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Original Research Article

Comorbidity patterns in children aged 6-12 years diagnosed with ADHD in South Kerala: a cross-sectional study

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ABSTRACT

Background: Attention deficit hyperactivity disorder (ADHD) is a common neurodevelopmental disorder of childhood, frequently associated with psychiatric, behavioural, sleep, and learning comorbidities which contribute significantly to functional impairment and complicate management. This study aimed to assess the prevalence of comorbid conditions among children aged 6-9 years diagnosed with ADHD.
Methods: A cross-sectional study was conducted among 206 children diagnosed with ADHD using the AIIMS-modified INDT ADHD tool. ADHD subtypes were identified using the Vanderbilt assessment scale-parent informant questionnaire. Sleep problems were assessed using the children's sleep health questionnaire, epilepsy using the INDT-EPI tool, and specific learning disability using NIMHANS SLD battery. Psychiatric comorbidities were diagnosed based on DSM-5 criteria. Data were analysed using SPSS version 26.
Results: The mean age was 7.1±1.0 years, with males constituting 85.4% of participants. The combined ADHD subtype was most prevalent (66.5%), followed by the inattentive (26.2%) and hyperactive/impulsive (7.3%) subtypes. Oppositional defiant disorder was the most common comorbidity (24.8%), followed by specific learning disability (10%), sleep disorders (7.8%) and conduct disorder (7.3%). Academic difficulties were reported in 78% of children. A significant association was observed between ADHD subtypes and both oppositional defiant disorder ($p<0.001$) and conduct disorder ($p<0.05$), predominantly in the combined subtype.
Conclusions: Children with ADHD, especially the combined subtype, have a high burden of disruptive behaviour and academic comorbidities, underscoring the need for early comprehensive assessment and integrated interventions.

Keywords: ADHD, Children, Comorbidity, Kerala, Oppositional defiant disorder

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is a multifaceted neurodevelopmental disorder that affects individuals throughout the lifespan and is characterized by widespread heterogeneity in its underlying causes, clinical presentations, and responses to treatment.[1,2] ADHD is primarily characterized by persistent and developmentally inappropriate levels of inattention, hyperactivity, and impulsivity, arising from widespread and subtle alterations in gene expression across multiple brain regions that influence overall brain function.[3] ADHD is most frequently diagnosed during the school years, although it can occur across all age groups. Growing evidence indicates that ADHD is a major contributor to the global burden of neurodevelopmental conditions among children and adolescents.[4] An umbrella review of meta-analyses has reported considerable variability in the estimated prevalence of ADHD across studies ranging from 5.9 to 14%.[5] Despite this heterogeneity, the global prevalence of ADHD among children and adolescents was estimated to be approximately 8.0% (95% CI: 6.0-10.0%).[5]

The prevalence of ADHD among children in India is consistent with the worldwide prevalence with some

exceptions. In India, the reported point prevalence of ADHD among children and adolescents also shows wide variation, ranging from 1.3% to 28.9% across studies.[6] The pooled prevalence has been estimated at 7.1% (95% CI: 5.1-9.8%), which is broadly comparable to global estimates. Sex-specific analyses indicate a higher prevalence among males (9.4%; 95% CI: 6.5-13.3%) than females (5.2%; 95% CI: 3.4-7.7%), with substantial heterogeneity observed across studies.[6] This heterogeneity is often attributed to the presence of other childhood-onset conditions.[7] Research suggests that approximately 60-100% of children diagnosed with ADHD also meet criteria for at least one comorbid disorder, many of which persist into adulthood.[7,8] Comorbidities associated with ADHD encompass a broad range of psychiatric, developmental, and neurological conditions, including oppositional defiant disorder, conduct disorder, anxiety and depressive disorders, learning disabilities, tic disorder, sleep disorders, and epilepsy, and is frequently associated with poor academic performance.[7-9] The presence of these comorbidities along with increasing the clinical heterogeneity of ADHD; also contributes to greater functional impairment, variability in symptom severity, and challenges in treatment and long-term outcomes.[7-9]

