


Research Article

Comparative Analysis of Executive Function Deficits in Autism and ADHD

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Abstract

Background: Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) are neurodevelopmental diseases linked to deficiencies in executive function (EF). Although both conditions share overlapping cognitive impairments, the nature and severity of these deficits differ and remain underexplored in low- and middle-income regions.

Methods: This cross-sectional study was performed from July 2024 to July 2025 at BMIMS, Pawapuri, Nalanda, Bihar. A total of 110 children (6–16 years) diagnosed with ASD (n = 55) or ADHD (n = 55) were recruited. Standardized tools were used to evaluate cognitive flexibility, working memory, planning, inhibitory control, and emotions. Independent t-tests, and chi-square tests were used to evaluate the data.

Results: Both groups exhibited high prevalence of EF deficits (ASD: 69.1%, ADHD: 76.4%). Children with ADHD had significantly greater impairments in working memory (71.8 ± 12.1) and inhibitory control (74.1 ± 10.8), whereas children with ASD demonstrated more pronounced deficits in cognitive flexibility (68.4 ± 11.7) and planning (66.1 ± 12.4). Emotional control challenges were common in both groups, affecting over 50% of participants.

Conclusion: EF deficits are prominent in both ASD and ADHD but follow distinct patterns. Early recognition and tailored interventions targeting the dominant domains in each disorder may improve functional outcomes and quality of life.

Keywords: Autism; ADHD; Cognitive regulation; Memory processing; Mental flexibility; Response inhibition.

Introduction

Among the most common neurodevelopmental diseases affecting children and adolescents are ADHD and ASD, which frequently cause severe deficits in social, academic, and behavioral functioning [1, 2]. Around 1% to 2% of children worldwide have been identified to have ASD, whereas 5-7 percent of children have ADHD [3]. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) classifies both disorders as distinct entities, but they share overlapping clinical features, such as difficulties with attention, socializing, and adaptive behavior, which makes diagnosis difficult and comorbidity common [4, 5].

Higher-order cognitive functions are required for goal-directed activity, including retention of information, flexibility of thought, strategic thinking, inhibitory control, and decision-making, are included in executive function (EF) [6]. Deficits in EF are well-established in ADHD, where they are closely linked with symptoms of impulsivity, inattention, and hyperactivity [7]. In

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contrast, EF impairments in ASD are often characterized by difficulties in cognitive flexibility, planning, and adaptive problem-solving, contributing to restricted interests, repetitive behaviors, and social communication challenges [8, 9]. Although both disorders demonstrate EF dysfunction, their profiles differ in severity and domain-specific impairments, reflecting underlying variations in neurocircuitry [10].

Comparative investigations of executive function (EF) difficulties in ASD and ADHD are essential for enhancing diagnostic accuracy and designing individualized interventions. Nevertheless, much of the current evidence is derived from high-income nations, while information from low- and middle-income settings such as India remains limited. Early detection of these deficits can guide focused cognitive rehabilitation, tailored educational approaches, and behavior management strategies adapted to the neurocognitive needs of each disorder. The present study was conducted to analyze and compare executive processing challenges in children with these neurodevelopmental diseases over a 12-month period in a tertiary care institution in Bihar, India, thereby contributing to a broader understanding of their cognitive profiles.

Materials and Methods

The duration of this study was for a period of 12 months, from July 2024 to July 2025, in the Department of Psychiatry, BMIMS, Pawapuri, Nalanda, Bihar. The aim of this research was to examine difficulties related to executive functioning among children diagnosed with ADHD and ASD. Approximately 110 participants of 6 and 16 years age, were recruited from both outpatient and inpatient services of the department during the study period. Diagnosis of ASD and ADHD was established by qualified psychiatrists using standard diagnostic criteria. Parental or guardian approval was obtained prior to enrolling the participants in the study. Children with severe intellectual disability (intelligence quotient below 70), major neurological conditions, history of significant head trauma, or ongoing use of medications that could interfere with cognitive functioning were excluded to maintain the homogeneity of the sample. Demographic details including age, gender, socioeconomic background, and clinical characteristics such as duration of illness and comorbidities were recorded in a structured data sheet. Executive function was assessed using standardized neuropsychological tools, namely the Behavior Rating Inventory of Executive Function (BRIEF) and Wisconsin Card Sorting Test (WCST), administered by trained psychologists under controlled and distraction-free testing conditions to ensure reliability. Based on their primary diagnosis, participants were categorized into two groups: ASD and ADHD, with nearly equal representation in each group. Data analysis was performed using SPSS (version 25.0). For categorical data, numbers and proportions

