

Association between allergic diseases, generalized anxiety disorder, and depressive symptoms in South Korean adolescents: a secondary data analysis of the 2022 Korea Youth Risk Behavior Survey

Jaeyoung Lee¹, So Yeon Park²

¹Associate Professor, Department of Nursing Science, Kyungsung University, Busan, Korea

²Assistant Professor, Department of Nursing, Dong-A University, Busan, Korea

Corresponding author

So Yeon Park

Department of Nursing, Dong-A University, 32 Daesingongwon-ro, Seogu, Busan 49201, Korea
TEL: +82-51-240-2689
FAX: +82-51-240-2920
E-MAIL: 156490@dau.ac.kr

Received: February 15, 2024

Revised: April 4, 2024

Accepted: April 15, 2024

Purpose: This study investigated the relationship between allergic diseases, general anxiety disorder, and depressive symptoms among Korean adolescents. **Methods:** A secondary analysis was conducted on the findings of the 18th Korea Youth Risk Behavior Survey (2022). The study included 51,850 adolescents and analyzed the relationships among allergic diseases, general anxiety disorder, and depressive symptoms using complex samples logistic regression analysis. **Results:** Among the Korean adolescents, 12.7% experienced general anxiety disorder, while 28.7% experienced depressive symptoms. The prevalence of allergic diseases was 5.7% for asthma, 36.3% for allergic rhinitis, and 22.2% for atopic dermatitis. General anxiety disorder was associated with asthma and allergic rhinitis but not atopic dermatitis. Depressive symptoms were associated with asthma, allergic rhinitis, and atopic dermatitis. **Conclusion:** Examining the correlation among allergic diseases, general anxiety disorder, and depressive symptoms in adolescents underscores the need for implementing suitable strategies. Moreover, when addressing general anxiety disorder and depressive symptoms in adolescents, it becomes crucial to consider the presence of allergic diseases.

Keywords: Adolescent; Depression; General anxiety disorder; Asthma; Rhinitis, allergic

INTRODUCTION

Allergic disease is a systemic disorder caused by an impaired immune system, and the complex interplay between environmental and genetic factors [1]. Approximately 500 million individuals are diagnosed with allergic disease worldwide [2], and 21% to 25% of 840,448 Korean adolescents aged 12 to 18 years have allergic diseases [3]. Typically, allergic disease—represented by asthma, allergic rhinitis (AR), and atopic dermatitis (AD)—begins in childhood and continues into adolescence and adulthood [1]. As the term “allergic march” reveals, allergic disease begins when chil-

dren are young and manifests symptoms in various target organs as they grow [1]. AD symptoms that began in infancy may disappear, followed by repeated worsening and improvement in asthma and, over time, AR symptoms [4].

In allergic disease, inflammatory mediators impact the circadian rhythm and directly affect the central nervous system, causing disorders [5]. Mediators released during allergic reactions may act on sensory nerves and affect nervous system processing or transmission of the autonomic nervous system [6]. Patients experience airway obstruction and breathing difficulty in asthma, sleep apnea and other respiratory disorders in AR [7], and itching and reduced sleep frequency and du-

This is an Open Access article distributed under the terms of the Creative Commons Attribution NonCommercial License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>) which permits unrestricted noncommercial use, distribution, and re-production in any medium, provided the original work is properly cited.

© 2024 Korean Academy of Child Health Nursing

ration in AD [5].

Several studies reported health problems in patients with allergic diseases [8-10]. Adults with asthma face risks of mental disorders such as depression, anxiety, and panic disorder, which can further worsen their asthma [9]. Studies on patients with AR found the disease to be associated with depression and suicidal ideation [8]; studies on patients with AD reported high stress levels, low sleep quality, and increased depression and suicidal ideation [10].

In adolescence—"a period of storm and stress"—children experience mood disorders and cognitive changes [11]. According to Counselling and Welfare Center for Youth [12], the most common problem dealt with in adolescent counseling is difficulty in interpersonal relationships, followed by mental health issues including depression, anxiety, and suicide-related problems. In adolescence, children are exposed to psychological difficulties, and allergic disease compounds their emotional problems [13]. Among these emotional problems, depression and anxiety (although treated as distinct) share and exacerbate negative feelings; if persistent, they develop into mental disorders [14]. Therefore, early identification and intervention for depression and anxiety are critical.

Children with AD experience itching and poor sleep quality [5]. Sleep is crucial for the physical and mental growth of young children and adolescents [15], as sleep deficiency causes chronic fatigue, hypersensitivity, cognitive dysfunction (e.g., inattention and memory problems), and emotional problems [5]. According to previous studies, sleep deficiency influences depression, anxiety, and suicidal ideation [8]. Psychopathological disorders such as anxiety, depression, and sleep disorders exacerbate the health of patients with allergic diseases or cause other health problems [5]. Hence, it is important to identify risk factors and intervene early [5].