ADHD frequently co-occurs with oppositional defiant disorder and conduct disorder, with comorbidity rates ranging from 30% to 50% in both epidemiological and clinical populations.[10] Oppositional defiant disorder involves persistent patterns of negativistic, hostile, and defiant behaviour, whereas conduct disorder represents a more severe condition marked by chronic rule-breaking behaviours such as aggression, property destruction, deceitfulness, theft, and truancy.[11] Both disorders typically emerge before puberty, highlighting the importance of early identification and intervention to reduce the risk of long-term impairment, social dysfunction, and delinquent outcomes.[10,11] Anxiety disorders commonly co-occur with ADHD, with approximately 25% of children with ADHD meeting criteria for one or more anxiety disorders in both epidemiological and clinical samples.[12] This comorbidity is associated with greater psychosocial impairment, increased academic and behavioural difficulties, higher rates of additional psychopathology, and poorer long-term outcomes compared to ADHD alone.[12] Children with ADHD were also reported to have poorer cognitive and academic performance compared to their peers, including lower academic achievement, increased grade repetition, and greater need for special educational support.[11,13] An estimated 25% to 50% of people with ADHD also experience sleep problems, including insomnia, frequent awakenings, delayed bedtimes, and a higher risk of developing sleep disorders which often begin in childhood and may worsen with age.[14] Sleep issues can further worsen core ADHD symptoms like focus, attention, and emotional regulation.[14]

ADHD being a clinically heterogeneous condition, often complicated by a range of comorbidities; screening for these comorbid conditions is essential to ensure appropriate management of children presenting with complex difficulties. Understanding the patterns and impact of comorbidity in ADHD is therefore critical for early identification, targeted intervention, and improving the overall prognosis of affected children. Our study therefore aimed to assess the comorbidities associated with children diagnosed with ADHD aged 6-9 years.

METHODS

The study adopted a cross-sectional design and was conducted at the child development centre (CDC); a tertiary care institution providing diagnostic and therapeutic service for children with neurodevelopmental disorders in south Kerala from June to December 2023.

The sample size was determined using Open Epi version 3.1, based on a previously reported prevalence of 31% ODD among children with ADHD from an earlier study.[15] Using a 95% confidence level and an absolute precision of 6%, the required sample size was calculated to be 205 participants.

Children aged 6-9 years attending CDC clinics with a primary diagnosis of ADHD using INCLEN diagnostic tool for attention deficit hyperactivity disorder AIIMS modified (AIIMS-modified INDT ADHD tool) were consecutively included in the study.[16] Children with audio-visual impairment, with IQ<85 and autism spectrum disorders were excluded from the study. Demographic details of the participants and developmental characteristics were assessed using a structured questionnaire. Children with the primary diagnosis of ADHD were administered Vanderbilt assessment scale-parent informant questionnaire to find out the type of ADHD (predominantly inattentive subtype, predominantly hyperactive/impulsive subtype or ADHD combined inattention/hyperactivity).[17] Children's sleep health questionnaire (CSHQ) was used to identify sleep problems.[18] Epilepsy was diagnosed with the help of INDT-EPI tool.[19] Psychopathological comorbidities like depressive disorder, anxiety disorder, Tic disorder, conduct disorder, and oppositional defiant disorder were diagnosed using diagnostic and statistical manual of mental disorders (DSM 5) criteria.[1] LD was assessed using The National Institute for Mental Health and Neurosciences index for Specific Learning Disabilities (NIMHANS SLD Battery).[20]

Statistical analysis

Data were analysed using statistical software IBN SPSS version 26. Descriptive statistics were used to summarize demographic variables. The association between ADHD subtypes and comorbid conditions was examined using Chi-square tests of independence.

Ethical considerations

This study adhered to the ethical principles set forth in the Declaration of Helsinki. Ethical clearance was obtained from the institutional ethics committee before commencement of the study. parental written informed consent and participant verbal assent were obtained from all study participants.

