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Article

A Comparative Study of Anxiety, Depression, Suicidal Ideation, and Self-Esteem in Students with or without ADHD

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Abstract: Background and Objectives: Although there has been growing interest in the association of ADHD with anxiety, depression, suicidal ideation, and self-esteem, there is a lack of consistent results and these associations remain unclear. This study investigated the differential patterns of anxiety, depression, suicidal ideation, and self-esteem with regard to the presence of ADHD. Materials and Methods: The subjects were divided into a patient group and a control group. The patient group included 49 patients diagnosed with ADHD at the department of psychiatry of one university hospital. For the control group, 3,727 students were invited to complete a questionnaire. Of the 1,717 students who responded to the questionnaire, 245 were selected for patient-controlled studies. All the subjects were instructed to complete the Beck Suicide Ideation Scale, Children's Depression Inventory, Beck's Depression Inventory, State-Trait Anxiety Inventory, and Rosenberg Self-Esteem Scale. Results: ADHD subjects experienced more anxiety, depression, and suicidal ideation as well as lower self-esteem compared to the control group comprising participants without ADHD. Conclusions: These findings suggest that ADHD symptoms may contribute to greater suicidal ideation through experienced depression, anxiety, and low self-esteem in school-aged children. Therefore, appropriate ADHD symptom management is necessary to reduce suicidal ideation among school-aged children with ADHD symptoms.

Keywords: ADHD; anxiety; depression; suicidal ideation; self-esteem

1. Introduction

Attention-deficit hyperactivity disorder (ADHD) develops gradually over long periods of time and involves developmentally inappropriate levels of inattention, impulsivity, and motor activity, which are sufficiently severe to cause serious disruptions in important domains of a child's life. Secondary symptoms of the disorder can often be very troublesome and include poor peer relationships, aggression, issues in academic performance and low levels of academic achievement, decrease in self-esteem, and depressive symptoms [1,2]. In particular, psychiatric disorders such as anxiety, depressive symptoms, low self-esteem, and suicidal ideation that accompany ADHD in children and adolescents may negatively impact the patients' quality of life.

Most individuals with ADHD (up to 93%) also experience comorbid disorders [3]. Epidemiological studies have shown that one of the most common complications is anxiety disorders, which are found in approximately 25% of the children and adolescents with ADHD [4–6]. In addition, the prevalence of depression is reported to be approximately 20% among this patient population [7–10]. The prevalence of anxiety disorders in children with ADHD is important; although the nature of anxiety and the substantive underlying mechanisms are uncertain, this complication places an additional burden on the child's life, may lead to diverse treatment outcomes, and likely indicates an important direction of treatment. However, most Asian studies to date have reported contradictory findings regarding the prevalence and symptoms of anxiety in children with ADHD, not only because of methodological weaknesses, but perhaps also because of cultural differences [11]. In

addition, many studies have shown that children diagnosed with ADHD are more likely to later develop depression than those without ADHD. Children with co-occurring ADHD and depression experience more severe impairments, such as suicidal ideation and increased rates of suicide completion compared to children with only one disorder [12].

Studies conducted thus far have not paid sufficient attention to the potential significance of anxiety, depressive symptoms, and low self-esteem in children with ADHD [2]. Moreover, one of the major concerns is how ADHD relates to suicidal ideation, suicide attempts, and suicidal behavior. Previous studies have reported that ADHD with comorbid disorders may be a risk factor for suicidal ideation in children and adults. However, little is known regarding the significant direct relationship between ADHD and suicidal behavior [13,14]. Similarly, although previous studies have suggested a link between ADHD and suicide completion, little is known regarding its association with suicidal behavior in community settings [15]. While a previous meta-analysis evaluated the incidence of suicide completion among patients with ADHD, to our knowledge, no published reviews or meta-analyses have investigated other dimensions of suicidal behavior, such as non-fatal suicide attempts or suicidal impulses. The lifetime incidence of these components in the general population is much higher than that of suicide completion and they have emotional and social consequences [16]. Previous studies have shown that ADHD increases the risk of depression and suicide attempts. However, few studies have assessed the association between ADHD and suicidal ideation, or those among ADHD, depression, and suicidal ideation [17].