Studies on adolescents with allergic disease focused on its impact on suicidal ideation [16], relationship between sleep disorder and emotional characteristics [16,17], and assessment of emotional state and behavioral problems in specific allergic diseases [8,10]. Although allergic diseases' underlying cause remains the same, their timing of occurrence and symptoms vary across individuals [1,18]. Therefore, different approaches for specific allergic diseases are needed. Liu et al.'s [18] study on allergies in women highlighted the necessity of analyzing specific disease-based allergies. However, in South Korea, limited research has conducted such disease-specific analyses.

Anxiety and depression are the most common problems

adolescents experience [19]. Among anxiety types, generalized anxiety disorder (GAD)—first appearing in the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* (1980)—is characterized by chronic anxiety or dread that continues for a long time [20]. Common GAD symptoms are both psychological (e.g., restlessness, anticipated feeling of panic, repetitive negative thinking, and trouble concentrating) and physiological (caused by hypervigilance in the autonomic nervous system) [6,20].

Among the depression types, depressive symptoms (DS) are less severe than major depressive disorder, minor depressive disorder, and subsyndromal depression [20]. However, focusing on DS is important as they have the highest prevalence and are risk factors for more severe depressive disorders [21].

A study analyzing GAD data from the 16th Korea Youth Risk Behavior Survey (KYRBS) [22] classified only 66.6% of Korean youth as normal; 33.4% had mild or more severe anxiety (mild, 22.2%; moderate, 7.6%; severe, 3.6%), and a high proportion (25.2%) of students experienced depression [19]. Accordingly, this study examined both GAD and DS among adolescents.

That is, this study investigated the specific relationship between GAD and DS among Korean middle and high school students using data from the KYRBS, a large-scale cross-sectional survey. It examined the allergic disease-specific links to GAD and DS in Korean youth and the influences of asthma, AR, and AD on both GAD and DS. It thus investigated the (1) prevalence rates of allergic diseases, GAD, and DS in adolescents; (2) differences in GAD and DS according to participants' general characteristics; and (3) the allergic disease-specific relationship between GAD and DS.

METHODS

Ethical statements: This study was a secondary analysis of existing data and did not require institutional review board approval or informed consent.

1. Study Design

This study conducted secondary research to examine the relationships between adolescents' allergic disease and their GAD and DS by analyzing the raw data from the 18th KYRBS [23]. The reporting of this study was based on the

Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [24].

2. Study Subjects and Data Collection

The KYRBS is an online, anonymous, self-administered survey conducted annually to examine the health status of Korean youth [23]. The study subjects were surveyed in April 2022. To minimize sampling errors, the groups were divided into 39 regions and school levels. After receiving the survey guide, students responded to the survey by individually accessing the survey website of the Korea Disease Control and Prevention Agency (KDCA) in a space where internet was available. The 2022 survey was performed by sampling 798 middle and high school students, and a total of 51,850 students participated (participation rate: 92.2%). Data from all participants were analyzed in this study.

The KYRBS is a statistical survey approved and performed by the central government (approval no. 117058). The data are secondary and anonymous and are made publicly accessible by the KDCA [23]. The data in this study were obtained after the researchers filed an approval request in accordance with the relevant KDCA regulations.

3. Research Tools

1) Generalized anxiety disorder

GAD was screened using a GAD screening scale (Seven-item Generalized Anxiety Disorder, GAD-7), which was included in the KYRBS in 2020. The following question was asked for the seven items: "In the last two weeks, how often were you bothered by each of the following problems?". Participants responded using a four-point scale ranging from "never" (0 points) to "almost daily" (3 points); the minimum score was 0 points, and the maximum was 21 points; a score of ≥ 10 points was classified as moderate-to-severe GAD.

2) Depressive symptoms

The presence or absence of DS was determined by the question "In the last 12 months, have you felt so sad or despaired that you could not carry on your activities of daily living continuously for 2 weeks?"

3) Allergic diseases

For allergic diseases, asthma, AR, and AD were investigated. Regarding asthma, participants who responded "yes" to

"Have you ever been diagnosed with asthma by a physician?" were classified as having asthma. Likewise, the presence of AR and AD was determined using the questions "Have you ever been diagnosed with AR by a physician?" and "Have you ever been diagnosed with AD (eczema or heat rash) by a physician?" respectively.

