CHARACTERISTICS OF HABITS AND BEHAVIORS RELATED TO SLEEP IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER

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Inappropriate sleep habits and behaviors are very common in children with attention deficit hyperactivity disorder (ADHD), often related to sleep disorders. A cross-sectional descriptive study was conducted on 277 children aged 6 to 12 years old, at the Vietnam National Children's Hospital from October 2022 to September 2023; we analyze the characteristics of inappropriate sleep-related habits and behaviors in those children who were diagnosed with ADHD. The results indicated that common sleep-related habits and behaviors in children with ADHD included bedtime resistance, difficulty initiating sleep (pre-sleep), difficulty maintaining sleep (during-sleep), and tiredness when waking up (post-sleep). Loud snore , enuresis, and tiredness when waking up in the morning are common in the inattentive subtype, while bedtime resistance, difficulty initiating sleep, and screen exposure time of more than 2 hours are common in the combined subtype. Inappropriate sleeping habits and behaviors are significantly more common in ADHD comorbidities.

Keywords: Habits, behavior, sleep, children, attention deficit hyperactivity disorder.

I. INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders in children, characterized by two core symptom clusters: inattention and/or hyperactivity/impulsivity.[1] The global prevalence of ADHD in children is estimated to be between 5 - 7%.[2,3] This rate is consistent with studies conducted on Vietnamese elementary school children (5.1 – 9.3%).[4,5] ADHD is classified into three clinical subtypes: predominantly inattentive, predominantly hyperactive-impulsive, and combined. The disorder negatively impacts emotional regulation and behavior, seriously affecting social relationships, educational function, and vocational performance.[6]

Children with ADHD frequently experience additional mental health disorders, known as ADHD comorbidities. Estimates indicate that approximately 59-87% of children with ADHD have at least one comorbid disorder, with sleep disorders being the most prevalent, affecting 50-80% of these children.[7] Parental interviews using a sleep questionnaire indicate that children with ADHD frequently experience problems such as difficulty initiating sleep, bedtime resistance, difficulty maintaining sleep, tiredness when waking up in the morning, and doze off.[8] These manifestations are related to inappropriate habits and behaviors pre-sleep, during-sleep, and post-sleep, and vary among the different clinical subtypes of ADHD.[9]

Previous studies have shown that inappropriate habits and behaviors related to sleep were significantly more prevalent in children with ADHD who had other comorbid

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disorders, potentially causing or exacerbating sleep disorders.[7,8] Therefore, we conducted this study to analyze the characteristics of sleep-related habits and behaviors in children with attention deficit hyperactivity disorder at the Vietnam National Children's Hospital in 2022 - 2023, to assist clinicians in improving the effectiveness of assessing and managing sleep in ADHD children.

II. METHOD

1. Participants

The study included 277 children aged 6 – 12 years who were diagnosed with ADHD by psychiatry pediatricians according to DSM-5 criteria, at the Psychiatry Department of the Vietnam National Children's Hospital from October 2022 to September 2023. Children or caregivers who did not agree to participate in the study, were unable to respond to interviews, did not provide sufficient information as required, or were currently using medications that affect sleep were excluded from the study.

2. Study Design

A cross-sectional descriptive study.

Research tools

Research case records and a two-week sleep diary, developed based on the study objectives with sections on general information, sleep-related behaviors and habits of the participants.

3. Research variables

General characteristics of the study subjects: age (years), gender, subtype of ADHD, ADHD comorbidities. Habits and behaviors pre-sleep, during-sleep, and post-sleep that occur frequently, at least three times a week, and have been present for at least one month before participation in the study, include: screen exposure time of more than 2 hours before bedtime; Parents/caregivers must be present when fall in asleep; bedtime resistance (child refuses, may cry to resist bedtime); difficulty initiating sleep (child takes more than 30 minutes to fall asleep); difficulty maintaining sleep (child is easily awakened by noise, light, or other factors); Wake up at least once during the night (child wakes up during the night and cannot fall back to sleep within 30 minutes); restless and moves a lot during sleep (child does not sleep soundly, often turning over, changing positions, or moving limbs during sleep); bruxism; snore loudly; sleep terror; sleepwalking; talking during sleep; nightmares; enuresis; difficult to wake up in the morning (parents/caregivers spend a significant amount of time or use various methods to get the child out of bed); tiredness when waking up in the morning; and doze off.

