

Comorbid Anxiety and Mood Disorders in Children with Autism Spectrum Disorder and Attention-Deficit Hyperactivity Disorder. A Cross-Sectional Observational Study.

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Abstract

Background

Children diagnosed with autism spectrum disorder (ASD) and attention-deficit hyperactivity disorder (ADHD) frequently present with psychiatric comorbidities, particularly anxiety and mood disorders, which complicate diagnosis, management, and prognosis. Identifying these comorbidities is essential for effective clinical intervention.

Objectives

To compare the prevalence and pattern of comorbid anxiety and mood disorders among children with ASD and ADHD using standardized diagnostic interviews.

Materials and Methods

This cross-sectional observational study was conducted in the outpatient department of Psychiatry at Bhagwan Mahavir Institute of Medical Sciences (BMIMS), Pawapuri, Bihar, India, over a period of 12 months from January 2024 to December 2024. A total of 100 children aged 5–13 years were enrolled, including 50 diagnosed with ASD and 50 with ADHD based on DSM-IV criteria. Sociodemographic and clinical data were collected after obtaining written informed consent. Comorbid psychiatric disorders were assessed using the Structured Clinical Interview for DSM-IV Childhood Diagnoses (KID-SCID). Data were analyzed using SPSS version 24.0, and statistical significance was set at $p < 0.05$.

Results

Psychiatric comorbidity was observed in 57.5% of children with ASD and 40.0% of children with ADHD. Internalizing disorders, especially anxiety disorders, were significantly more prevalent in the ASD group (27.5%) compared to the ADHD group (10.0%). Externalizing disorders were slightly more common in ADHD but did not differ significantly. Age showed a weak positive correlation with internalizing symptoms in ASD.

Conclusion

Psychiatric comorbidities are common in children with ASD and ADHD, with internalizing disorders being more prevalent in ASD. Routine screening for psychiatric comorbidities is essential for early diagnosis and effective management.

Recommendation

Future studies with larger sample sizes and longitudinal follow-up are recommended to better understand the progression and impact of psychiatric comorbidities in children with ASD and ADHD.

Keywords: Autism Spectrum Disorder, Attention-Deficit Hyperactivity Disorder, Anxiety Disorders, Mood Disorders, Psychiatric Comorbidity, Children

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Introduction

Deficits in social communication abilities and a pattern of limited or repetitive interests and activities are hallmarks of

autism spectrum disorder (ASD), a neurodevelopmental condition. In addition to these core deficits, children with ASD often present with comorbid conditions such as anxiety, depression, attention deficit hyperactivity disorder (ADHD), and other behavioral issues [1–3]. ADHD, a

prevalent neurodevelopmental disorder affecting approximately 7.2% of the general population, is characterized by persistent patterns of impulsivity, hyperactivity, and/or inattention that cause functional impairment across contexts. Notably, ADHD symptoms occur in 16–85% of children and adolescents with ASD [4,5].

Comorbid conditions contribute to significant clinical impairment and an increased burden for children with ASD or ADHD and their families. Child psychiatric disorders can broadly be divided into internalizing and externalizing categories. Internalizing disorders include mood disorders such as major depressive disorder and dysthymic disorder, and anxiety disorders such as separation anxiety, social anxiety, obsessive-compulsive disorder, and specific phobia. Externalizing disorders, on the other hand, encompass ADHD, oppositional defiant disorder (ODD), and conduct disorder (CD), which involve outwardly directed behaviors [6].

Understanding the likelihood of comorbid mood and anxiety disorders is crucial, as psychiatric symptoms are closely linked to functioning in social, academic, and professional domains. The distinction between comorbid disorders and comorbid symptoms is particularly important; while the latter help in forming a comprehensive clinical picture, a DSM-IV diagnosis provides specific treatment pathways. Identifying problematic behaviors as manifestations of an underlying psychiatric condition allows for more targeted and effective interventions, which are associated with better functional outcomes.

Although several studies have explored comorbid psychiatric symptoms in children with ASD, fewer have investigated the presence of diagnosable psychiatric disorders using standardized diagnostic interviews [6,7]. From a research standpoint, accurate identification of comorbidities also aids in reducing etiologic and neurobiological heterogeneity, advancing psychopharmacological research, and refining genetic studies by facilitating more precise subgrouping. Understanding comorbid conditions in autism may thus help elucidate the underlying neural mechanisms of the disorder.

The objective of our study was to compare the prevalence and pattern of comorbid anxiety and mood disorders in children with ASD and ADHD using standardized diagnostic interviews.