4) General characteristics

For the socio-demographic characteristics, sex, age, BMI (body mass index), perceived economic status, perceived academic performance, living arrangement, and location were examined. BMI was calculated in kg/m^2 . Perceived economic status and perceived academic performance were each classified as "high," "middle-high," "middle," "middle-low," and "low." Living arrangement was classified as "with family" and "without family," and the location as "small and medium cities/country area," and "big cities."

For school characteristics, school type and school type by sex were examined. The categories of "middle school" and "high school" were used for school type, and "coeducational school" and "girls/boys' school" were used for school type by sex.

With respect to mental health characteristics, perceived stress, sleep satisfaction, self-rated health, and body weight perception were examined. Perceived stress level was classified into "very high," "high," "middle," "low," and "very low." Sleep satisfaction was classified into "very satisfied," "satisfied," "neutral," "dissatisfied," and "very dissatisfied." Self-rated health was classified into "very good," "good," "average," "poor," and "very poor," and body weight perception was classified into "very underweight," "slightly underweight," "right weight," "slightly overweight," and "very overweight."

4. Data Analysis Method

Data analysis was performed using the IBM SPSS Statistics 25 software (IBM Corp.). To perform complex sampling analysis, information regarding strata, cluster, weight, and finite population correction factor, all provided by the KDCA, was used [23]. For descriptive statistics, frequencies, weighted percentages and weighted means, standard error.

To examine the difference in GAD and DS based on the presence versus absence of each allergic disease, a chi-square test was conducted. To identify factors affecting GAD and DS, complex samples simple/multinomial logistic regression

analysis was performed; Nagelkerke R^2 was used to test the logistic regression models, and odds ratios and the 95% confidence interval were computed for each factor.

RESULTS

1. General Characteristics in Adolescents

Regarding socio-demographic characteristics, 51.6% were boys and 48.4% were girls. The mean age was 15.20 years, and the mean BMI was 21.36 kg/m². Moreover 46.0% perceived their economic status as “middle,” while 30.0% perceived their academic performance level to be “middle”; 95.5% lived with family, and 41.5% lived in big cities; 51.6% were middle school students, and 48.4% were high school students; 68.7% attended coeducational schools. Regarding mental health characteristics, 41.9% of the respondents felt “middle”-level stress, and sleep satisfaction was “neutral” for 31.9%. Self-rated health was “good” among 43.0% of the respondents, and body weight perception was “right weight” for 36.1% (Table 1).

2. Differences between GAD and DS by General Characteristics in Adolescents

Among the socio-demographic characteristics, sex, age, perceived economic status, perceived academic performance, and living arrangement were statistically significantly different based on the presence and absence of GAD ($p < .001$). Among the mental health characteristics, perceived stress, sleep satisfaction, self-rated health, and body weight perception were statistically significantly different based on the presence and absence of GAD ($p < .001$; Table 1).

As regards the presence versus absence of DS, the following variables of socio-demographic characteristics showed significant differences: sex ($p < .001$), age ($p = .003$), BMI ($p < .001$), perceived economic status ($p < .001$), perceived academic performance ($p < .001$), and living arrangement ($p < .001$). Among the school characteristics, both school type ($p = .021$) and school type by sex ($p < .001$) were significantly different. Among the mental health characteristics, perceived stress, sleep satisfaction, and self-rated health were significantly different ($p < .001$; Table 1).

3. GAD, DS, and Allergic Diseases in Adolescents

Of all participants, 6,587 (12.7%) experienced GAD with a mean GAD score of 4.22, and 14,956 (28.7%) experienced DS. In addition, 2,934 (5.7%) of those with allergic diseases experienced asthma, 18,319 (36.3%) experienced AR, and 11,440 (22.2%) experienced AD (Table 2).

4. Differences between GAD and Depression Symptoms by Allergic Disease

Asthma, AR, and AD were all significantly different in the presence versus absence of both GAD and DS ($p < .001$; Table 3).

5. Association of Allergic Diseases on GAD and DS

The effect of allergic diseases on GAD and DS was examined by performing complex samples simple/multiple logistic regression analysis (Tables 4 and 5). In each regression model, the dependent variable was coded 1 if GAD or DS was present and 0 if not. For the independent variables regarding allergic diseases, values 1 and 0 were used to indicate the presence and absence of each disease, respectively. Covariates were included in the complex multinomial logistic regression analysis. There were 13 covariates which were significant variables in the chi-square tests conducted to compare the presence versus absence of both GAD and DS, as shown in Table 1.

Nine covariates (sex, age, perceived economic status, perceived academic performance, living arrangement, perceived stress, sleep satisfaction, self-rated health, and body weight perception) were included in the model testing GAD. Moreover, 11 covariates (sex, age, BMI, perceived economic status, perceived academic performance, living arrangement, school type, school type by sex, perceived stress, sleep satisfaction, and self-rated health) were included in the model testing DS.