Thus, although there is growing interest in the association of ADHD with anxiety, depression, self-esteem, and suicidal ideation, there is a lack of consistent results and these associations remain unclear. In addition, since previous studies have included limited age groups and samples that were not representative of the population, their results have limited generalizability. Therefore, in this study, we hypothesized that children with ADHD would have a higher risk of anxiety, depression, and suicidal ideation as well as lower self-esteem, and based on data from a survey of students, we aimed to investigate the differential patterns of anxiety, depression, self-esteem, and suicidal ideation with regard to the presence of ADHD.

2. Materials and Methods

The present study and consent form were approved by the Institutional Review Board (IRB) of our hospital (IRB No. 04-2014-006). The present study included students receiving treatment at the hospital after being diagnosed with ADHD and students who were not. The case group included patients with ADHD receiving outpatient or inpatient treatment at the pediatric psychiatry department at our hospital between 2008 and October 2014 who voluntarily agreed to participate in the study and responded to the survey. Of the 62 patients who responded to the survey, 49 who were diagnosed with ADHD according to the Diagnostic and Statistical Manual of Mental Disorders (DSM), Fourth Edition, Revised criteria for ADHD were selected. Participants were excluded if the patient or caregiver withdrew their consent for participation in the study, or if the patient displayed psychotic symptoms or mental retardation at the time of the survey. Participants were also excluded if they had a major neurological abnormality or barriers to language comprehension due to other physical conditions such as sight or hearing impairments. Considering the participant characteristics, the survey was conducted only after obtaining consent from the parents and in the presence of a psychiatrist.

To select the control group, a survey was administered to the general student population in elementary, middle, and high schools. With the cooperation of the Department of School Violence Prevention in the Busan Metropolitan City Office of Education, each office of education received applications from classes wishing to participate in the survey, yielding a sample of 3,272 students from 40 sixth-grade classes in elementary schools, 40 second-grade classes in middle schools, and 37 second-grade classes in high schools. Of the 1,717 students who responded to the survey, 245 were selected as the control group for the case-control study through stratified sampling and computerized random number generation, taking into consideration differences across class levels and the sex ratio.

For this sample, there were no particular exclusion criteria other than not consenting to complete the survey.

2.1. Measures

Anxiety symptoms were measured using the State-Trait Anxiety Inventory (STAI) instrument, which consisted of 40 items in total and was developed by Spielberger et al. to measure anxiety [18]. The 40-item STAI includes 20 items (STAI-I) that measure state anxiety and 20 items (STAI-II) that measure trait anxiety. In the present study, only the state anxiety scale was used since state anxiety better explains the current state. Each item in the STAI uses a 4-point scale ranging from not relevant at all (1 point) to highly relevant (4 points). Scores ranging from 41 to 44 points correspond to slightly high, 45-48 to moderately high, and 49 or higher to severely high state anxiety.

Depression was assessed using Kovacs’ Children’s Depression Inventory (CDI) and Beck’s Depression Inventory (BDI). Kovacs’ CDI was used for elementary school students [19]. In this depression scale, 0-21 points correspond to lack of depression, 22-25 to mild depression, 26-28 to depression, and 29 or higher to severe depression. BDI was used for middle and high school students [20]. In this depression scale, 0-9 points correspond to lack of depression, 10-15 to mild depression, 16-23 to depression, and 24-63 to severe depression.

Suicidal ideation was measured using the Beck Suicide Ideation Scale [21]. Participants were divided into those with or without suicidal ideation according to Beck’s Suicidal Ideation Scale criteria. In this scale, scores ranging from 16 to 19 correspond to slight suicidal ideation, 20-23 to moderate suicidal ideation, and 24 or higher to severe suicidal ideation compared to their age group.

Self-esteem was measured using the translated Rosenberg Self-Esteem Scale items [22], and comparisons were made using average values.

2.2. Statistics

Using the survey data, the symptoms of anxiety, depression, self-esteem, and suicidal ideation were compared between the case group of participants with ADHD and the control group using the chi-squared test (χ^2 test). Analyses were performed using SPSS software version 24 (IBM Corp., Armonk, NY, USA), and statistical significance was determined using the two-tailed test at $p < 0.05$.