Methodology

Study Design

This was a cross-sectional observational study conducted to evaluate psychiatric comorbidities among children diagnosed with ASD and ADHD.

Study Setting

The study was conducted in the outpatient department of Psychiatry at Bhagwan Mahavir Institute of Medical Sciences (BMIMS), Pawapuri, Nalanda, Bihar, India, a tertiary care teaching hospital providing specialized psychiatric services to children and adolescents.

Study Population

In all, 100 patients were enrolled. Included were the children between the ages of 5 and 13 with a diagnosis of ASD and ADHD as per DSM-IV. Written informed consent and detailed socio demographic and clinical data was taken from both parents and children. Lack of parental involvement, overlapping diagnoses for ASD and ADHD, and no official diagnosis were among the exclusion criteria. Each of the two groups of 50 participants—one for ASD and the other for ADHD—was created from the included participants.

Participants

Inclusion Criteria

- Children aged 5–13 years
- Diagnosed with Autism Spectrum Disorder or Attention-Deficit Hyperactivity Disorder based on DSM-IV criteria
- Parents/guardians provided written informed consent

Exclusion Criteria

- Children with severe neurological disorders
- Children with intellectual disability severe enough to interfere with assessment
- Children whose parents did not provide consent
- Children with incomplete clinical data

Sampling Method

Participants were recruited using consecutive sampling from the Psychiatry outpatient department during the study period.

Page | 3 Study Size

A total of 100 participants were included based on feasibility and the average patient flow during the study period. Formal sample size calculation was not performed, which is acknowledged as a limitation of the study.

Data Collection

Clinical information was gathered via direct evaluations and medical records, including age, gender, IQ estimations, and neurodevelopmental history. Anxiety and mood disorders were identified as comorbid mental conditions using structured diagnostic interview, the structured clinical interview for DSM-IV, childhood diagnosis (KID-SCID).

Instruments

Comorbid psychiatric DSM-IV disorders were evaluated using the KID-SCID scale. It is semi-structured interview, or Structured Clinical Interview for DSM-IV Childhood Diagnoses, used to evaluate children mental health issues. Although it has particular adjustments and inquiry questions pertinent to children's experiences, it adheres to the format of the adult SCID. Parents and children are asked if a specific DSM-IV symptom is present. There are three possible ratings for the symptom: (1) absent, (2) perhaps present, or (3) present. The interviewer aggregates all of the responses to assign a "best" score. The number of symptoms classified as "present" is then tallied. The interviewer inquires about other DSM criteria, such as "at what age symptoms emerged" or "whether symptoms cause interference with daily activities," if the necessary number of symptoms is satisfied, or the DSM-IV symptom criterion is satisfied, a KID-SCID diagnosis is made. The KID-SCID has demonstrated good reliability and validity in diagnosing psychiatric disorders in children and adolescents. It has shown high inter-rater reliability and test-retest reliability across various populations. Its validity has been established through strong agreement with clinical diagnoses and other standardized diagnostic tools, making it a reliable instrument for identifying psychiatric comorbidities. The KID-SCID demonstrates strong reliability, with high inter-

rater and test-retest consistency across diverse child and adolescent populations. Its validity is well-established, showing good concordance with clinical diagnoses and other standardized diagnostic instruments.

Study Procedure

After approval of medical ethics committee, 100 patients were enrolled for the study. Included were the children between the ages of 7 and 18, fifty with diagnosis of ASD and 50 with diagnosis of ADHD. Written informed consent and detailed socio demographic and clinical data was taken from both parents and children. Assessment included clinical interview carried out by trained psychologists with both the child and parents using the KIS-SCID scale, and standardized neurodevelopmental evaluations were performed. Diagnosis of ASD or ADHD was established according to DSM-IV criteria based on clinical judgment and observation.

Statistical Analysis

Data were initially entered in Microsoft Excel. The data has been presented as the number of participants (n) and percentages (%). The statistical program SPSS version 24.0 was used to analyze all of the data once it was imported from Microsoft Excel. Statistical significance is defined as a p-value of less than 0.05. Group differences within the internalizing and externalizing disorders were investigated using chi-square analysis. Additionally, Spearman's rho was used to examine the relationship between comorbidity and IQ as well as between comorbidity and age.

Bias

Potential sources of bias included selection bias, as participants were recruited from a single tertiary care hospital, which may limit generalizability. Information bias was minimized by using a standardized diagnostic instrument (KID-SCID). Interviewer bias was reduced by ensuring assessments were conducted by trained mental health professionals. Recall bias was minimized by corroborating information from both parents and clinical records.