The complex samples simple logistic regression analysis (Table 4) found that all three allergic diseases (i.e., asthma, AR, and AD) were significant in GAD and DS ($p < .001$). For each allergic disease, the level of both GAD and DS increased in the disease's presence.

The results of complex samples multinomial logistic regression analysis with covariates based on allergic disease (Table 5) are as follows. Asthma was significantly different in the presence versus absence of both GAD ($p = .013$) and DS ($p < .001$): in participants with asthma, the likelihood of GAD

Table 1. Comparison of General Characteristics according to Generalized Anxiety Disorder and Depressive Symptoms among Adolescents (N=51,850)

Variables	Categories	n (%) ^{a)}	M ± SE ^{b)}	Generalized anxiety disorder χ^2 / t (p)	Depressive symptoms χ^2 / t (p)
Socio-demographic characteristics					
Sex	Male	26,397 (51.6)		448.47 (<.001)	551.04 (<.001)
	Female	25,453 (48.4)			
Age (year) (n=51,767)	-		15.20 ± 0.024	3.61 (<.001)	2.94 (.003)
Body mass index (kg/m ²) (n=50,455)	-		21.36 ± 0.033	-0.17 (.865)	-6.40 (<.001)
Perceived economic status (n=51,847)	High	5,984 (11.9)		11.98 (<.001)	11.28 (<.001)
	Middle-high	15,904 (31.4)			
	Middle	24,143 (46.0)			
	Middle-low	4,807 (8.8)			
	Low	1,009 (1.9)			
Perceived academic performance (n=51,848)	High	6,935 (13.5)		9.74 (<.001)	19.90 (<.001)
	Middle-high	13,116 (25.3)			
	Middle	15,484 (30.0)			
	Middle-low	11,380 (21.8)			
	Low	4,933 (9.4)			
Living arrangement (n=51,845)	With family	49,182 (95.5)		15.02 (<.001)	40.32 (<.001)
	Without family	2,663 (4.5)			
Location	Small and medium cities/ Country area	29,638 (58.5)		0.38 (.608)	0.52 (.566)
	Big cities	22,212 (41.5)			
School characteristics					
School type	High school	23,835 (48.4)		5.59 (.052)	8.64 (.021)
	Middle school	28,015 (51.6)			
School type by sex	Coeducational school	35,527 (68.7)		5.71 (.060)	51.87 (<.001)
	Girls/Boys' school	16,323 (31.3)			
Mental health characteristics					
Perceived stress	Very high	6,343 (12.3)		-68.45 (<.001)	-78.52 (<.001)
	High	15,053 (29.0)			
	Middle	21,641 (41.9)			
	Low	7,316 (13.9)			
	Very low	1,497 (2.9)			
Sleep satisfaction	Very satisfied	3,550 (6.7)		38.30 (<.001)	43.49 (<.001)
	Satisfied	8,109 (15.5)			
	Neutral	16,656 (31.9)			
	Dissatisfied	15,342 (29.8)			
Self-rated health	Very dissatisfied	8,193 (16.0)		40.60 (<.001)	33.27 (<.001)
	Very good	10,543 (20.2)			
	Good	22,337 (43.0)			
	Average	13,565 (26.3)			
	Poor	5,038 (9.8)			
Body weight perception	Very poor	367 (0.7)		8.37 (<.001)	0.10 (.921)
	Very underweight	2,539 (5.0)			
	Slightly underweight	11,122 (21.8)			
	Right weight	18,602 (36.1)			
	Slightly overweight	15,791 (30.2)			
	Very overweight	3,796 (6.9)			

^{a)}Weighted %; ^{b)}Weighted mean; ^{c)}Rao-Scott χ^2 ; M, mean; SE, standard error.

increased by 1.17 times and that of DS by 1.26 times.

AR also showed a significant difference in the presence versus absence of both GAD ($p < .001$) and DS ($p = .027$): in

participants with AR, the likelihood of GAD and DS increased by 1.12 and 1.05 times, respectively. AD was significantly different in the presence versus absence of DS ($p = .009$)

Table 2. Generalized Anxiety Disorder, Depressive Symptoms, and Allergic Diseases among Adolescents (N=51,850)

Variables	Categories	n (%) ^{a)}	M ± SE ^{b)}
Generalized anxiety disorder	Yes	6,587 (12.7)	4.22 ± 0.029
	No	45,263 (87.3)	
	Total score (range=0–21)		
Depressive symptoms	Yes	14,956 (28.7)	4.22 ± 0.029
	No	36,894 (71.3)	
Asthma	Yes	2,934 (5.7)	4.22 ± 0.029
	No	48,916 (94.3)	
Allergic rhinitis	Yes	18,319 (36.3)	4.22 ± 0.029
	No	33,531 (63.7)	
Atopic dermatitis	Yes	11,440 (22.2)	4.22 ± 0.029
	No	40,410 (77.8)	

^{a)}Weighted %; ^{b)}Weighted mean; M, mean; SE, standard error.