Sample and sampling method:

Convenience sampling.

Statistical analysis

Statistical analysis was conducted using SPSS software version 20.0 to determine frequencies, and percentages, and to perform Chi-square tests for comparing proportions between groups.

4. Ethics

The study was approved by the Biomedical Research Ethics Board of Hanoi Medical University, approval number 794/GCN-HĐĐĐNCYSH-ĐHYHN, November 16, 2022

III. RESULTS

Table 1. Study population characteristics

Study population characteristics		n = 277	%
Sex	Male	238	85.9
	Female	39	14.1
Age groups	6 – 9 years old	222	80.1
	10 – 12 years old	55	19.9
ADHD subtypes	Inattentive subtype	57	20.6
	Hyperactive – impulsive subtype	54	19.5
	Combined subtype	166	59.9
ADHD comorbidities	No	99	35.7
	Yes	178	64.3
Type of ADHD comorbidities (n = 178)	Learning disorder	57	32.0
	Oppositional defiant disorder	70	39.3
	Anxiety - Depression disorder	20	11.2
	Autism spectrum disorder	19	10.7
	Tic disorder	40	22.5
	Behavioral disorders	18	10.1
	Intellectual disability	22	12.4

The average age of the study participants was 8.4 ± 1.7 years old. The male-to-female ratio was 6.1:1. Up to two-thirds of the children with ADHD comorbidities.

Table 2. Inappropriate habits and behaviors pre-sleep and post-sleep according to the subtype of ADHD

Subtype of ADHD / Behaviors and habits	Hyperactive – impulsive subtype (n = 54)	Inattentive subtype (n = 57)	Combined subtype (n = 166)	Total (n = 277)
Habits and behaviors PRE-SLEEP, n (%)				
Screen exposure time of more than 2 hours	19 (35.2)	25 (43.9)	89 (53.6)*	133 (48.0)
Parents must be present when falling asleep	24 (44.4)	22 (38.6)	77 (46.4)	123 (44.4)

Subtype of ADHD / Behaviors and habits	Hyperactive – impulsive subtype (n = 54)	Inattentive subtype (n = 57)	Combined subtype (n = 166)	Total (n = 277)
Bedtime resistance	30 (55.6)	21 (36.8)	101 (60.8)*	152 (54.9)
Difficulty initiating sleep	28 (51.9)	27 (47.4)	110 (66.3)*	165 (59.6)
Habits and behaviors POST-SLEEP, n (%)				
Difficult to wake up in the morning	15 (27.8)	29 (33.3)	47 (28.3)	81 (29.2)
Tiredness when waking up in the morning	14 (25.9)	37 (64.9)*	85 (51.2)	136 (49.1)
Doze off	15 (27.8)	17 (29.8)	50 (30.1)	73 (26.3)

**Chi-square test, p < 0.05*

Screen exposure of more than 2 hours before bedtime, bedtime resistance, and difficulty initiating sleep were more common in the combined subtype, with statistically significant differences. Tiredness when waking up in the morning was more prevalent in the inattentive subtype.

