



The Relationship Between Specific Adult Attention-Deficit/Hyperactivity Disorder Symptoms and Anxiety Using Self-Report Diagnostic Scales

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Objectives: This study aimed to investigate the relationship between adult attention-deficit/hyperactivity disorder (ADHD) and anxiety symptoms.

Methods: A total of 52 patients diagnosed with adult ADHD completed self-report assessment scales. The clinical features of ADHD were assessed using the Adult ADHD Self-Report Scale (ASRS) and Korean Adult ADHD Rating Scale (K-AARS). The State-Trait Anxiety Inventory (STAI) was used to assess anxiety-related symptoms. Correlation and linear regression analyses were conducted to examine the relationships between the diagnostic scales of adult ADHD and anxiety.

Results: Higher scores on the ASRS were related to higher scores on the STAI-S ($r=0.482$) and STAI-T ($r=0.573$), which assess state anxiety and trait anxiety, respectively. Subscales of inattention (STAI-S, $r=0.485$; STAI-T, $r=0.648$), impulsivity (STAI-S, $r=0.404$; STAI-T, $r=0.491$), emotional dysregulation (STAI-S, $r=0.498$; STAI-T, $r=0.639$), disorganization (STAI-S, $r=0.427$; STAI-T, $r=0.545$) on the K-AARS, and the subtotal of K-AARS clinical subscales (STAI-S, $r=0.517$; STAI-T, $r=0.540$) had significant correlations with both STAI-S and STAI-T scores. After adjusting for demographic characteristics, there were significant associations between ASRS total scores ($\beta=0.299$) and STAI-S scores, and between inattention ($\beta=0.297$), impulsivity ($\beta=0.560$), emotional dysregulation ($\beta=0.393$), disorganization ($\beta=0.817$), subtotal scores on the K-AARS subscales ($\beta=0.114$), and STAI-S scores. The multivariate regression analysis also showed significant associations between ASRS total scores ($\beta=0.409$) and STAI-T scores. Associations between K-AARS subscales of inattention ($\beta=0.468$), impulsivity ($\beta=0.817$), emotional dysregulation ($\beta=0.598$), disorganization ($\beta=1.120$), subtotal scores on the K-AARS subscales ($\beta=0.134$), and STAI-T scores remained significant after adjusting demographic variables.

Conclusion: Comprehensive assessment of ADHD symptoms related to anxiety would be important for the evaluation and treatment of anxiety in adult ADHD patients.

Keywords: Attention-deficit/hyperactivity disorder; Anxiety; ASRS; K-AARS.

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INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder that frequently persists into adulthood [1]. ADHD affects approximately 5% of children and the prevalence in adults is estimated to be around 2.5% [2]. Up to 65% of patients diagnosed with ADHD during childhood continue to have residual symptoms into adulthood, although the rate varies according to how one defines the per-

sistence of symptoms [3].

The diagnosis of ADHD is based on diagnostic manuals such as the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [4] and the International Classification of Diseases, 11th Revision (ICD-11) [5], and the diagnosis requires a consistent pattern of inattention and/or hyperactivity-impulsivity symptoms inappropriate for the developmental level, resulting in functional impairment across multiple settings. In addition, a comprehensive interview by a medical professional, standardized rating scales, and neuropsychological evaluations are necessary for a thorough clinical assessment [6].

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The diagnostic criteria in the DSM-5 and ICD-11 delineate that symptoms of ADHD are similar in children and adults, characterized by impulsive behavior, inattentiveness, and a sense of restlessness [7]. However, prior studies show that clinical manifestations of ADHD evolve with age [7,8]. Approximately half of the people who retrospectively report childhood ADHD meet the criteria for adult ADHD [9], and inattention tends to be more persistent than symptoms of hyperactivity and impulsivity [7].

