

Sleep disorders in children with attention-deficit/hyperactivity disorder

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Abstract

Background Chemotherapy-induced nausea and vomiting are some Background Attention-deficit/hyperactivity disorder (ADHD) is a neurobehavioral abnormality that commonly occurs among children. Sleep disorders are comorbid with ADHD. Sleep disorders in Indonesian children with ADHD have not been widely studied.

Objective To understand the proportion and factors that influence sleep disorders in children with ADHD.

Methods This cross-sectional study involved 54 children aged 3-14 years who had been diagnosed with ADHD by a pediatric growth and development consultant using DSM-5 criteria. The subjects were consecutively selected from March to August 2017 at the Child Development Polyclinic, Dr. Sardjito Hospital, Yogyakarta. Sleep data were collected using the *Sleep Disturbances Scale for Children* (SDSC) and the *Children's Sleep Hygiene Scale* (CSHS).

Results Of the 54 children with ADHD (46 males and 8 females), 35 (64.8%) experienced sleep disorders. The majority (26 subjects, 48.1%) had the disorder of initiating and maintaining sleep. Children with the combined (inattention and hyperactive-impulsive) type of ADHD experienced significantly greater sleep disturbance compared to the inattention type or hyperactive-impulsive type (OR=3.750; 95% CI 1.133 to 12.41; P=0.027). Poor sleep hygiene was also significantly associated with more severe sleep disorders ($r=-0.383$, P=0.004).

Conclusion The proportion of sleep disorder in children with ADHD is relatively high, with the majority having a disorder of initiating and maintaining sleep. Children with combined type ADHD experience a higher amount of sleep disorder than those with either the inattention or hyperactive-impulsive types of ADHD. Children with poor sleep hygiene have significantly more severe sleep disorders. [Paediatr Indones. 2018;58:48-52; doi: <http://dx.doi.org/10.14238/pi58.1.2018.48-52>].

Keywords: sleep disturbance; ADHD; SDSC; CSHS

Sleep is a basic human necessity. Quality of sleep impacts the quality of life in children. Various psychiatric, somatic, and neurologic diseases often follow sleep disorders. A number of neurological diseases are linked with sleep disorder including Asperger's syndrome, Tourette's syndrome, ADHD, autism, epilepsy and learning/motoric difficulties.¹

Attention-deficit/hyperactivity disorder (ADHD), a neurobehavioral abnormality, is a chronic condition most frequently affecting school-aged children.² The prevalence of ADHD is 5% amongst children worldwide.³ However, Gamayanti et al. found the prevalence of ADHD children in Yogyakarta to be 6.68%.⁴ Very little study has been done on the prevalence of ADHD in Indonesia. Common comorbidities with ADHD include learning difficulty (15-20%), sleep disturbance (50-80%), obesity, language difficulty (30-35%), anxiety (20-25%), mood disturbance (15-20%), conduct disorder (20%), oppositional defiant disorder (40%) and substance abuse (15%).⁵ Sleep disorders are reported

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by 25-50% of parents of children and teenagers with ADHD, especially with regards to their children's difficulty initiating and maintaining sleep.⁶ Sleep problems in children with ADHD are linked with worsened daily function and intensified ADHD symptoms.⁷ Factors that contribute to sleep disorders in ADHD include circadian rhythm irregularity, poor sleep hygiene, delinquency, anxiety and mood disturbance, as well as use of stimulant drugs.⁸

We aimed to understand the proportion of sleep disorders and also factors that influenced sleep disorders in children with ADHD. As such, we hope our study results will be of benefit towards providing clear explanations for parents regarding factors that influence sleep disorders in children with ADHD. Thereby children with ADHD may be able to receive comprehensive management so as to prevent medical and social consequences.

Methods

This analytic, cross-sectional study was conducted in the Child Development Polyclinic, Dr. Sardjito Hospital, Yogyakarta, from March to August 2017. We utilized primary data from the SDSC questionnaires that had been filled based on history of sleep patterns history in the last six months, and the CSHS questionnaire, based on the sleep hygiene history of the past month.