RESULTS

The mean age of study participants was 7.1±1.0 years. The study included 206 participants, more than half were aged 6-7 years (65.5%) and predominantly males (85.4%). About 62.6% were living in rural areas and 40.3% belonged to nuclear families. Regarding birth and developmental history, 80.6% were full-term births, and 77.7% had normal developmental milestones. Most participants had normal vision (80.1%) and hearing (99.0%). The sociodemographic details of study participants are depicted in Table 1.

Among the 206 participants, the most common ADHD subtype was the combined inattention/hyperactive type, observed in 137 children (66.5%). Predominantly inattentive subtype was reported in 54 participants (26.2%), while the predominantly hyperactive/impulsive subtype was the least frequent, occurring in 15 participants (7.3%) (Table 2).

Table 1: Sociodemographic and developmental characteristics of study participants (n=206).

Variables	N (%)
Age (in years)	
6.0	59 (28.6)
7.0	76 (36.9)
8.0	42 (20.4)
9.0	29 (14.1)
Gender	
Male	176 (85.4)
Female	30 (14.6)
Mother's education	
High school	23 (11.16)
Higher secondary	65 (31.6)
Graduate and above	118 (57.2)
Father's Education	
High school	69 (33.4)
Higher secondary	52 (25.2)
Graduate and above	85 (41.3)
Mother's occupation	
Unemployed	132 (64.1)
Employed	74 (35.9)
Father's occupation	
Unemployed	7 (3.4)
Employed	199 (96.6)
Socio-economic status	
Upper	11 (5.3)
Upper middle	40 (19.4
Lower middle	71 (34.5)
Upper lower	84 (40.8)
Religion	
Hindu	131 (63.6)
Muslim	53 (25.7)
Christian	20 (9.7)
Others	2 (1.0)
Type of family	
Nuclear	83 (40.3)
Joint	77 (37.4)
Extended	46 (22.3)

Continued.

Variables	N (%)
Place of residence	
Rural	129 (62.6)
Urban	77 (37.4)
Type of school	
Government	94 (45.63)
Private	112 (54.4)
Birth history	
Premature birth	40 (19.4)
Full term birth	166 (80.6)
Developmental history	
Normal	160 (77.7)
Delayed	46 (22.3)
Vision	
Normal	165 (80.1)
Impaired	41 (19.9)
Hearing	
Normal	204 (99.0)
Impaired	2 (1.0)

Table 2: ADHD subtypes-Vanderbilt assessment interpretation (n=206).

Type of ADHD	N (%)
Predominantly inattentive	54 (26.2)
Predominantly hyperactive/impulsive	15 (7.3)
ADHD combined inattention/ hyperactive	137 (66.5)

Table 3: Comorbidities among ADHD children (n=206).

Type of comorbidities	N (%)
Oppositional defiant disorder (ODD)	51 (24.8)
Conduct disorder (CD)	15 (7.3)
Sleep disorder	16 (7.8)
Bed time resistance	14 (6.8)
Sleep duration	7 (3.4)
Night walking	5 (2.4)
Sleep onset delay	8 (3.9)
Sleep anxiety	10 (4.9)
Parasomnias	11 (5.3)
Sleep Disordered breathing	5 (2.4)
Daytime sleepiness	12 (5.8)
Epilepsy	3 (1.5)
Specific learning disability (SLD)	21 (10.1)
Dysgraphia	5 (2.4)
Learning difficulty	6 (2.9)
Mixed	10 (4.9)
Problems in studies	161 (78.1)
Poor academic performance	105 (51.0)
Poor memory	26 (12.6)
Poor concentration	114 (55.3)
Poor reading skill	115 (55.8)