The main clinical features of adult ADHD include inattention, impulsivity, and emotional dysregulation. Adult patients with ADHD often experience functional impairments in various domains, such as work and interpersonal relationships [10,11]. Adults with ADHD tend to have lower educational levels and employment rates, which impose a significant psychosocial and socioeconomic burden on both the individuals and society [12,13]. In particular, inattention is related to cognitive impairment, impairment in daily activities, and overall distress, such as increased negative emotions [14].

Emotional dysregulation or emotional lability is frequently reported in adults with ADHD. Although it is not included as a core component in the diagnosis of the disorder, it is recognized as an associated feature [15]. Emotional dysregulation in adults with ADHD is associated with anxiety symptoms, and distress from mood symptoms results in significant functional impairment [16,17]. In addition, adults with ADHD have a higher risk of developing mood disorders, and anxiety is one of the most frequently co-occurring conditions as research indicates that up to 47% of adults with ADHD have a diagnosis of comorbid anxiety disorder [18-20]. Compared with people without ADHD, adult patients with ADHD encounter more adverse events in their lives, such as poor performance at work and difficulty in maintaining peer relationships, which result in negative thoughts, expectations of failure, and anticipatory anxiety [21,22]. Even in patients without a comorbid mood disorder, emotional symptoms are a significant mediator between ADHD symptoms and quality of life [23].

Despite supporting evidence that anxiety has a significant impact on the overall functioning of adults with ADHD, there is a lack of comprehensive research examining the relationship between the clinical features of adult ADHD and anxiety symptoms. Therefore, we aimed to clarify the association between the various clinical symptoms of adult ADHD and anxiety using several diagnostic scales. Core ADHD symptoms were assessed using tools such as the Adult ADHD Self-Report Scale (ASRS) [24] and the Korean Adult ADHD Rating Scale (K-AARS) [25]. Anxiety was measured by the State-Trait Anxiety Inventory (STAI) [26,27], which includes a measure of both current and persisting symptoms of anxiety.

METHODS

Participants

The study included adult ADHD patients aged 18 years or older who visited the outpatient clinic of the Psychiatry Department of Ewha Womans University Mokdong Hospital between January 1, 2018 and July 31, 2024. A total of 264 patients were diagnosed with adult ADHD by a specialist in the Department of Psychiatry based on the diagnostic criteria of the DSM-5 and comprehensive psychological assessments. The diagnosis was independently confirmed by a second experienced psychiatrist by reviewing the patients' medical records. Patients undergoing pharmacological treatment and those who did not fully complete the assessments were excluded. A final sample of 52 patients was identified and the clinical features of ADHD were assessed using the ASRS [24] and K-AARS [25]. The STAI [26] was administered to assess symptoms related to anxiety. Data from participants who did not complete all the scales were excluded. This study was approved by the Institutional Review Board of Ewha Womans University Medical Center (IRB No. 2024-07-008). Informed consent was not required for this retrospective study.

Assessment tools

Adult ADHD Self-Report Scale

The World Health Organization's ASRS is one of the most widely used measures for assessing the symptoms of adult ADHD [24]. The ASRS symptom checklist is an 18-item self-report scale developed to identify adults who may be at risk for adult ADHD based on the diagnostic criteria of the DSM-IV-TR. It is divided into two sections: part A has six items for screening purposes and part B consists of 12 items for a detailed symptom assessment. Out of the 18 items, nine items assess inattention, and nine items assess symptoms of hyperactivity/impulsivity. Each item is rated on a 5-point Likert scale from 0 to 4 based on symptom frequency (0=never, 1=rarely, 2=sometimes, 3=often, and 4=very often) over the past 6 months, which yields a total score ranging from 0 to 72 [6,28]. Unlike ADHD rating scales intended for children, the ASRS describes symptoms in the context of adulthood. Compared to diagnostic interviews, the ASRS shows competent quality as a screening tool [29].