were calculated, while continuous variables were described using averages with their standard deviations. Comparisons of executive function scores between the two groups were analyzed through independent t-tests and chi-square analyses, considering p-values below 0.05 as statistically meaningful.

Results

This study included 110 children in total, 55 of whom had ASD and 55 of whom had ADHD. Of the participants, 72.7% were male, and the mean age was 10.8 ± 2.4 years. The majority (60.9%) lived in cities and went to regular schools. The symptoms persisted for an average of 2.2 ± 1.1 years. An overview of the participants' clinical and demographic characteristics is given in Table 1. Age, gender, place of residence, and attendance at school did not significantly differ between the two groups.

Table 1: Demographic and Clinical Profile of Participants (n = 110)

Variable	ASD (n = 55)	ADHD (n = 55)	Total (n = 110)
Mean Age (years)	10.6 ± 2.5	11.0 ± 2.3	10.8 ± 2.4
Male (%)	41 (74.5%)	39 (70.9%)	80 (72.7%)
Urban Residence (%)	32 (58.2%)	35 (63.6%)	67 (60.9%)
Mean Duration of Symptoms (years)	2.3 ± 1.1	2.1 ± 1.0	2.2 ± 1.1
School-going (%)	49 (89.1%)	51 (92.7%)	100 (90.9%)

The executive function (EF) scores varied notably between the two groups. Participants with ASD demonstrated greater challenges in cognitive flexibility and planning, whereas those with ADHD exhibited more pronounced deficits in working memory and inhibitory control. Table 2 presents the mean EF domain scores for both groups.

Table 2: Executive Function Domain Scores (Mean ± SD)

Executive Function Domain	ASD (n = 55)	ADHD (n = 55)	p-value
Working Memory	62.3 ± 10.5	71.8 ± 12.1	<0.01
Cognitive Flexibility	68.4 ± 11.7	60.5 ± 9.8	<0.01
Planning & Organization	66.1 ± 12.4	63.2 ± 11.0	0.12
Inhibition Control	61.8 ± 9.6	74.1 ± 10.8	<0.001
Emotional Control	65.7 ± 10.2	67.9 ± 11.5	0.18

The overall prevalence of executive function impairment (defined as scores exceeding 1.5 SD above normative values) was higher in the ADHD group (76.4%) compared to the ASD group (69.1%). Table 3 displays the frequency of EF impairment in both groups.

Table 3: Frequency of Executive Function Impairment by Group

Impairment Status	ASD (n = 55)	ADHD (n = 55)	Total (n = 110)
Present	38 (69.1%)	42 (76.4%)	80 (72.7%)
Absent	17 (30.9%)	13 (23.6%)	30 (27.3%)

Domain-wise analysis showed that working memory and inhibitory control deficits were significantly more frequent in ADHD, while cognitive flexibility deficits were more prominent in ASD. Planning and organization impairments were common in both groups but not statistically different. Table 4 outlines the domain-wise severe dysfunction patterns.

Table 4: Distribution of Domain-wise Severe Executive Dysfunction

Domain	ASD Severe (%)	ADHD Severe (%)	Total Severe (%)
Working Memory	24 (43.6%)	33 (60.0%)	57 (51.8%)
Cognitive Flexibility	31 (56.4%)	22 (40.0%)	53 (48.2%)
Planning & Organization	26 (47.3%)	24 (43.6%)	50 (45.5%)
Inhibition Control	21 (38.2%)	35 (63.6%)	56 (50.9%)
Emotional Control	29 (52.7%)	31 (56.4%)	60 (54.5%)

These findings suggest that while both groups exhibit significant executive dysfunction, the nature of deficits differs, with ADHD being more strongly associated with working memory and inhibition impairments, and ASD with cognitive flexibility and planning deficits.