3. Results

Of the 49 participants in the ADHD case group, 12 (24.5%) were elementary school students, 14 (28.6%) were middle school students, and 23 (46.9%) were high school students. The proportion of boys was slightly higher (32 [65.3%] boys and 17 [34.7%] girls). The control group of participants without ADHD was selected using the same ratio, with 60 elementary school students, 70 middle school students, and 115 high school students. The sex ratio was also matched with that in the ADHD case group, with 160 boys and 85 girls in the control group (Table 1).

Table 1. Demographic characteristics of the participants.

	ADHD		Typical students		p-value
	Number	Frequency (%)	Number	Frequency (%)	
Male	32	65.31	160	65.31	1.000
Female	17	34.69	85	34.69	
Elementary school	12	24.50	60	24.50	1.000
Middle school	14	28.60	70	28.60	
High school	23	46.90	115	46.90	
9 yrs old	3	6.12	0	0.00	
11 yrs old	7	14.29	50	20.41	
12 yrs old	3	6.12	6	2.45	

13 yrs old	5	10.20	34	13.88	
14 yrs old	5	10.20	25	10.20	
15 yrs old	3	6.12	15	6.12	< 0.001
16 yrs old	8	16.33	40	16.33	
17 yrs old	9	18.37	57	23.27	
18 yrs old	6	12.24	18	7.35	
Total	49	100.00	245	100.00	

Differences in suicidal ideation, depression, anxiety, and self-esteem between the case and control groups are shown in Table 2. Anxiety symptoms were more prevalent in participants with ADHD than in the control group. Of the 49 participants in the case group, 12 (24.4%) showed symptoms of anxiety. Among these, six reported slight anxiety, five reported considerable anxiety, and one reported severe anxiety. Of the 245 participants in the control group, 29 (11.8%) showed symptoms of anxiety. Of these, 24 reported slight anxiety, four reported significant anxiety, and one reported severe anxiety. The difference between the two groups was statistically significant ($p = 0.006$).

The prevalence of depressive symptoms in the ADHD group was significantly greater than that in the control group. In the case group, four participants were excluded from the evaluation of depression because they did not complete the relevant items. Of the 45 participants who completed the survey, 20 (44.5%) reported depression. Of these, seven reported slight depression, four reported significant depression, and nine reported severe depression. Of the 245 participants in the control group, 54 (22.0%) reported depression. Of these, 26 reported mild depression, 22 reported significant depression, and six reported severe depression. The difference between the two groups was statistically significant ($p < 0.001$).

Next, the relationship between ADHD and suicidal ideation was examined by measuring the proportion of the participants who reported suicidal ideation in each group and evaluating the severity by further dividing these participants into groups reporting frequent, quite frequent, or very frequent thoughts of suicide compared to their age group. Of the 49 participants in the case group, 11 (22.4%) reported suicidal ideation. Of these, four reported frequent, four reported quite frequent, and three reported very frequent thoughts of suicide. Of the 245 participants in the control group, nine (3.7%) reported suicidal ideation. Of these, six reported frequent, two reported quite frequent, and one reported very frequent thoughts of suicide. The difference between the two groups was statistically significant ($p < 0.001$).

In assessments of self-esteem, a higher total score is thought to indicate higher levels of self-esteem. The mean self-esteem score was 21.9 in the case group and 24.5 in the control group. The case group showed lower self-esteem than the control group, and the intergroup difference was statistically significant ($p = 0.006$).

Thus, statistically significant differences between the case and control groups were found for all four variables, namely, suicide ideation, depression, anxiety, and self-esteem ($p < 0.01$). Compared to the control group, the case group reported more suicidal ideation, depression, and anxiety and lower levels of self-esteem.

Table 2. Anxiety, depression, suicide ideation and self-esteem in school-aged youths with and without attention-deficit hyperactivity disorder.