Korean Adult ADHD Rating Scale

The K-AARS is a self-report diagnostic scale developed in Korea to assess ADHD symptoms in adults [25]. The scale contains 73 items that encompass the symptoms of adult ADHD, and is divided into three parts. The first part comprises 55 items across six subscales: inattention, hyperactiv-

ity, impulsivity, antisocial personality disorder/oppositional defiant disorder/conduct disorder, emotional dysregulation, and disorganization. The second part contains six items evaluating impairment. The third part consists of 12 items questioning specifically about the individual’s driving habits. Each item is rated on a 5-point Likert scale ranging from “never” to “always.” A total score of 132 or greater on the six clinical subscales has been suggested as the cutoff for considering an ADHD diagnosis [30].

State-Trait Anxiety Inventory

The STAI was developed by Spielberger et al. [27] to provide a scale to assess anxiety among adults. It is one of the most widely used self-report scales to assess anxiety and is based on the concept that anxiety lies on a spectrum between two different types: state anxiety and trait anxiety [26]. State anxiety refers to a temporary anxious state provoked by a particular situation or stimulus. On the other hand, trait anxiety is an individual’s baseline level of anxiety that is part of their general disposition and personality. Anxiety, as measured using the State-Trait Anxiety Inventory-State scale (STAI-S), tends to change over time and across different circumstances. There are 20 items each on the STAI-S and State-Trait Anxiety Inventory-Trait scale (STAI-T). The items are rated on a 4-point Likert scale, with a total score ranging from 20 to 80. A total score of 40 or higher indicates clinical levels of anxiety [27].

Statistical analysis

Continuous data were presented as means and standard deviations, and categorical data were presented as frequencies and percentages. To examine the correlations between the diagnostic scales of adult ADHD and anxiety, we used Pearson’s correlation analysis for data satisfying normal distributions, and Spearman’s correlation analysis for variables with non-normal distributions. Bonferroni correction was applied for multiple comparisons, and a p-value of less than 0.004 was considered statistically significant. A univariate linear regression analysis was performed to evaluate the effects of various adult ADHD symptoms on anxiety. Additionally, multivariate linear regression analysis was performed after adjusting for sex, marital status, education level, presence of other psychiatric comorbidities, and occupation. All statistical analyses were performed using SPSS 22 (IBM Corp., Armonk, NY, USA), and statistical significance was defined at a two-tailed $p < 0.05$ with the exception of correlation analyses.

RESULTS

Sociodemographic characteristics of participants

The age range of the participants was 19–58 years, with a

mean age of 29.85 ± 9.16 years. There were more male than female participants, with 38 men (73.1%) and 14 women (26.9%). Most participants were unmarried (80.8%). Forty participants (76.9%) had college-level education or higher, and 12 participants (23.1%) had completed high school or less. The majority (65.4%) had one or more comorbidities, such as generalized anxiety disorder, depressive disorder, bipolar disorder, and personality disorders, whereas 18 participants (34.6%) had no comorbidities. There were 23 participants (44.2%) who were unemployed and 29 (55.8%) were employed (Table 1).

Correlation analysis between ASRS and K-AARS with STAI scores

The mean STAI-S score of adult ADHD patients was 47.37 ± 11.23 and the mean score of STAI-T scales was 49.23 ± 12.96 . Higher scores on both parts of the ASRS (part A, $r = 0.429$; part B, $r = 0.473$) and the total ASRS score ($r = 0.482$) were related to higher scores on STAI-S, which assesses state anxiety. Scores on both parts of the ASRS (part A, $r = 0.470$; part B, $r = 0.567$) and the total ASRS score ($r = 0.573$) also showed significant correlations with STAI-T scores. The mean number of positive items included in ASRS part A, which is used as a screener for the diagnosis of adult ADHD, was 3.77 ± 1.83 .