Table 3. Comparison of Allergic Diseases according to Generalized Anxiety Disorder and Depressive Symptoms among Adolescents (N=51,850)

Variables	Categories	Generalized anxiety disorder			Depressive symptoms		
		No	Yes	χ^2 (p) ^{b)}	No	Yes	χ^2 (p) ^{b)}
		n (%) ^{a)}	n (%) ^{a)}		n (%) ^{a)}	n (%) ^{a)}	
Asthma	Yes	2,435 (5.5)	499 (7.7)	49.06 (<.001)	1,860 (5.2)	1,074 (7.1)	72.23 (<.001)
	No	42,828 (94.5)	6,088 (92.3)		35,034 (94.8)	13,882 (92.9)	
Allergic rhinitis	Yes	15,659 (35.5)	2,660 (41.4)	83.46 (<.001)	12,690 (35.4)	5,629 (38.4)	41.63 (<.001)
	No	29,604 (64.5)	3,927 (58.6)		24,204 (64.6)	9,327 (61.6)	
Atopic dermatitis	Yes	9,730 (21.7)	1,710 (26.0)	58.56 (<.001)	7,796 (21.3)	3,644 (24.4)	57.61 (<.001)
	No	35,533 (78.3)	4,877 (74.0)		29,098 (78.7)	11,312 (75.6)	

^{a)}Weighted %; ^{b)}Rao-Scott χ^2 .

Table 4. Associations Between Independent variables and Allergic Diseases and Dependent variables among Adolescents^{a)} (N=51,850)

Independent variables (reference)	Categories	Dependent variables					
		Generalized anxiety disorder			Depressive symptoms		
		OR (95% CI)	p	Nagelkerke R ²	OR (95% CI)	p	Nagelkerke R ²
Asthma (No)	Yes	1.44 (1.30–1.61)	<.001	.002	1.41 (1.30–1.53)	<.001	.002
Allergic rhinitis (No)	Yes	1.28 (1.21–1.35)	<.001	.003	1.14 (1.09–1.19)	<.001	.001
Atopic dermatitis (No)	Yes	1.27 (1.19–1.35)	<.001	.002	1.19 (1.14–1.25)	<.001	.002

^{a)}Complex sample simple logistic regression analysis; CI, confidence interval; OR, odds ratio.

Table 5. Associations Between Independent Variables and Allergic Diseases and Dependent variables among Adolescents^{a)} (N=51,850)

Independent variables (reference)	Categories	Dependent variables					
		Generalized anxiety disorder			Depressive symptoms		
		OR (95% CI)	p	Nagelkerke R ²	OR (95% CI)	p	Nagelkerke R ²
Asthma (No)	Yes	1.17 (1.03–1.33)	.013	.306	1.26 (1.15–1.39)	<.001	.210
Allergic rhinitis (No)	Yes	1.12 (1.06–1.19)	<.001	.306	1.05 (1.01–1.10)	.027	.210
Atopic dermatitis (No)	Yes	1.07 (0.99–1.15)	.064	.306	1.07 (1.02–1.12)	.009	.210

^{a)}Complex sample multiple logistic regression analysis; CI, confidence interval; OR, odds ratio.

but not of GAD ($p = .064$): in participants with AD, the likelihood of DS increased by 1.07 times.

DISCUSSION

This study was conducted to examine the presence of both GAD and DS in adolescents with specific allergic diseases (asthma, AR, and AD) and investigate the effect of each allergic disease on GAD and DS. As a result, GAD was associated with asthma and allergic disease. DS was associated with asthma, AR, and AD. The study findings are discussed below.

Of the participants, 12.7% experienced GAD and 28.7% DS. In a study that analyzed data from the 16th KYRBS (2020) [19], the proportion of adolescents experiencing GAD (≥ 10 points) was 11.2%, and the proportion of those experiencing DS was 25.2%. A follow-up study is needed because the current study examined data from the 18th survey [23], which was conducted after the COVID-19 pandemic, and this point is a factor in the slight decrease in both GAD and DS. According to Park [25], during the pandemic, psychological anxiety and depression were aggravated among adolescents in vulnerable families due to school closures. This is likely because adolescents had to care for their family members because of the family's economic or health problems [26], but this aspect must be confirmed in future research.