		ADHD (N=49)		Normal (N=245)		p-value
		Number	Values	Number	Values	
Anxiety	Normal	37	75.5	216	88.2	0.006
	Slight	6	12.2	24	9.8	
	Moderate	5	10.2	4	1.6	
	Severe	1	2.0	1	0.4	
	Total	49	100	245	100	
Depression	Normal	25	55.6	191	78.0	< 0.001
	Slight	7	15.6	26	10.6	
	Moderate	4	8.9	22	9.0	
	Severe	9	20.0	6	2.4	
	Total	45*	100	245	100	
Suicide ideation	No	38	77.6	236	96.3	< 0.001
	Yes	11	22.4	9	3.7	
	Total	49	100	245	100	
Self-Esteem	Mean		21.9 [‡]		24.5	0.006

*4 participants did not provide answers. Values represents % or mean [‡].

4. Discussion

The present study examined how anxiety, depression, suicidal ideation, and self-esteem differed in people with or without ADHD. The results indicated that those with ADHD experienced more anxiety, depression, and suicidal ideation as well as low self-esteem compared to the control group of participants without ADHD. These findings suggest that ADHD symptoms may contribute to greater suicidal ideation through emotions such as depression, anxiety, and low self-esteem in school-aged children. Therefore, appropriate ADHD symptom management is necessary to reduce suicidal ideation in school-aged children with ADHD symptoms

Differences between the ADHD group and the control group were examined for each item. Students with ADHD showed a significantly higher prevalence of anxiety symptoms than the control group. This is consistent with the results of previous epidemiological studies [4–6]. Anxiety symptoms and disorders in children with ADHD are often overlooked, but anxiety results in additional psychological and social deficits in children with ADHD. Several studies have revealed that children with both disorders have a much poorer quality of life, show poor overall behavior, and experience impairment of daily functioning [25,26]. Previous studies have shown that anxiety disorders co-occur at a considerably high rate in children with ADHD [27,28]. Tsang et al. also reported that 31% of children with ADHD experience anxiety disorders as defined by the DSM criteria (Fourth Edition; DSM-IV; APA, 1994) [29]. This is much higher than the reported prevalence of these disorders in the community (5%-15%) in various Asian and Western studies [31–33]. In comparison with Western countries, only a fraction of the studies in Asia have focused on the comorbid disorders commonly observed in ADHD children. However, most of these studies did not specifically investigate the co-occurrence of ADHD and anxiety [32,34–37]. In addition, the results reported in these studies were inconsistent. According to a Korean study using a semi-structured interview (Korean Kiddle-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version , 33.5% of the 105 examined ADHD patients experienced anxiety disorders [11,34]. Considering the importance of psychosocial treatment, a study focusing on the family environment of children with both ADHD and anxiety disorders found a strong association between parental anxiety and child anxiety [38–40]. In conclusion, although the nature of anxiety and the substantive underlying reasons are uncertain, this comorbid disorder is very important in clinical settings because it places an additional burden on the child's life and can effect the treatment outcomes [11].

The prevalence of depressive symptoms was significantly higher in students with ADHD in comparison with the control group. This result is consistent with the findings of previous studies reporting that ADHD patients displayed significantly more depressive symptoms than the control group [2]. Large amounts of data, especially from clinic-based samples, have shown that children with ADHD are more likely to meet one or more of the mood disorder criteria than children in comparison groups [30,41,42]. Children with co-occurring ADHD and depression have been shown to carry a higher risk of negative outcomes (e.g., suicide) than children with only one disorder [43]. ADHD has also been associated with an increase in depressive symptoms in community samples [44,45]. The overlap between ADHD and major depressive disorder (MDD) has been documented consistently in the literature. This overlap has been shown to affect at least 20%–30% of the cases in epidemiological [27,46] and clinical studies [30,47–49] of children and adolescents. The robustness of this overlap was explained in a meta-analysis by Angold et al. (Odds ratio, 5.5; 95% confidence interval, 3.5–8.4), which found a strong association between ADHD and MDD [7]. A meta-analysis of family research data by Faraone and Biederman suggested a familial link between the two disorders (Faraone and Biederman, 1997[50]. Because ADHD and MDD are individually associated with important long-term morbidity rates, their co-occurrence can be associated with particularly poor outcomes. Men with co-occurring ADHD and MDD had a significantly higher risk of bipolar disorder, impairment in psychosocial functioning, and hospitalization due to illness [51]. Boys who met the criteria for MDD showed prototypical symptoms of the disorder, chronic progression, and severe impairment in psychosocial functioning [52]. The co-occurrence of ADHD and depressive disorders results in more severe disabilities and developmental disorders than those caused by only one disorder [53]. Adolescents with ADHD and depression experience more intensive disruptions and stress than adolescents with ADHD alone, along with more psychological, social, and family problems [54,55]. People who have long-term ADHD and depression have a high rate of recurring depression and high healthcare costs overall [23,56].