Subscales of inattention ($r = 0.485$), impulsivity ($r = 0.404$), emotional dysregulation ($r = 0.498$), and disorganization ($r = 0.427$) on the K-AARS, and subtotals of the K-AARS clinical subscales ($r = 0.517$) were related to higher STAI-S scores. In terms of the correlation with the STAI-T scale, the subscales

Table 1. Demographic and clinical characteristics of participants

Variables	Adult ADHD patients (n=52)
Age (yr)	29.85 ± 9.16
Sex	
Male	38 (73.1)
Female	14 (26.9)
Marriage	
Unmarried	42 (80.8)
Married	10 (19.2)
Education	
≥ College	40 (76.9)
< College	12 (23.1)
Comorbidity	
None	18 (34.6)
≥ 1	34 (65.4)
Occupation	
Unemployed	23 (44.2)
Employed	29 (55.8)

Data are presented as mean ± standard deviation or n (%). ADHD, attention-deficit/hyperactivity disorder

Table 2. Correlation between ASRS and K-AARS with STAI scores

	Adult ADHD (n=52)	Correlation coefficient	
		STAI-S	STAI-T
ASRS			
Total score	39.17 ± 15.58	0.482*	0.573*
Part A	14.46 ± 5.83	0.429*	0.470*
Part A positive	3.77 ± 1.83		
Part B	24.69 ± 10.57	0.473*	0.567*
K-AARS			
Inattention	39.37 ± 15.66	0.485*	0.648*
Hyperactivity	9.46 ± 3.99	0.181	0.283
Impulsivity	17.69 ± 7.70	0.404*	0.491*
APD/CD/ODD	7.17 ± 5.60	0.255	0.220
Dysregulation	28.25 ± 12.79	0.498*	0.639*
Disorganization	11.83 ± 5.56	0.427*	0.545*
Subtotal of clinical subscales	111.13 ± 46.52	0.517*	0.540*
Impairment	11.69 ± 21.39	0.273	0.395*
Driving	15.44 ± 18.38	-0.236	-0.284

Data are presented as mean ± standard deviation. * $p < 0.004$. ADHD, attention-deficit/hyperactivity disorder; APD, antisocial personality disorder; ASRS, Adult ADHD Self-Report Scale; CD, conduct disorder; K-AARS, Korean Adult ADHD Rating Scale; ODD, oppositional defiant disorder; STAI-S, State-Trait Anxiety Inventory-State scale; STAI-T, State-Trait Anxiety Inventory-Trait scale

of inattention ($r=0.648$), impulsivity ($r=0.491$), emotional dysregulation ($r=0.639$), and disorganization ($r=0.545$) on the K-AARS, and the subtotals of the K-AARS subscales ($r=0.540$) also showed positive correlations. The subscale measuring functional impairment was only associated with STAI-T scores and did not show an association with STAI-S scores (Table 2).

Linear regression analyses of ASRS and K-AARS on STAI-S scores

Univariate linear regression analysis revealed a statistically significant association between ASRS scores and STAI-S scores. In the multivariate regression analysis adjusting for demographic characteristics, the association between ASRS and STAI-S scores remained significant. For every 1-point increase in the total ASRS score, STAI-S scores increased by 0.299 (Table 3).

In the univariate linear regression analysis between scores on the K-AARS and STAI-S, statistically significant associations were found in subscales of inattention ($\beta=0.333$, $p=0.001$), impulsivity ($\beta=0.588$, $p=0.003$), emotional dysregulation ($\beta=0.437$, $p<0.001$), disorganization ($\beta=0.862$, $p=0.002$), and the subtotal of clinical subscales ($\beta=0.125$, $p<0.001$).

In the multivariate model, associations between STAI-S scores and the subscales of inattention ($\beta=0.297$, $p=0.005$), impulsivity ($\beta=0.560$, $p=0.008$), emotional dysregulation ($\beta=0.393$, $p=0.002$), disorganization ($\beta=0.817$, $p=0.008$), as well as the subtotal score on the K-AARS ($\beta=0.114$, $p=0.001$), remained significant after adjustment of demographic vari-

ables (Table 3).