Additionally, this study only investigated GAD and DS, but the results for other types of anxiety and depressive disorders may differ. Further, because depression and GAD are known to share many symptoms and the cases in which they co-exist tend to be severe [20], it is recommended to investigate how the disorders' or symptoms' co-existence affects mental health.

This study found that adolescents experiencing asthma, AR, or AD were more likely to have GAD and DS compared with both control groups, confirming their association with allergic diseases and the diseases' effects. This finding is consistent with previous studies' findings and shows that Korean adolescents with allergic disease also experience emotional difficulty [8-10].

Adolescence is an important period in which children go through psychological difficulties due to physical changes, and they develop into adulthood after adequately overcoming the difficulties. Adolescents experiencing anxiety and depression due to an illness in this period may develop psychiatric disorders in adulthood [27]. Moreover, anxiety and de-

pression in adolescence are affected by not only personal factors but also other diverse factors such as academic performance, relationship with parents, and support system [13]. In this study, analysis was performed by controlling the variables of general characteristics that significantly affected anxiety and depression; moreover, asthma and AR were found to influence both anxiety and depression, whereas AD was found to influence depression only.

Allergic disease begins in childhood, and the symptoms manifest in diverse forms and lead to a variety of diagnoses, reducing quality of life and inducing problems such as depression and anxiety. Consistent with previous research, this study found that children diagnosed with asthma were more likely to experience GAD and DS compared to the control group. Currently, a direct mechanism for the linkage between asthma and depression is unknown. It is reported, however, that the younger the child with the condition, the more likely they are to feel that their condition is life-threatening and experience anxiety, panic, and depression due to low quality of life [7]. According to a previous study, among patients with various allergic diseases, patients with asthma were more likely to complain of anxiety and panic attacks and visit the hospital due to such psychological problems [28]. The researchers stated that emotional problems aggravated symptoms, as such problems increased contraction in the bronchi or impacted the immune system through the vagus nerve [1]. Anxiety and depression may persist even if asthma symptoms improve [7]; hence, patients should be regularly screened for anxiety and depression.

Patients with AR showed a significant difference in GAD and DS. In particular, anxiety increased by 1.12 times in the AR versus control groups. In a previous study conducted with adolescents, anxiety increased in cases with AR, which may be linked to sleep disturbance [29]. AR is seasonally affected, and symptoms are more severe during a particular period in a year, thus increasing anxiety [1]. Moreover, sleep disturbance makes it difficult to maintain sleep, reducing sleep duration and quality, and may cause psychiatric symptoms, impulses, and suicidal ideation [8,16]. The use of drugs to relieve symptoms also causes sleep disturbance [6]. Mou et al. [30] reported that the duration of symptoms, comorbidities, medications used, immune inflammatory response, etc., are related to depression caused by AR, which is consistent with the results of this study. It is believed that it is necessary to approach psychological problems (anxiety and depression) related to drug use, which were not included as vari-

ables in this study.

Unlike other allergic diseases, AD was found to influence depression only. AD decreases sleep quality due to not only visible symptoms (e.g., sensitivity, dryness, redness, flaking, and bleeding caused by scratching and skin deformation) but also diet restriction, symptom recurrence, and severe itching [31]. Patients with AD withdraw from daily living activities due to the symptoms, which lowers their quality of life and induces depression [10,17]. Jaworek et al. [31] reported that severe AD was linked to depression and low serum serotonin levels. Previous studies also supported the validity of the current study's findings. Anxiety increases in situations in which a threat is highly likely to occur [32]; this finding is interpreted as demonstrating that AD—a chronic recurrent disease—does not influence anxiety because it does not occur or worsen suddenly, unlike asthma and AR.

This study is of significance because it identified allergic disease-specific factors affecting depression and anxiety in adolescents. It is notable that the analysis was performed by controlling several variables and using only disease characteristics. A study limitation is that the survey investigated only the presence or absence of the diagnosis of allergic disease, and data on its timing of occurrence or severity level were not collected. In the future, a repeat study should be conducted to investigate depression and anxiety levels by also collecting the aforementioned information in subjects with allergic diseases. Additionally, it is suggested to conduct studies that investigate how the characteristics of specific allergic diseases impact one's emotional and behavioral problems, such as those caused by depression and anxiety. This is because specific allergic diseases may have different effects on stress.

CONCLUSION

This study analyzed data from the 18th KYRBS (2022) to determine the relationship between allergic diseases, GAD, and DS among Korean adolescents. The results revealed that GAD was associated with asthma, AR, and AD. DS were associated with asthma and AR but not with AD. The results allowed the identification of depression and anxiety in adolescents caused by allergic disease. Moreover, it showed the necessity of regularly evaluating depression and anxiety in adolescents with allergic diseases during the initial treatment process.