Next, the relationship between ADHD and suicidal ideation was examined by measuring the proportion of participants reporting suicidal ideation in each group and evaluating the severity by further dividing these participants into groups reporting frequent, quite frequent, or very frequent thoughts of suicide compared to their age group. The difference between the case and control groups was statistically significant ($p < 0.001$). Suicide has become one of the leading causes of death among youth and young adults worldwide. Therefore, further investigation is needed to clarify the direct link between ADHD and suicidal behavior. One of the major concerns is the link between ADHD, suicidal ideation, suicide attempts, and suicidal impulse. Studies have reported that ADHD with a co-occurring disorder may be a risk factor for suicidal ideation in children and adults. A cohort study with 51,707 ADHD patients found that even after adjusting for comorbid disorders, ADHD increased the risk of suicide attempts and completed suicide [57]. Suicide attempts and suicidal ideation were more prevalent in the group previously diagnosed with ADHD than in the control group. Comorbidities, including delinquency and drug abuse, had a large effect on this association [24]. In men, even after adjusting for psychiatric disorder and drug use, childhood hyperactivity and attention-deficit symptoms in a community sample were associated with lifelong and adolescent suicide planning/attempts. In women, childhood hyperactivity and attention-deficit symptoms did not increase the risk of lifetime or adolescence suicide planning/attempts. The risk of suicidal behavior among men must be considered in ADHD management [15]. Although studies have suggested that ADHD may increase the risk of suicidal ideation [58,59], few potential mechanisms underlying this association have been studied. A meta-analysis of the association between ADHD and suicide showed that the risk of suicide in ADHD patients is 2.91 times higher than that in respective control groups [59]. People diagnosed with ADHD during childhood were almost twice as likely to consider suicide, and a longitudinal follow-up study found that they were seven times more likely to attempt suicide in high school compared to people without ADHD [60]. Young adults with a previous diagnosis of ADHD were still 2.6 times more likely to have considered suicide than the control group. Depressive symptoms associated with suicidal ideation can worsen the link between suicide risk and ADHD. However, studies on the association between ADHD and

depressive symptoms have shown both positive [23,61] and negative results [58], and only one study investigated the relationships among ADHD, depression, and suicide risk. In a longitudinal study, Barkley and Fischer [62] found that children diagnosed with ADHD during childhood and those who had attempted to commit suicide in high school were much more likely to develop major depressive disorder (MDD) (49%) compared to children who were diagnosed with ADHD during childhood but did not have suicidal ideation (10%). This result was extended to suicidal ideation during young adulthood (63% vs. 15%). These results suggest that depressive symptoms may mediate the association between ADHD and suicidal ideation. Identifying the mediators of suicidal ideation in patients with ADHD could help develop effective prevention strategies to reduce the negative consequences for this population [17]. The management of ADHD, which is a potential risk factor for severe suicidal ideation, would benefit from early diagnosis and appropriate treatment [15].