Linear regression analyses of ASRS and K-AARS on STAI-T scores

In the univariate linear regression analysis, there was a statistically significant association between the ASRS and STAI-T scores. After adjusting for demographic variables, the association between ASRS scores and STAI-T scores remained significant. The STAI-T scores increased by 0.409 for every 1-point increase in the total ASRS score (Table 4).

The univariate linear regression analysis between scores on the K-AARS and STAI-T showed statistically significant associations in the symptom domains of inattention ($\beta=0.522$, $p<0.001$), impulsivity ($\beta=0.826$, $p<0.001$), emotional dysregulation ($\beta=0.648$, $p<0.001$), disorganization ($\beta=1.270$, $p<0.001$), driving behavior ($\beta=-0.211$, $p=0.031$), and the subtotal of clinical subscales ($\beta=0.150$, $p<0.001$).

After adjusting for demographic variables in the multivariate analysis, scores of inattention ($\beta=0.468$, $p<0.001$), impulsivity ($\beta=0.817$, $p<0.001$), emotional dysregulation ($\beta=0.598$, $p<0.001$), disorganization ($\beta=1.120$, $p=0.001$), and the subtotal score on the K-AARS ($\beta=0.134$, $p<0.001$) had statistically significant associations with STAI-T scores (Table 4).

DISCUSSION

This study aimed to investigate the relationship between symptoms of adult ADHD and anxiety using diagnostic scales. Due to the high rate of comorbid mood symptoms, the

Table 3. Linear regression analysis of ASRS and K-AARS on STAI-S scores in the adult ADHD group

	Univariate			Multivariate [†]		
	β (95% CI)	SE	p	β (95% CI)	SE	p
ASRS						
Total score	0.347 (0.168, 0.526)	0.089	<0.001***	0.299 (0.091, 0.506)	0.103	0.006**
Part A	0.835 (0.342, 1.328)	0.245	0.001**	0.755 (0.178, 1.331)	0.286	0.011*
Part B	0.503 (0.237, 0.769)	0.132	<0.001***	0.414 (0.112, 0.716)	0.150	0.008**
K-AARS						
Inattention	0.333 (0.153, 0.514)	0.090	0.001**	0.297 (0.097, 0.497)	0.099	0.005**
Hyperactivity	0.511 (-0.276, 1.297)	0.391	0.198	0.395 (-0.467, 1.257)	0.428	0.361
Impulsivity	0.588 (0.210, 0.967)	0.189	0.003**	0.560 (0.154, 0.966)	0.201	0.008**
APD/CD/ODD	0.419 (-0.138, 0.976)	0.277	0.137	0.248 (-0.315, 0.810)	0.279	0.380
Dysregulation	0.437 (0.221, 0.653)	0.108	<0.001***	0.393 (0.147, 0.638)	0.122	0.002**
Disorganization	0.862 (0.343, 1.380)	0.258	0.002**	0.817 (0.223, 1.411)	0.295	0.008**
Subtotal of clinical subscales	0.125 (0.066, 0.183)	0.029	<0.001***	0.114 (0.052, 0.177)	0.031	0.001**
Impairment	-0.061 (-0.209, 0.087)	0.074	0.414	-0.127 (-0.279, 0.025)	0.075	0.099
Driving	-0.126 (-0.295, 0.044)	0.085	0.144	0.060 (-0.156, 0.275)	0.107	0.581

*p<0.05; **p<0.01; ***p<0.001; †adjusted for age, sex, marriage, education level, presence of other psychiatric comorbidity, and occupation. β, estimated regression coefficient; ADHD, attention-deficit/hyperactivity disorder; APD, antisocial personality disorder; ASRS, Adult ADHD Self-Report Scale; CD, conduct disorder; CI, confidence interval; K-AARS, Korean Adult ADHD Rating Scale; ODD, oppositional defiant disorder; SE, standard error; STAI-S, State-Trait Anxiety Inventory-State scale