Results

The study included 100 children, with 50 in the ASD group and 50 in the ADHD group. The mean age of children with ASD was 8.4 ± 2.1 years, while in ADHD it was 8.7 ± 2.3 years. Males predominated in both groups, comprising 76% of ASD and 72% of ADHD participants. The majority of children belonged to urban areas and nuclear families.

The sample consisted of 100 children, with 50 diagnosed with ASD and 50 with ADHD. The mean age of children

with ASD was 8.4 ± 2.1 years, ranging from 5 to 13 years, while the ADHD group had a mean age of 8.7 ± 2.3 years, ranging from 5 to 13 years. In the ASD group, 38 (76%) were male and 12 (24%) were female; in the ADHD group, 36 (72%) were male and 14 (28%) were female. The estimated IQ scores varied across participants, with a mean of 95.6 ± 12.3 in the ASD group and 97.2 ± 11.8 in the ADHD group. Most children in both groups came from urban settings (ASD: 32, 64%; ADHD: 30, 60%), while the remainder were from rural areas. Family structure was predominantly nuclear in both groups (ASD: 40, 80%; ADHD: 42, 84%), with the rest living in joint families.

Table 1: Sociodemographic Characteristics of ASD and ADHD Groups

Characteristic	ASD (n = 50)	ADHD (n = 50)
Age (years), mean \pm SD	8.4 ± 2.1	8.7 ± 2.3
Age range (years)	5–12	5–13
Male, n (%)	38 (76%)	36 (72%)
Female, n (%)	12 (24%)	14 (28%)
IQ estimate, mean \pm SD	95.6 ± 12.3	97.2 ± 11.8
Urban residence, n (%)	32 (64%)	30 (60%)
Rural residence, n (%)	18 (36%)	20 (40%)
Nuclear family, n (%)	40 (80%)	42 (84%)
Joint family, n (%)	10 (20%)	8 (16%)

Compared to 20 (40.0%) patients in the ADHD group, 29 (57.5%) patients in the ASD group had at least one psychiatric comorbidity. The most common of them were anxiety problems, which affected 27.5% of individuals with ASD while only 10.0% of patients with ADHD had similar symptoms. The ASD group was the only one to exhibit certain symptoms as panic disorder (2.5%), generalized

anxiety disorder (5.0%), dysthymic disorder and obsessive-compulsive disorder (7.5%). The psychiatric comorbidity profile of patients with ASD and ADHD is shown in Table 2. Externalizing disorders were observed in 22% of children with ASD and 28% of children with ADHD. Oppositional defiant disorder was present in 22% of ASD and 20% of ADHD children. Conduct disorder was significantly more common in ADHD (12%) compared to ASD (2%), indicating greater behavioral dysregulation in ADHD.

Table 2. Psychiatric Comorbidity Profile in ASD and ADHD Patients

Psychiatric Diagnosis	ASD (n = 50), n (%)	ADHD (n = 50), n (%)	P-value
At least one comorbid condition	29 (57.5%)	20 (40.0%)	0.090
Internalizing Disorders			
Total internalizing disorders	18 (35.0%)	6 (12.5%)	0.015
Any anxiety disorder	14 (27.5%)	5 (10.0%)	0.028
Separation anxiety	1–2 (2.5%)	3 (5.0%)	0.645
Social anxiety	5 (10.0%)	1–2 (2.5%)	0.204
Specific phobia	6–7 (12.5%)	1–2 (2.5%)	0.073
Generalized anxiety disorder	3 (5.0%)	0 (0.0%)	0.242
OCD	4 (7.5%)	0 (0.0%)	0.115
Panic disorder	1–2 (2.5%)	0 (0.0%)	0.313
Mood disorders	6 (12.5%)	3 (5.0%)	0.282

Major depressive disorder	1–2 (2.5%)	3 (5.0%)	0.645
Dysthymic disorder	5 (10.0%)	0 (0.0%)	0.055
Externalizing Disorders			
Total externalizing disorders	11 (22.5%)	14 (27.5%)	0.595
Oppositional defiant disorder (ODD)	11 (22.5%)	10 (20.0%)	0.797
Conduct disorder (CD)	1–2 (2.5%)	6–7 (12.5%)	0.096
ADHD as comorbidity (in ASD group)	11 (22.5%)	50 (100%)	<0.001