Finally, regarding self-esteem, the mean self-esteem score was 21.9 for the case group and 24.5 for the control group. The case group was found to show lower self-esteem than the control group, and this difference between the two groups was statistically significant ($p = 0.006$). In previous studies, results regarding the self-esteem of children with ADHD were somewhat contradictory. Contrary to research showing that children with ADHD have lower self-esteem [63], other studies have found that children with ADHD have inflated self-esteem despite chronic behavioral and academic problems [64,65]. Other studies have suggested the possibility that these differences could be attributed to the use of different measures of self-esteem, differences in statistical significance according to sample size, and differences in sampling [2]. In our study, the self-esteem of school-aged children with ADHD was found to be lower than that of the control group. This suggests that children with ADHD are more aware that their behavior is worse than their peers without ADHD. Instead of studies that generally find excessively inflated self-esteem among boys with ADHD [65,66], our results support the finding that children with ADHD have lower academic self-esteem, social self-esteem, and happiness, while experiencing more anxiety and feelings of discomfort, compared to those without ADHD [63]. These findings raise questions regarding the mediator of the relationship among ADHD, depression, and low self-esteem, based on the fundamental question of how ADHD relates to depression [2].

This study strongly suggests that it is necessary to thoroughly analyze the risks of suicide, depression, anxiety, and decrease in self-esteem among people with ADHD. However, there are some limitations to keep in mind when interpreting the current results. First, the sample was ethnically homogeneous, and the generalization potential is limited as participants were recruited from only one area. Second, children with ADHD were under treatment at the hospital, possibly leading to selection bias. Third, the results are based on survey data with no additional diagnostic interviews, and thus reflect the proportion of children placed above the cutoff score on a commonly used sorting instrument rather than actual clinical diagnosis. Fourth, all children who participated were diagnosed using a uniform multi-method assessment protocol, but information on ADHD subtypes and severity was not available, making it impossible to conduct analyses related to the severity of ADHD symptoms. Fifth, the method used in this study was limited by including only self-reporting methodology. Incorporating observer ratings in addition to self-reports may be the recommended approach to psychological assessment, as self-reporting alone may lead to biased understanding. Sixth, the survey used for data retrieval contained questions limited to questions limited to confirming the presence of anxiety, depressive symptoms, self-esteem, and suicide ideation, possibly limiting the interpretation of results related to psychiatric disorders. Seventh, because this study was cross-sectional, the causal relationship between ADHD, anxiety, depressive symptoms, self-esteem, and suicidal ideation could not be evaluated. Research on this matter and further analyses are needed in the future.

Despite these limitations, this study has the following strengths. First, one of the important features of this study was its case-control design using a case group with ADHD and a control group without ADHD. Second, it evaluated anxiety, depression, suicidal ideation, and self-esteem among school-aged children. Studies investigating suicide in the ADHD population are relatively scarce. Studies pertaining to the younger population in particular are rare, with only two studies with

children under 10 years of age. While the younger population is less likely to commit suicide, the additional effects of ADHD can raise the risk by increasing depression. [24]. Finally, this study used direct self-rating reports by the participants rather than assessments by the caregiver or teacher. Symptoms are reported by the children themselves and may be more severe than those reported by parents or teachers. Self-reporting provides important information regarding the child's subjective experiences, which are often inaccessible through other sources [67], and the current outcome emphasizes the need to include self-report data in studies with children with ADHD [68].

5. Conclusions

This study compared the symptoms of anxiety, depression, suicidal ideation, and self-esteem among children with ADHD and children without ADHD and found that the symptoms of ADHD can play an important role in the progression of suicidal ideation through experienced anxiety, depression, and decreased self-esteem. This strongly suggests that a thorough analysis of the risks of anxiety, depression, suicidal ideation, and decreased self-esteem is needed for the emotional and physical safety of ADHD patients. Although this study evaluated the symptoms of anxiety, depression, suicidal ideation, and self-esteem in children and adolescents with ADHD and those without ADHD, direct causal relationships between these factors in the context of ADHD were not analyzed, necessitating further analyses in the future. The results of this study present a strategy for mitigating the recent increase in suicide among students and suggest that it is necessary to identify depression and/or suicidal ideation when ADHD is present. Further research is needed in the future to determine the actual effects that treatment for ADHD may have on psychopathology.

Author Contributions: B-S.C. and J. K. conceptualized and designed the work, acquired and analyzed the data, drafted the initial manuscript, and reviewed the manuscript. All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Pusan National University Yangsan Hospital (IRB No. 04-2014-006).

Informed Consent Statement: Written informed consent was obtained from the parents. Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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