Table 4. Linear regression analysis of ASRS and K-AARS on STAI-T scores in the adult ADHD group

	Univariate			Multivariate [†]		
	β (95% CI)	SE	p	β (95% CI)	SE	p
ASRS						
Total score	0.476 (0.283, 0.670)	0.096	<0.001***	0.409 (0.184, 0.634)	0.111	0.001**
Part A	1.123 (0.578, 1.668)	0.271	<0.001***	0.967 (0.328, 1.605)	0.317	0.004**
Part B	0.696 (0.409, 0.983)	0.143	<0.001***	0.584 (0.259, 0.909)	0.161	0.001**
K-AARS						
Inattention	0.522 (0.330, 0.704)	0.091	<0.001***	0.468 (0.264, 0.672)	0.101	<0.001***
Hyperactivity	0.958 (0.033, 1.803)	0.441	0.042	0.961 (0.019, 1.902)	0.467	0.046
Impulsivity	0.826 (0.430, 1.242)	0.207	<0.001***	0.817 (0.385, 1.249)	0.215	<0.001***
APD/CD/ODD	0.504 (-0.138, 1.146)	0.320	0.121	0.300 (-0.336, 0.937)	0.316	0.347
Dysregulation	0.648 (0.427, 0.869)	0.110	<0.001***	0.598 (0.348, 0.849)	0.124	<0.001***
Disorganization	1.270 (0.715, 1.825)	0.276	<0.001***	1.120 (0.475, 1.765)	0.320	0.001**
Subtotal of clinical subscales	0.150 (0.084, 0.217)	0.033	<0.001***	0.134 (0.064, 0.205)	0.035	<0.001***
Impairment	0.120 (-0.048, 0.289)	0.084	0.159	0.053 (-0.124, 0.230)	0.088	0.549
Driving	-0.211 (-0.403, -0.020)	0.095	0.031*	-0.028 (-0.273, 0.217)	0.122	0.820

*p<0.05; **p<0.01; ***p<0.001; †adjusted for age, sex, marriage, education level, presence of other psychiatric comorbidity, and occupation. β, estimated regression coefficient; ADHD, attention-deficit/hyperactivity disorder; APD, antisocial personality disorder; ASRS, Adult ADHD Self-Report Scale; CD, conduct disorder; CI, confidence interval; K-AARS, Korean Adult ADHD Rating Scale; ODD, oppositional defiant disorder; SE, standard error; STAI-T, State-Trait Anxiety Inventory-Trait scale

assessment of mood problems such as anxiety is crucial in adult ADHD patients [31]. Furthermore, there are overlapping symptoms shared between ADHD and anxiety disorders, including symptom manifestations such as restlessness, concentration difficulties, high distractibility, mood swings, and anger outbursts [32]. In a previous study by Reimherr et al. [33], patients with higher anxiety levels consistently showed greater impairment in multiple measures of ADHD.

In this study, in order for a comprehensive evaluation of adult ADHD symptoms, we used the ASRS and K-AARS, which are widely used adult ADHD assessment scales. We examined the specific symptoms within the domains of adult ADHD that are linked to higher levels of anxiety.

The symptom domains of inattention, impulsivity, dysregulation, and disorganization on the K-AARS were associated with both state anxiety and trait anxiety, as measured

by the STAI. Adult ADHD is characterized by a more extensive set of impairments than what is outlined by the DSM-5. Previous research indicates that symptoms of inattention predominate during adulthood, which give rise to a broader range of problems such as executive function impairments, restlessness, as well as impairment in domains such as driving and occupational tasks [3,8,34]. Patients find it challenging to engage in certain activities, such as reading, having conversations, or participating in meetings, and tend to postpone demanding tasks that are not very stimulating [35]. Difficulties faced by adult ADHD patients in these aspects may provoke constant worrying or anxiety about failing in important or routine tasks [34]. Lack of concentration would also require excessive effort to stay on task, which could deplete cognitive resources and increase anxiety levels. Research also suggests that high levels of anxiety can disrupt normal developmental processes and result in cognitive impairments, such as inattention [36].