In the present study, oppositional defiant disorder (ODD) was the most common comorbidity, observed in 51 participants (24.8%) followed by conduct disorder (CD) in 15 participants (7.3%). Sleep-related comorbidities were identified, with clinically significant sleep disorders present in 16 participants (7.8%). Specific sleep problems included bedtime resistance in 14 (6.8%), sleep duration issues in 7 (3.4%), night walking in 5 (2.4%), sleep onset delay in 8 (3.9%), sleep anxiety in 10 (4.9%), parasomnias in 11 (5.3%), sleep-disordered breathing in 5 (2.4%), and daytime sleepiness in 12 (5.8%). Epilepsy was reported in 3 participants (1.5%). Specific learning disability (SLD) was present in 21 participants (10.1%), with dysgraphia in 5 (2.4%), learning difficulty in 6 (2.9%), and mixed learning problems in 10 (4.9%). Academic-related difficulties were highly prevalent, with problems in studies reported by 161 participants (78.1%). Poor academic performance was reported by 105 (51.0%), poor memory by 26 (12.6%), poor concentration by 114 (55.3%), and poor reading skills by 115 (55.8%) of children. However, other known comorbidities including depressive disorder, anxiety disorder and tic disorder were not found in the study sample (Table 3).

Association between ADHD subtypes and comorbid conditions

A statistically significant association was observed between ADHD subtypes and oppositional defiant disorder (ODD) ($\chi^2(2) = 20.35$, $p<0.001$), with the highest prevalence noted in the combined ADHD subtype (45.3%), followed by the hyperactive-impulsive (26.7%) and inattentive subtypes (11.1%). A significant association was also found between ADHD subtype and conduct disorder (CD) ($\chi^2(2) = 8.99$, $p=0.01$). CD was most frequently observed in children with the combined ADHD subtype (19.7%), while no cases were identified

in the hyperactive-impulsive subtype. No statistically significant associations were observed between ADHD subtypes and other comorbid conditions.

DISCUSSION

The present study provides a comprehensive overview of the ADHD subtypes and associated comorbidities in children aged 6-9 years. The combined subtype predominated in the study group, with inattentive presentations also common while hyperactive/impulsive forms were less frequent. Comorbidities were prevalent, particularly disruptive behaviour disorders, with half of the children with oppositional defiant disorder. Conduct disorder was also found along with frequent sleep-related and academic difficulties. Specific learning disabilities were present in nearly one fourth of the children while epilepsy was rare. Anxiety-depressive and tic disorders were not observed. Overall, the findings highlight the clinical heterogeneity of ADHD and the importance of comprehensive assessment in this population.

Regarding ADHD subtypes, the combined inattentive and hyperactive/impulsive subtype was the most prevalent (66.5%), followed by the predominantly inattentive subtype (26.2%). This finding is consistent with previous studies reporting the combined subtype as the most common presentation in clinical samples. Clinical studies have also reported that the combined type is the most prevalent presentation, followed by the inattentive type, with the hyperactive/impulsive type being the least common.[21,22] The relatively lower prevalence of the predominantly hyperactive/impulsive subtype (7.3%) in children aged 6-9 years may be because hyperactive symptoms at this age often occur together with inattentive symptoms, leading to a higher proportion of combined presentations.

Comorbid conditions observed in our study underscores the clinical complexity of ADHD. Oppositional defiant disorder (ODD) emerged as the most common comorbidity (24.8%), followed by conduct disorder (7.3%). The significant association between ADHD subtypes and ODD, with the highest prevalence seen in the combined subtype, suggests that children exhibiting both inattentive and hyperactive-impulsive symptoms are at greater risk for oppositional behaviours. Similarly, the significant association between ADHD subtype and conduct disorder, predominantly affecting the combined subtype, highlights the need for early identification and targeted behavioural interventions in this group. Numerous studies have reported comorbidities, overlapping symptoms, and shared risk factors among cases of ADHD, oppositional defiant disorder and conduct disorder both in clinical and epidemiological samples.[23] Twin and family studies indicate strong genetic contributions to ADHD and shared familial aetiology with ODD and CD, with particularly strong genetic links between hyperactive–impulsive ADHD and both ODD and CD.[24] Prior findings demonstrate that combined and hyperactive ADHD subtypes present with behavioural problems supporting emotional dysregulation as a core component of ADHD with comorbid disruptive behaviour disorders.[25,26]