ARTICLE INFORMATION

Authors' contribution

Conceptualization: all authors; Data collection, Formal analysis: all authors; Writing-original draft: all authors; Writing-review and editing: all authors; Final approval of published version: all authors.

Conflict of interest

Jaeyoung Lee has been an editor of *Child Health Nursing Research* since 2022. She was not involved in the review process of this article. No existing or potential conflict of interest relevant to this article was reported.

Funding

None.

Data availability

Please contact the corresponding author for data availability.

Acknowledgements

None.

ORCID and ResearcherID

Jaeyoung Lee <https://orcid.org/0000-0002-5516-8199>
<https://researcherid.com/rid/KHY-6320-2024>
So Yeon Park <https://orcid.org/0000-0002-0498-6271>
<https://researcherid.com/rid/JXL-5769-2024>

REFERENCES

1. Wang J, Zhou Y, Zhang H, Hu L, Liu J, Wang L, et al. Pathogenesis of allergic diseases and implications for therapeutic interventions. *Signal Transduction and Targeted Therapy*. 2023;8(1):138. <https://doi.org/10.1038/s41392-023-01344-4>
2. Bousquet J, Van Cauwenberge P, Khaltaev N. Allergic rhinitis and its impact on asthma. *Journal of Allergy and Clinical Immunology*. 2001;108(5 Suppl):S147-S334. <https://doi.org/10.1067/mai.2001.118891>
3. Koo MJ, Kwon R, Lee SW, Choi YS, Shin YH, Rhee SY, et al. Nation-

- al trends in the prevalence of allergic diseases among Korean adolescents before and during COVID-19, 2009-2021: a serial analysis of the national representative study. *Allergy*. 2023;78(6):1665-1670. <https://doi.org/10.1111/all.15600>
4. Pyun BY. Relationship between atopic dermatitis, wheezing during infancy and asthma development. *Journal of the Korean Medical Association*. 2007;50(6):533-538. <https://doi.org/10.5124/jkma.2007.50.6.533>
 5. Silverberg JI, Garg NK, Paller AS, Fishbein AB, Zee PC. Sleep disturbances in adults with eczema are associated with impaired overall health: a US population-based study. *Journal of Investigative Dermatology*. 2015;135(1):56-66. <https://doi.org/10.1038/jid.2014.325>
 6. Udem BJ, Taylor-Clark T. Mechanisms underlying the neuronal-based symptoms of allergy. *Journal of Allergy and Clinical Immunology*. 2014;133(6):1521-1534. <https://doi.org/10.1016/j.jaci.2013.11.027>
 7. Kullowatz A, Kanniss F, Dahme B, Magnussen H, Ritz T. Association of depression and anxiety with health care use and quality of life in asthma patients. *Respiratory Medicine*. 2007;101(3):638-644. <https://doi.org/10.1016/j.rmed.2006.06.002>
 8. Kim JY, Han YJ, Lee JS, Lee JH, Jo SH, Kim SH. Evaluation of a possible association between allergic rhinitis and depression, suicidal ideation, and suicide attempts among adolescents based on a nationwide cross-sectional study. *International Journal of Pediatric Otorhinolaryngology*. 2020;134:110070. <https://doi.org/10.1016/j.ijporl.2020.110070>
 9. Koh YI. Asthma and psychological disorders. *Allergy Asthma & Respiratory Disease*. 2014;2(3):151-152. <https://doi.org/10.4168/aard.2014.2.3.151>
 10. Kyung Y, Choi MH, Jeon YJ, Lee JS, Lee JH, Jo SH, et al. Association of atopic dermatitis with suicide risk among 788,411 adolescents: a Korean cross-sectional study. *Annals of Allergy, Asthma & Immunology*. 2020;125(1):55-64. <https://doi.org/10.1016/j.anai.2020.03.023>
 11. Degenhardt L, Stockings E, Patton G, Hall WD, Lynskey M. The increasing global health priority of substance use in young people. *Lancet Psychiatry*. 2016;3(3):251-264. [https://doi.org/10.1016/s2215-0366\(15\)00508-8](https://doi.org/10.1016/s2215-0366(15)00508-8)
 12. Ministry of Gender Equality & Family (MOGEF). Youth white paper 2022. MOGEF; 2023. p. 246-261.
 13. Kim S, Ko H, Park S, Yang E. Factors related to depression of children and adolescents in South Korea: a meta-analysis. *Korean Journal of Culture and Social Issues*. 2012;18(4):533-555.
 14. American Psychiatric Association (APA). Diagnostic and statistical manual of mental disorders: DSM-IV. 4th ed. APA; 1994. p. 317-444.
 15. Verkooijen S, de Vos N, Bakker-Camu BJW, Branje SJT, Kahn RS, Ophoff RA, et al. Sleep disturbances, psychosocial difficulties, and health risk behavior in 16,781 Dutch adolescents. *Academic Pediatrics*. 2018;18(6):655-661. <https://doi.org/10.1016/j.acap.2018.03.003>
 16. Kim JS, Seo Y. Allergic disease, short sleep duration, and suicidal ideation and plans among Korean adolescents. *Journal of School Nursing*. 2022;38(2):173-183. <https://doi.org/10.1177/1059840520921920>
 17. Park CH. Mental health in adolescents with allergic diseases-using data from the 2020 Korean Youth's Risk Behavior Web-based Study. *Journal of Industrial Convergence*. 2022;20(1):87-96. <https://doi.org/10.22678/JIC.2022.20.1.087>
 18. Liu L, Luo C, Zhang M, Ao X, Liu H, Peng S. Relationship between allergic diseases and mental disorders in women: a systematic review and meta-analysis. *Frontiers in Psychiatry*. 2022;13:1026032. <https://doi.org/10.3389/fpsy.2022.1026032>
 19. Park E. The influences of mental health problem on suicide-related behaviors among adolescents: based on Korean Youth Health Behavior Survey. *Journal of Korean Academic Society of Nursing Education*. 2023;29(1):98-108. <https://doi.org/10.5977/jkasne.2023.29.1.98>
 20. Kim CH. Recent advances in the pharmacotherapy of generalized anxiety disorder. *Korean Journal of Psychopharmacology*. 2004; 15(1):9-13.
 21. Park JH, Kim KW. A review of the epidemiology of depression in Korea. *Journal of the Korean Medical Association*. 2011;54(4):362-369. <https://doi.org/10.5124/jkma.2011.54.4.362>
 22. Korea Disease Control and Prevention Agency (KDCA). The 16th (2020) Korea Youth Risk Behavior Survey. Cheongju: KDCA; 2021 May. Report No.: 11-1460736-000038-10.
 23. Korea Disease Control and Prevention Agency (KDCA). The 18th (2022) Korea Youth Risk Behavior Survey. Cheongju: KDCA; 2023 May. Report No.: 11-1790387-000797-10.24.
 24. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Medicine*. 2007;4(10):e296. <https://doi.org/10.1371/journal.pmed.0040296>
 25. Park SM. The impact of the COVID-19 pandemic on mental health among population. *Korean Journal of Health Education and Promotion*. 2020;37(5):83-91. <https://doi.org/10.14367/kjhep.2020.37.5.83>
 26. Fegert JM, Vitiello B, Plener PL, Clemens V. Challenges and burden of the Coronavirus 2019 (COVID-19) pandemic for child and adolescent mental health: a narrative review to highlight clinical and research needs in the acute phase and the long return to normality.