Table 3. Inappropriate habits and behaviors pre-sleep and post-sleep according to the ADHD comorbidities

ADHD comorbidities / Habits and behaviors	No (n = 99)	Yes (n = 178)	Total (n = 277)
Habits and behaviors PRE-SLEEP, n (%)			
Screen exposure time of more than 2 hours	18 (18.2)	115 (64.6)*	133 (48.0)
Parents must be present when falling asleep	39 (39.4)	84 (47.2)	123 (44.4)
Bedtime resistance	25 (25.3)	127 (71.3)*	152 (54.9)
Difficulty initiating sleep	41 (41.4)	124 (69.7)*	165 (59.6)
Habits and behaviors POST-SLEEP, n (%)			
Difficult to wake up in the morning	24 (24.2)	57 (32.0)*	81 (29.2)
Tiredness when waking up in the morning	38 (38.4)	98 (55.1)*	136 (49.1)
Doze off	11 (11.1)	62 (34.8)*	73 (26.3)

**Chi-square test, p < 0.05*

Children with ADHD comorbidities exhibited significantly higher issues with inappropriate habits and behaviors pre-sleep and post-sleep compared to those without ADHD comorbidities, with statistical significance at $p < 0.05$.

Table 4. Inappropriate habits and behaviors during-sleep according to the subtype of ADHD

Habits and behaviors during-sleep	Hyperactive – impulsive subtype (n = 54)	Inattentive subtype (n = 57)	Combined subtype (n = 166)	Total (n = 277)
Difficulty maintaining sleep	28 (51.9)	30 (52.6)	82 (49.4)	140 (50.5)
Wake up at least once during the night	9 (16.7)	19 (33.3)	56 (33. 7)	84 (30.3)
Restless and moves a lot during sleep	21 (38.9)	22 (38.6)	87 (52.4)	130 (46.9)
Bruxism	25 (46.3)*	16 (28.1)	52 (31.3)	93 (33.6)
Snore loudly	6 (11.1)	25 (43.9)*	44 (26.5)	75 (27.1)
Sleep terrors	7 (13.0)	9 (15.8)	27 (16.3)	41 (15.5)
Sleepwalking	3 (5.5)	9 (15.8)*	22 (13.3)	31 (11.2)
Talks during sleep	30 (55.6)*	22 (38.6)	77 (46.4)	129 (46.6)
Nightmares	6 (11.1)	9 (15.8)	30 (18.1)	45 (16.2)
Enuresis	4 (7.4)	12 (21.1)*	28 (16.9)	44 (15.9)

**Chi-square test, p < 0.05*

Bruxism during sleep was more common in the hyperactive-impulsive subtype. Snore loudly, sleepwalking, and enuresis were more common in the inattentive subtype. Talking during sleep was more common in the combined subtype (p < 0.05)

Table 5. Inappropriate habits and behaviors during-sleep according to the ADHD comorbidities

ADHD comorbidities / Habits and behaviors	No (n = 99)	Yes (n = 178)	Total (n = 277)
Difficulty maintaining sleep	22 (22.2)	118 (66.3)*	140 (50.5)
Wake up at least once during the night	19 (19.2)	65 (36.5)*	84 (30.3)
Restless and moves a lot during sleep	37 (37.4)	93 (52.2)	130 (46.9)
Bruxism	23 (23.2)	70 (39.3)*	93 (33.6)
Snore loudly	16 (16.2)	59 (33.1)*	75 (27.1)
Sleep terrors	6 (6.1)	35 (19.7)*	41 (15.5)
Sleepwalking	5 (5.1)	26 (14.6)*	31 (11.2)
Talks during sleep	28 (28.3)	101 (56.7)*	129 (46.6)
Nightmares	11 (11.1)	34 (19.1)	45 (16.2)
Enuresis	14 (14.1)	30 (16.9)	44 (15.9)

**Chi-square test, p < 0.05*

Difficulty maintaining sleep, wake up at least once during the night, bruxism, snore loudly, sleep terrors, sleepwalking, and talks during sleep were more prevalent among children with ADHD comorbidities ($p < 0.05$).