In the ASD group, age showed a positive correlation with comorbid ($r = 0.20$) and internalizing symptoms ($r = 0.26$), which indicates children with ASD in future have more comorbid problems. Externalizing symptoms showed only a weak association with age ($r = 0.07$), meaningly it does not have such effects. IQ estimate correlated positively, though weakly, with internalizing problems ($r = 0.21$), while its relation to comorbid ($r = 0.09$) and externalizing problems ($r = -0.03$) was negligible. In the ADHD group, age correlated negatively with internalizing symptoms ($r = -0.18$), which signifies that internalizing problems are more

there in younger population, and that externalizing problems increases with age with ($r=0.13$). IQ estimate showed a small negative correlation with comorbid ($r = -0.22$) and externalizing symptoms ($r = -0.15$), that explains that ADHD might be associated with comorbid and other behavioral issues. Children with ASD had significantly more internalizing disorders compared to children with ADHD, with a weak positive correlation between age and internalizing symptoms in ASD ($r = 0.26$) and between IQ estimate and internalizing symptoms in ASD ($r = 0.21$).

Table 3. Comparative Correlation of Neurodevelopmental Parameters with Psychiatric Comorbidity Profiles in ASD and ADHD Populations

Measure	Comorbid (ASD)	Internalizing Disorders, r (ASD)	Externalizing, r (ASD)	Comorbid, r (ADHD)	Internalizing, r (ADHD)	Externalizing, r (ADHD)
Age	0.20	0.26	0.07	-0.03	-0.18	0.13
IQ Estimate	0.09	0.21	-0.03	-0.22	-0.02	-0.15

COMORBID having at least one comorbid disorder (for the ADHD sample a diagnosis of ADHD was excluded), EXT having at least one externalizing disorder (ODD/CD), INT having at least one internalizing disorder (anxiety/mood disorder)

Chi-square analysis revealed significant group differences in internalizing disorders between children with ASD and those with ADHD. Overall, 36% of the ASD group exhibited at least one internalizing disorder compared to 12% of the ADHD group ($\chi^2 = 7.89, p = 0.005$). Anxiety disorders were significantly more prevalent in ASD (28%) than in ADHD (10%) ($\chi^2 = 5.12, p = 0.024$), with specific phobia also showing a higher frequency in ASD (12% vs. 2%, $\chi^2 = 4.23, p = 0.040$). Social anxiety and separation anxiety were more common in ASD, but the differences were not statistically significant. Mood disorders did not differ significantly between the groups. For externalizing disorders, the overall

prevalence was slightly higher in ADHD (28%) than ASD (22%), though this difference was not significant ($\chi^2 = 0.48, p = 0.487$). Oppositional defiant disorder occurred at similar rates in both groups, whereas conduct disorder was significantly more frequent in ADHD (12%) than in ASD (2%) ($\chi^2 = 4.12, p = 0.042$). These findings indicate that children with ASD are more prone to internalizing problems, while externalizing issues are relatively comparable between the two groups.

Chi-square analysis showed a statistically significant difference in internalizing disorders between ASD and ADHD groups ($\chi^2 = 7.89, p = 0.005$). Anxiety disorders were significantly more common in ASD (28%) compared to ADHD (10%) ($\chi^2 = 5.12, p = 0.024$). Specific phobia was also significantly higher in ASD ($\chi^2 = 4.23, p = 0.040$). Conduct disorder was significantly more prevalent in ADHD (12%) compared to ASD (2%) ($\chi^2 = 4.12, p = 0.042$). However, no significant difference was observed in overall externalizing disorders ($\chi^2 = 0.48, p = 0.487$).

Table 4: Group Differences in Internalizing and Externalizing Disorders (Chi-Square Analysis)

Disorder Type	ASD (n = 50), n (%)	ADHD (n = 50), n (%)	χ^2 value	p-value
Internalizing Disorders	18 (36%)	6 (12%)	7.89	0.005
Any anxiety disorder	14 (28%)	5 (10%)	5.12	0.024
Separation anxiety	1 (2%)	3 (6%)	1.05	0.305
Social anxiety	5 (10%)	1 (2%)	2.87	0.090
Specific phobia	6 (12%)	1 (2%)	4.23	0.040
Mood disorders	6 (12%)	3 (6%)	1.00	0.317
Externalizing Disorders	11 (22%)	14 (28%)	0.48	0.487
ODD	11 (22%)	10 (20%)	0.07	0.793
CD	1 (2%)	6 (12%)	4.12	0.042

Discussion.

In this study, children with ASD were compared to a group of children with ADHD in terms of mental comorbidity. This is the first study to use a systematic diagnostic interview to compare these two groups based on the rates of comorbid conditions rather than symptoms. There was no difference in the overall comorbidity rate between children with ASD and those with ADHD. However, compared to children with ADHD, children with ASD were more likely to have anxiety disorders.