Higher scores on impulsivity on the K-AARS also had an association with higher anxiety levels in this study. A study by Malloy-Diniz et al. [37] suggests that impulsivity in adult ADHD patients is multidimensional and has three components: attentional, motor, and cognitive impulsivity. While there is some evidence stating that symptoms of hyperactivity and impulsivity tend to diminish at a higher rate than inattention as patients with ADHD reach adulthood [7], other studies have found that impulsivity is a persisting symptom in ADHD, and behavioral dysfunctions observed in adults with ADHD could be a result of the inability to control impulses [38]. According to previous research, the association between impulsivity and anxiety in ADHD has been inconclusive. Salvi et al. [39] reported that anxiety disorders were more common in adults with the hyperactive/impulsive type of ADHD. Similar results were found in a study by Soendergaard et al. [40] where researchers examined the association between ADHD subtypes and comorbid psychiatric disorders in a sample of 155 adult ADHD patients. However, there is contrasting evidence from studies which suggests that anxiety in patients may reduce symptoms of impulsivity in ADHD [41]. In this model, anxiety serves as an alternative method to manage impulsivity and inappropriate social behavior since the normal mechanisms of inhibition are dysfunctional. In the current study, higher scores on impulsivity on the K-AARS were associated with higher STAI-S and STAI-T scores. This is in line with previous research which posited that impulsivity is related to higher levels of anxiety. Impulsivity can exacerbate symptoms of anxiety through poor decision-making, difficulty in social interactions, emotional dysregulation, and risk-taking behaviors [42]. Thus, it would be important for clinicians to identify the cognitive

and behavioral aspects of impulsivity in patients and address them to properly manage anxiety.

Emotional dysregulation is considered as one of the core features of adult ADHD and is a significant contributing factor to functional impairment in adult ADHD patients, even when controlling for psychiatric comorbidities and subthreshold psychiatric symptoms [15,43]. Emotional dysregulation in ADHD patients has been characterized by deficits in regulation of emotions, including irritability, anger, emotional impulsivity, and mood lability [15,17]. Patients experience frequent alterations in mood while coping with daily events, and impulsive anger, which is a feature of emotional dysregulation, is associated with anxiety [44]. The results in the current study found an association between emotional dysregulation and higher levels in anxiety. In a study by Skirrow et al. [45], which investigated the role of everyday experiences on emotional lability in adult ADHD patients, emotional instability, irritability, and frustration were observed as a reaction to adverse events. However, even after accounting for positive and negative events, adults with ADHD experienced more intense and unstable emotions. This indicates that individuals who have difficulty regulating their emotions would easily feel incapable of coping with changes in mood, leading to increased anxiety.

Disorganization is a symptom closely related to executive functioning impairments, and includes problems with the initiation, prioritization, and overall organization of tasks [46]. Compared to hyperactivity and attentional problems, cognitive impairment and disorganization associated with ADHD are more subtle and difficult to quantify using neuropsychological tests [47]. Computerized assessments for diagnosing ADHD primarily focus on impairments in sustained attention, making the identification and treatment of disorganization symptoms difficult. Despite its importance in daily activities and the workplace, disorganization is a clinical feature that is often overlooked due to these reasons. In a study by Oscarsson et al. [48], which interviewed 20 participants with adult ADHD, a significant number of participants reported difficulties in maintaining structure and organization at work. In work-related settings, patients tend to feel persistently anxious and exhausted due to inadequacy in completing tasks. Disorganization and poor planning skills were found to be predictors of mood symptoms such as anxiety, depression, and stress in individuals with adult ADHD [49]. These findings are consistent with those of our study, which showed that prominent disorganization symptoms were related to higher levels of anxiety.