Sleep-related problems were identified in a considerable proportion of participants, with bedtime resistance, parasomnias, sleep anxiety, and daytime sleepiness being commonly reported. Sleep disturbances in children with ADHD have been widely documented and may exacerbate core ADHD symptoms, impair emotional regulation, and negatively affect academic performance.[27] Although sleep disorders were prevalent, no significant association with ADHD subtypes was observed, suggesting that sleep problems may be a common pervasive issue in ADHD irrespective of subtype.

Specific learning disabilities were found in our study with mixed learning difficulties being the most frequent. Additionally, academic difficulties were found in more than three fourth of the study participants including problems in studies poor concentration, poor reading skills, and poor academic performance. Overall, there is an estimated comorbidity rate of 31 to 45% between SLD and ADHD in previous studies.[27] These findings reinforce the strong relationship between ADHD and academic underachievement and emphasize the need for comprehensive educational assessment and individualized academic support. Epilepsy was identified in a small proportion of children consistent with previous studies reporting a modest but notable association between ADHD and seizure disorders.[28] While no subtype-specific association was found, the coexistence of epilepsy further complicates clinical management and necessitates a multidisciplinary approach. However, other known comorbidities including depressive disorder, anxiety disorder and tic disorder were not found in the study sample.

The relative absence of certain psychiatric comorbidities observed in the present study may be partly attributable to the age range of the study population. Several comorbid conditions, particularly internalizing disorders such as anxiety and depression, tend to emerge or become more clinically evident at later developmental stages. As assessments in this study were conducted during an early phase of childhood, some conditions may not yet have fully manifested or may have been less readily detectable, potentially leading to an underestimation of their prevalence compared with reports from studies including older children and adolescents. However, the study provides valuable insight into the early clinical profile of psychiatric comorbidities in young children with ADHD, underscoring the importance of early identification and assessment.

CONCLUSION

Overall, the findings of this study highlight the high burden of comorbidities, particularly disruptive behaviour

disorders and academic difficulties, among children with ADHD, especially those with the combined subtype. Early screening for comorbid conditions, along with integrated behavioural, educational, and family-based interventions, is essential to improve long-term outcomes in this population.