IV. DISCUSSION

We interviewed 277 children with ADHD (male: female ratio = 6.1:1) and their parents/ caregivers. The average age of this group was 8.4 ± 1.7 years (6 – 12 years), 59,9% the combined subtype, 20.6% the inattentive subtype, and 19.5% the hyperactive-impulsive subtype. Up to two-thirds of the children with ADHD comorbidities, most commonly oppositional defiant disorder and learning disorders. The characteristics of our study subjects are similar to those found in the majority of studies both domestically and internationally.[10,11]

Recent studies on sleep in children with ADHD had noted that their sleep tended to be unstable, with increased difficulties at the onset of sleep in the evening. These issues were driven by inappropriate sleep-related habits and behaviors.[9] In our survey of pre-sleep and post-sleep habits and behaviors, we recorded that 48% of children with ADHD had a screen exposure time of more than 2 hours just before bedtime, bedtime resistance (54.9%), and difficulty initiating sleep (59.6%), particularly more common in the combined subtype and children with ADHD comorbidities. Our findings were similar to those of the study by Vander Heijden KB et al.[12]e.g. caffeine use This group of authors concluded that screen time was associated with the prevalence of sleep problems in children with ADHD. Laboratory experiments had also shown that light from screen devices reduced the already delayed melatonin secretion process in children with ADHD, and the content of videos increased the excitation of the prefrontal cortex in this group of children, thereby delaying their sleep onset and leading to a series of behaviors resisting bedtime and difficulty initiating sleep.[13] Other studies on sleep in children with ADHD had also shown that difficulties in initiating sleep, bedtime resistance, difficulty maintaining sleep or easy awakening during sleep, and difficulty to wake up in the morning and doze off were common in this group, accounting for 41 – 84%, significantly higher than in the non-ADHD group.[8] The rates of these issues in our study also fell within the above range. Additionally, we noted differences in behavior and habits related to sleep among the clinical subtypes of ADHD (Table 2) and in the ADHD comorbidities (Table 3).

There were opinions suggesting that different clinical subtypes of ADHD exhibited distinct sleep behaviors.[9] This hypothesis was supported by scientific studies, some of which concluded that children with the combined subtype of ADHD experienced significantly greater sleep issues than those with the inattentive subtype, specifically that children with the combined subtype tended to have poorer sleep quality and were more prone to waking up during the night.[14] Other studies did not find differences in sleep behavior between the clinical subtypes.[15] However, they did indicate that the predominantly inattentive subtype group tended to experience more daytime sleepiness compared to the combined subtype.[15] These findings suggested that sleep behaviors might differ between these two subtypes and could affect daytime alertness. Our study did not observe differences in difficulty maintaining sleep, wake up at least once during the night, and doze off among the clinical subtypes, but tiredness when waking up in the morning was more common in the inattentive subtype group. This difference might have been due to our collection of sleep information

through parents/caregivers, differing from the objective sleep measurement methods used in the aforementioned studies. Additionally, we noted that snore loudly and enuresis were significantly higher in the inattentive subtype group. Clinically, snore loudly and enuresis could be clinical manifestations of obstructive sleep apnea in children, a disorder that often causes inhibition of the prefrontal cortex, thereby leading to prominent inattentive symptoms (Table 4).[13]

Parasomnia observed in our study, including sleep terrors, talking during sleep, sleepwalking, nightmares, and enuresis, was more prevalent among children with ADHD comorbidities, with no differences observed between the clinical subtypes of ADHD. Comorbid disorders with ADHD can exacerbate sleep issues and the core symptoms of ADHD. This was consistent with our observations that inappropriate sleep-related habits and behaviors were more common in the group of children with ADHD comorbidities (Table 5).

Although our study analyzed some characteristics of inappropriate sleep-related habits and behaviors in children with ADHD, it has limitations such as the absence of a control group and only using subjective sleep assessments (sleep diary), without conducting objective sleep measurements. Therefore, recommendations for future perspectives include similar studies with a larger sample size, including a healthy control group, using polysomnography or actigraphy to study sleep in children with ADHD, and research on behavioral treatment methods for children with ADHD with sleep disorders.

V. CONCLUSIONS

Children with ADHD exhibit numerous inappropriate habits and behaviors related to sleep. These issues vary among the different clinical subtypes of ADHD and those with comorbidities. The study suggests that clinicians should pay attention to and assess inappropriate sleep-related habits and behaviors in children with ADHD, and integrate sleep management into the treatment process for ADHD.

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