- Child and Adolescent Psychiatry and Mental Health. 2020;14:20. <https://doi.org/10.1186/s13034-020-00329-3>
27. Johnson D, Dupuis G, Piche J, Clayborne Z, Colman I. Adult mental health outcomes of adolescent depression: a systematic review. *Depression and Anxiety*. 2018;35(8):700-716. <https://doi.org/10.1002/da.22777>
28. ten Brinke A, Ouwerkerk ME, Zwinderman AH, Spinhoven P, Bel EH. Psychopathology in patients with severe asthma is associated with increased health care utilization. *American Journal of Respiratory and Critical Care Medicine*. 2001;163(5): 1093-1096. <https://doi.org/10.1164/ajrccm.163.5.2004020>
29. Muñoz-Cano R, Ribó P, Araujo G, Giralt E, Sanchez-Lopez J, Valero A. Severity of allergic rhinitis impacts sleep and anxiety: results from a large Spanish cohort. *Clinical and Translational Allergy*. 2018;8:23. <https://doi.org/10.1186/s13601-018-0212-0>
30. Mou YK, Wang HR, Zhang WB, Zhang Y, Ren C, Song XC. Allergic rhinitis and depression: profile and proposal. *Frontiers in Psychiatry*. 2022;12:820497. <https://doi.org/10.3389/fpsy.2021.820497>
31. Jaworek AK, Jaworek M, Makara-Studzińska M, Szafraniec K, Doniec Z, Szepietowski J, et al. Depression and serum content of serotonin in adult patients with atopic dermatitis. *Advances in Experimental Medicine and Biology*. 2020;1271:83-88. https://doi.org/10.1007/5584_2019_470
32. Bateson M, Brilot B, Nettle D. Anxiety: an evolutionary approach. *Canadian Journal of Psychiatry*. 2011;56(12):707-715. <https://doi.org/10.1177/070674371105601202>