
Yes-Life time	1.431	1.283	1.597	1.326	1.225	1.436
No	Reference					
Sex						
Female	2.323	2.194	2.459	2.194	2.082	2.312
Male	Reference					
Age*	1.065	1.038	1.092	1.031	1.008	1.055
Grade						
Middle School	Reference					
High School	1.023	0.935	1.120	0.816	0.752	0.885
Economic Status						
High	Reference					
Middle	1.310	1.244	1.380	0.927	0.884	0.973
Low	1.807	1.651	1.978	1.455	1.359	1.559
Residence Area						
Metropolitan	1.050	0.947	1.165	1.062	0.966	1.168
City	1.066	0.963	1.181	1.088	0.991	1.195
Rural	Reference					
Smoking Experience						
Yes	1.111	1.027	1.202	1.571	1.469	1.680
No	Reference					
Drinking Experience						
Yes	1.287	1.223	1.355	1.754	1.674	1.838
No	Reference					
Physical Activity						
More than 4 days a week	Reference					
1–3 days a week	1.270	1.196	1.350	0.964	0.916	1.015
None	1.101	1.033	1.173	0.804	0.758	0.852

Note: *Mean/Standard Deviation.

white blood cells,³¹ as well as increasing Th2, responsible for allergic immune responses, and IL-4, which plays an essential role in treating chronic inflammation.³² This leads to the development of major allergic diseases such as AD symptoms, as it makes the body sensitive to environmental antigens such as pollen, animal dander, and house dust mites. In addition, previous studies reported that environments easily exposed to smoking by family members and/or their friends who smoke and direct smoking increase the risk of AD.^{33,34} Given the positive association between AD and smoking, alcohol use is also associated with AD symptoms. Alcohol use excessively increases the production of IgE antibody corresponding to allergies in the body,^{35,36} and increased IgE antibody also stimulates Th2 cells.³⁷ Because of these biological reactions, adolescent drinking experiences exacerbate AD and smoking experiences. Furthermore, alcohol use causes skin dryness and an acute inflammatory response due to the release of histamine from acetaldehyde.^{38,39} Since their smoking and drinking experiences in adolescence reduced their immune function, their AD symptoms would have been exacerbated and increased their stress and depressive symptoms.

Esthetic and functional skin changes caused by AD in adolescence lead to low perceived happiness, high stress, and depression.¹⁵ One previous study demonstrated that adolescents who suffer from AD could have problems establishing a healthy body image and making them experience negative social and psychological issues.¹⁶ However, one interesting observation in this study is that participation in physical activity helps adolescents with AD to decrease their

psychological stress. It is consistent with outcomes from Kong et al, stating AD adolescent patients who participated in regular physical activity indicated a 30% lower risk of stress than those who did not participate in physical activity.⁴⁰ This may be because physical activity not only helps the reabsorption process of cortisol, which is secreted in significant amounts in response to stress⁴¹ but also helps to produce and activate endorphins that directly affect the brain.⁴² Several previous studies have also shown that physical activity benefits the mental health of patients suffering from allergic diseases like AD, asthma, and allergic rhinitis.^{43,44} However, physical activity can delay recovery from the damaged skin of AD patients, and sweat induced by physical activity can cause itching, so it may cause AD symptoms to suffer more.⁴⁵ Therefore, future studies need a guideline to promote physical activity so that AD symptoms are not exacerbated. The number of adolescents diagnosed with AD steadily increases yearly,^{3,9} but the specific cause and treatments are still unclear. Some scholars have reported that AD is a multidisciplinary disease.^{46,47} El Hachem et al indicated that medical specialists' and even psychologists' support should be provided to adolescent patients, and treatment education programs should also be provided to patients/families to treat AD.⁴⁷ Although anti-inflammatory and antimicrobial treatments such as emollients, Fusidic acid, and calcineurin inhibitors can be one of the treatments for AD,^{48–50} the study found that health-related behaviors (drinking and smoking) and psychological factors in adolescents are related to AD, and it will be needed more multidisciplinary efforts to treat AD.

There are a few limitations to this study. First, this study utilized nationally representative data from an online survey; thus, we did not obtain information on AD treatment history and severity. Secondly, we conducted a cross-sectional study, so the causality between stress and depressive symptoms in adolescents with AD cannot be determined. Lastly, the prevalence of depressive symptoms in our population may have been overestimated because we used simplified diagnostic criteria. The prevalence of diagnosed depression is generally lower than that of depression symptoms. Despite these limitations, this study utilized a large sample size from a nationwide general adolescent population survey with good representativeness and generalizability. In addition, we used depressive feelings and stress feelings to identify the consistency of relationships with AD. This is a noteworthy finding because it denotes that AD may lead to destructive outcomes, like major depressive disorders or stress, which could be prevented if suspected early.

Conclusion

The present study found high levels of stress and depressive symptoms in adolescents with AD, especially for females, those from families of low socio-economic status, and those with a history of smoking and drinking and low physical activity. Pharmacological treatments like using drugs or steroids are the most common medications to alleviate AD, however, based on the results of this study, increased physical activity can be one of the effective treatments for AD adolescents. In addition, future studies need to be examined in a multilateral effort to decrease the high stress and depressive symptoms of female adolescents diagnosed with AD.

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Disclosure

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