A score of 132 or higher on the clinical subscales of the K-AARS is indicative of a diagnosis of adult ADHD [30]. The mean score of the clinical subscales of participants in this

study was 111.13 ± 46.52 , which was lower than the suggested cutoff score, but had significant associations with STAI scores. The optimal cutoff score on the ASRS is 32, and part A of the ASRS, which was devised as a screener for the scale, has a cutoff score of four positive items for optimal clinical utility. The mean score of the ASRS for adult ADHD patients in this study was 39.17 ± 15.58 , which was higher than the cutoff score, and had associations with the severity of anxiety symptoms. The mean number of positive items on part A of the ASRS were 3.77 ± 1.83 , which is near the suggested cutoff score, and higher scores on part A correlated with higher STAI scores. These results indicate an association between the overall severity of ADHD symptoms and anxiety. This finding is consistent with previous research which has shown that patients who report greater impairment due to ADHD symptoms also have higher anxiety levels [33].

In addition to investigating the relationship between the overall severity of ADHD symptoms and anxiety, the results of this study found that specific symptom domains of adult ADHD were associated with anxiety, even when adjusting for demographic variables. The expression of ADHD symptoms in adults differs from that in children, and diagnosis in adults is often further complicated by their ability to adapt and compensate for deficits, making the symptoms less prominent [42]. It would be important for clinicians to assess anxiety as well as the core clinical features and related functional impairments of adult ADHD upon diagnosis. When evaluating anxiety in adult ADHD patients, clinicians should consider assessing specific ADHD symptoms that could affect anxiety, such as inattention, impulsivity, emotional dysregulation, and disorganization. Thus, rather than limiting the scope of treatment to anxiety itself, managing the overall severity of ADHD symptoms and specific ADHD symptoms related to anxiety could result in improved treatment outcomes for alleviating anxiety. There is evidence from previous research which indicate that there was improvement in the severity of anxiety symptoms in adult ADHD patients after treatment with ADHD medications [33,50].

This study has several limitations. First, the number of participants was relatively small, limiting the generalizability of results. Second, participants with comorbid anxiety disorders were not differentiated from those without a diagnosis. Considering the high rate of psychiatric comorbidities in adult patients with ADHD, it is important to examine whether high levels of anxiety are due to co-occurring anxiety disorders or clinical features of ADHD. Third, although standardized diagnostic tools were used, the scales used to measure ADHD and anxiety symptoms were self-report questionnaires which could be prone to bias. Participants may underreport or overestimate the severity of symptoms based on their perceived

experiences.

Despite these limitations, this study investigated the relationship between different ADHD symptom domains and anxiety in drug-naïve patients, using standardized, accessible measures. Among the symptoms, inattention, impulsivity, emotional dysregulation, and disorganization were significantly associated with higher anxiety. Clinical features of ADHD and anxiety both pose a great burden on the overall function of patients; therefore, a comprehensive approach to the diagnosis and treatment of adult ADHD would be necessary.

CONCLUSION

This study aimed to investigate the relationship between ADHD symptoms and anxiety. While there have been previous reports on the high co-occurrence of anxiety and adult ADHD, our study revealed how specific symptoms of ADHD are associated with anxiety. When evaluating and managing anxiety in adult ADHD patients, it would be crucial to consider ADHD symptoms related to anxiety. Some aspects of ADHD symptoms can directly affect patients' anxiety and emotional states; however, anxiety can result from maladaptive coping strategies used by ADHD patients in response to stressors and adverse events. In future studies, it would be important to examine the mechanisms underlying the association between ADHD and anxiety.

Availability of Data and Material

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Eui-Jung Kim. Data curation: MinA Park, Hee Youn Won. Formal analysis: Eui-Jung Kim, Ga Eun Kim. Investigation: Eui-Jung Kim. Methodology: Eui-Jung Kim, Ga Eun Kim. Writing—original draft: Hee Youn Won, Ga Eun Kim. Writing—review & editing: Eui-Jung Kim, Ga Eun Kim, Hee Youn Won.

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