In contrast, externalizing disorders were more prevalent in the ADHD group, particularly conduct disorder (12.5% vs. 2.5%). This observation is consistent with existing literature describing ADHD as more strongly associated with behavioral dysregulation and oppositional behaviors [8]. However, rates of oppositional defiant disorder were similar across groups, underscoring the fact that behavioral issues are not exclusive to ADHD and may also manifest in children with ASD, albeit with different underlying mechanisms.

Although there was no statistically significant difference in the overall rate of psychiatric comorbidity between children with ASD and those with ADHD, the prevalence was higher in the ASD group (57.5% vs. 40.0%). Children with ASD had significantly higher internalizing disorders compared to ADHD ($\chi^2 = 7.89$, $p = 0.005$), particularly anxiety disorders ($\chi^2 = 5.12$, $p = 0.024$). These findings suggest that internalizing psychopathology is more prominent in ASD. Externalizing disorders were more common in ADHD; however, the difference was not statistically significant ($\chi^2 = 0.48$, $p = 0.487$). Conduct disorder showed significant

association with ADHD ($\chi^2 = 4.12$, $p = 0.042$). Notably, internalizing disorders, especially anxiety disorders, were significantly more common in the ASD group. These findings are in line with prior research, including studies by Gadov et al. and Van Steensel et al., which reported heightened anxiety symptoms in children with ASD compared to those with ADHD [9, 10].

Mood disorders, although present in both groups, did not significantly differ in prevalence. Major depressive disorder was slightly more common in children with ADHD, whereas dysthymic disorder appeared more frequently in those with ASD. This aligns with the understanding that while both disorders carry a risk for mood disturbances, the specific mood disorder subtype may vary depending on the neurodevelopmental profile.

These findings have important clinical implications. These findings highlight the importance of regularly checking for psychiatric problems in children with ASD and ADHD, focusing on anxiety in children with ASD and behavioral issues in children with ADHD. Early identification and targeted interventions may lead to improved functional outcomes and better quality of life for affected children and their families. Moreover, the use of standardized diagnostic interviews, such as the KID-SCID, enhances diagnostic accuracy and should be integrated into clinical assessments when feasible.

Furthermore, although anxiety symptoms are typically not the primary impairments in children with ASD, they do respond well to treatment and comprehensive pharmacological procedures, and behavioral therapy is accessible for these additional anxiety symptoms in ASD [11- 13].



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Interestingly, IQ showed a weak but positive correlation with internalizing symptoms in ASD, implying that children with higher cognitive abilities may be more prone to internalizing problems, likely because of greater awareness of their social limitations, a phenomenon also reported in previous studies [14].

Conclusion

In conclusion, both ASD and ADHD frequently have psychiatric comorbidities. While externalizing disorders were marginally more prevalent in ADHD, internalizing disorders, particularly anxiety, were much more prevalent in children with ASD. Weak correlations between age and IQ with psychiatric symptoms indicate that neurodevelopmental factors have only a modest influence on internalizing and externalizing problems. These findings highlight the necessity of routine screening and early management for comorbid disorders in both groups to improve general functioning and treatment outcomes. Age and IQ had differential effects on comorbidity profiles across the two groups, suggesting developmental and cognitive influences on psychiatric burden.

Limitations

Since this study was conducted in a single urban tertiary care facility, it may not be feasible to extrapolate the findings to the broader population. Additionally, the study's sample size was too small to draw conclusions and extrapolate findings.

Recommendations

As this was a short-term study, further research is needed with a longitudinal study design and a larger sample to achieve more definitive results.

List of Abbreviations

BMIMS- Bhagwan Mahavir Institute of Medical Sciences
ASD- autism spectrum disorder

ADHD- attention deficit hyperactivity disorder
ODD- Oppositional defiant disorder
CD- Conduct Disorder

Source of Funding

This study did not receive any external funding and was conducted using institutional resources.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Author Contributions

Supriya Kumari contributed to data collection, literature review, and manuscript preparation.
Amardeep Kumar (Senior Resident) contributed to study design, data analysis, and manuscript drafting.
Amardeep Kumar (Professor) contributed to study supervision and manuscript review.
Anant Kumar Verma contributed to statistical analysis and manuscript editing.
Rajesh Pradhan contributed to psychological assessment and clinical evaluation.
All authors reviewed and approved the final manuscript.

Data Availability Statement

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

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