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REFERENCES

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Washington (DC): American Psychiatric Publishing; 2013.
2. Ayano G, Yohannes K, Abraha M. Epidemiology of attention-deficit/hyperactivity disorder (ADHD) in children and adolescents in Africa: a systematic review and meta-analysis. Ann Gen Psychiatr. 2020;19:21.
3. Berger I. Diagnosis of attention deficit hyperactivity disorder: much ado about something. Isr Med Assoc J. 2011;13(9):571.
4. Doshi JA, Hodgkins P, Kahle J, Sikirica V, Cangelosi MJ, Setyawan J, et al. Economic impact of childhood and adult attention-deficit/hyperactivity disorder in the United States. J Am Acad Child Adolesc Psychiatr. 2012;51(10):990-1002.e2.
5. Ayano G, Demelash S, Gizachew Y, Tsegay L, Alati R. Global prevalence of attention deficit hyperactivity disorder in children and adolescents: an umbrella review of meta-analyses. J Affect Disord. 2023;339:860-6.
6. Joseph JK, Devu BK. Prevalence of attention-deficit hyperactivity disorder in India: a systematic review and meta-analysis. Indian J Psychiatr Nurs. 2019;16(2):118-25.
7. Gillberg C, Gillberg IC, Rasmussen P, Kadesjö B, Söderström H, Råstam M, et al. Co-existing disorders in ADHD- implications for diagnosis and intervention. Eur Child Adolesc Psychiatr. 2004;13(Suppl 1):I80-92.
8. Biederman J, Faraone SV, Spencer T, Wilens T, Norman D, Lapey KA, et al. Patterns of psychiatric comorbidity, cognition, and psychosocial functioning in adults with attention deficit hyperactivity disorder. Am J Psychiatr. 1993;150:1792-8.
9. Gnanavel S, Sharma P, Kaushal P, Hussain S. Attention deficit hyperactivity disorder and comorbidity: a review of literature. World J Clin Cases. 2019;7(17):2420-6.
10. Biederman J, Newcorn J, Sprich S. Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety, and other disorders. Am J Psychiatr. 1991;148:564-77.
11. Spencer TJ. ADHD and comorbidity in childhood. J Clin Psychiatr. 2006;67(Suppl 8):27.
12. Xenakis SN, Richters J. Anxiety and depressive disorders in attention deficit disorder with hyperactivity: new findings. Am J Psychiatr. 1993;150(8):1203-9.
13. Faraone SV, Biederman J, Lehman BK, Spencer T, Norman D, Seidman LJ, et al. Intellectual performance and school failure in children with attention deficit hyperactivity disorder and in their siblings. J Abnorm Psychol. 1993;102(4):616.
14. Wajszilber D, Santiseban JA, Gruber R. Sleep disorders in patients with ADHD: impact and management challenges. Nat Sci Sleep. 2018;10:453-80.
15. Sahar SA, Seleem MAEH, Badawy AAEK, Eissa MAER. Psychiatric comorbidities among children with attention deficit hyperactivity disorders. J Adv Med Med Res. 2020;32(23):85-96.
16. Gulati S, Saini L, Kaushik JS, Chakrabarty B, Arora NK, Pandey RM, et al. Development and validation of DSM-5 based AIIMS-modified INDT ADHD tool. Neurol India. 2020;68:352-7.
17. Wolraich ML, Lambert W, Doffing MA, Bickman L, Simmons T, Worley K. Psychometric properties of the Vanderbilt ADHD diagnostic parent rating scale in a referred population. J Pediatr Psychol. 2003;28(8):559-68.
18. Owens JA, Spirito A, McGuinn M. The Children's Sleep Habits Questionnaire. Sleep. 2000;23(8):1043-51.
19. Konanki R, Mishra D, Gulati S, Aneja S, Deshmukh V, Silberberg D, et al. INCLEN diagnostic tool for epilepsy (INDT-EPI). Indian Pediatr. 2014;51(7):539-43.
20. Hirisave U, Oommen A, Kapur M. Psychological assessment of children in the clinical setting. Bengaluru: NIMHANS; 2002.
21. Magnus W, Anilkumar AC, Shaban K. Attention deficit hyperactivity disorder. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2025.
22. Willcutt EG, Nigg JT, Pennington BF, Solanto MV, Rohde LA, Tannock R, et al. Validity of DSM-IV ADHD symptom dimensions and subtypes. J Abnorm Psychol. 2012;121(4):991-1010.
23. Qian QJ, Liu J, Wang YF, Yang L, Guan LL, Faraone SV. ADHD with comorbid ODD and inattentive type. Behav Brain Funct. 2009;5:8.
24. Ghosh S, Sinha M. ADHD, ODD, and CD: a common psychopathological spectrum? Case Rep Psychiatr. 2012;2012:520689.
25. Burt SA, Krueger RF, McGue M, Iacono WG. Sources of covariation among ADHD, ODD, and CD. J Abnorm Psychol. 2001;110(4):516-25.
26. Cassoff J, Wiebe ST, Gruber R. Sleep patterns and risk for ADHD. Nat Sci Sleep. 2012;4:73-80.
27. Pham AV, Riviere A. Specific learning disorders and ADHD. Curr Psychiatr Rep. 2015;17(6):38.

28. Reilly CJ. Attention deficit hyperactivity disorder in childhood epilepsy. Res Dev Disabil. 2011;32(3):883-93.

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