Discussion

This study offers an in-depth examination of executive function (EF) impairments in children diagnosed with ASD and ADHD over a 12-month period at a tertiary care center in Bihar, India. Findings indicated that while both groups exhibited notable executive dysfunction, the type and intensity of these difficulties varied across distinct cognitive domains. Specifically, ADHD was more strongly linked to deficits in working memory and inhibitory control, whereas ASD was mainly associated with challenges in cognitive flexibility and planning. These observations reinforce the growing evidence that EF impairment is a fundamental neurocognitive characteristic of both conditions, though its presentation differs depending on the underlying neural circuit disruptions [14].

Working memory impairment was significantly higher in the ADHD group, with nearly 60% of participants demonstrating severe deficits compared to 43.6% in the ASD group. Working memory plays a critical role in sustaining attention, organizing tasks, and regulating behavior, and its dysfunction in ADHD has been widely documented

[15]. Inhibition control deficits were also more severe in ADHD, consistent with models that attribute hyperactivity and impulsive behavior to deficits in response suppression and inhibitory regulation [16]. These findings reinforce the notion that fronto-striatal circuit dysregulation is a principal contributor to the cognitive deficits observed in ADHD and highlight the need for interventions that enhance inhibitory control and working memory capacities in this population.

Conversely, children with ASD in our study showed higher levels of cognitive flexibility impairment, with 56.4% exhibiting severe deficits in shifting and adapting to new tasks. Cognitive flexibility is closely linked to the ability to transition between activities, modify behavior according to context, and engage in social reciprocity. Its impairment may underline the repetitive and restricted behaviors frequently observed in ASD [17]. Planning and organizational difficulties were found in both groups without significant differences, suggesting that certain EF deficits may represent shared neurodevelopmental vulnerabilities rather than disorder-specific traits [18]. Furthermore, emotional control impairments were present in over half of both groups, indicating that emotional dysregulation is a transdiagnostic challenge that can exacerbate behavioral symptoms and hinder social adaptation [19].

The implications of these findings are clinically significant. Early identification of EF deficits allows for tailored interventions addressing the dominant cognitive challenges of each disorder. For ADHD, evidence supports the utility of targeted cognitive training programs focusing on working memory and inhibitory control, as well as behavioral parent training to reinforce adaptive behavior [20]. For ASD, structured teaching methods and executive function coaching aimed at enhancing cognitive flexibility and planning abilities may improve daily functioning and reduce behavioral rigidity [9]. Moreover, these findings highlight the need for region-specific screening protocols in India, where resources for neuropsychological assessment are limited, and comorbid presentations often delay early intervention. Longitudinal studies could further clarify the developmental trajectory of these deficits and their response to therapeutic interventions, enabling more precise and individualized care pathways.

Conclusion

ADHD and ASD both affect children's cognitive abilities, but the types and severity of these problems are different for each disorder. Children with ASD experience greater challenges in cognitive flexibility and planning, but those with ADHD generally demonstrate more significant impairments in working memory and inhibitory control. Despite these differences, both groups also struggle with emotional regulation, reflecting the shared influence of executive dysfunction on behavioral and emotional processes. These observations highlight the critical importance of early

evaluation of executive functioning in neurodevelopmental disorders, as such assessments can offer valuable insight into the distinct cognitive challenges faced by each group. Interventions tailored to the dominant executive domains impaired in ADHD or ASD could enhance therapeutic outcomes, improve learning performance, and support social integration. Additionally, this study emphasizes the importance of region-specific screening strategies and structured cognitive rehabilitation approaches to effectively manage these difficulties from an early stage.

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