The SDSC had been validated against 147 children aged 5-16 years and obtained the value of Cronbach's alpha of 0.71 to 0.79.⁹ In Indonesia, the results of Natalita et al. study showed that the diagnostic results of SDSC on wrist actigraphy obtained 71.4% sensitivity and 54.5% specificity, with positive predictive value and negative predictive value respectively 75% and 50%, so this instrument can be used as a screening tool for sleep disorders.¹⁰

Validity test was done by testing the questionnaires to 30 respondents which has the same characteristics at the Child Development Polyclinic, Dr. Sardjito Hospital, Yogyakarta. Using Pearson product moment correlation, the result of validity test was valid (r count > 0.361). For reliability test, we get the value of Cronbach's alpha was 0.749.

Subject recruitment was done through consecutive sampling. Inclusion criteria were children that had

been diagnosed with ADHD by a pediatric growth and development consultant using the DSM-5 criteria,² in good general health, aged 3-14 years, and whose parents were willing to be respondents. The exclusion criteria were children with illnesses that affected their sleep pattern, namely, uncontrolled asthma.

Bivariate statistical analysis was carried out using the Chi-square method to analyze relationships between dependent variables [ADHD types and medication (methylphenidate)]. Possible correlation between sleep hygiene and sleep disorder was analyzed by Pearson's test. This study was approved by the Research Ethics Committee at Dr. Sardjito Hospital.

Results

During the study period, 58 children aged 3-14 years were diagnosed with ADHD. Among them, four subjects with asthma were excluded from the study. Hence, 54 children who fulfilled the inclusion criteria. The subjects' characteristics are presented in **Table 1**.

The proportion of subjects with sleep disorders was relatively high (35 subjects, 64.8%). Types of sleep disorders based on the SDSC questionnaire are presented in **Table 2**. The most common form of sleep disorder found in this study was initiating and maintaining sleep (26 subjects, 48.1%), followed by sleep-wake transition disorder (8 subjects, 14.8%) and excessive somnolence disorder (1 subject, 1.9%).

The analysis results of subgroup and bivariate variables associated with sleep disorders are summarized in **Table 3**. Chi-square test revealed that children with combined type ADHD had 3.75 times increased risk of sleep disturbance than inattention and hyperactive-impulsive types of ADHD (OR 3.750; CI 1.133 to 12.41; $P=0.027$). Medication for ADHD was not significantly associated with sleep disorders in children with ADHD.

Pearson's correlation coefficient was used to analyze the relationship between sleep hygiene and sleep disorders. The r -value (correlation coefficient) was -0.383, with P value = 0.004. The negative correlation coefficient indicated that in children with ADHD, poorer sleep hygiene was significantly associated with more severe sleep disorders, with both variables having a significant connection.

Table 1. Research subjects' characteristics

Characteristics	(N=54)
Age, n (%)	
3-6 years	28 (51.9)
≥ 7 years	26 (48.1)
Sex, n (%)	
Male	46 (85.2)
Female	8 (14.8)
ADHD type, n (%)	
Inattention	14 (25.9)
Hyperactive-impulsive	4 (7.4)
Combined	36 (66.7)
Stimulant drugs, n (%)	
Yes	11 (20.4)
No	43 (79.6)
Sleep hygiene, n (%)	
Good	29 (53.7)
Poor	25 (46.3)

Table 2. Types of sleep disorder in children with ADHD

SDSC results	(N=54)
No sleep disorder, n (%)	19 (35.2)
Sleep disorder, n (%)	
Disorder of initiating and maintaining sleep	26 (48.1)
Sleep-wake transition disorder	8 (14.8)
Excessive somnolence disorder	1 (1.9)
Total	35 (64.8)

male counterparts.¹²

Sleep disorders occurred in 64.8% of the children with ADHD, with a total of the score SDSC exceeding 39. The proportion of sleep disorders in our subjects was slightly less than that of a study conducted in the Child Development Polyclinic of Sanglah Hospital, Bali, which also used the SDSC questionnaire, though there were differences in subjects' age range and population. Wedayanti reported that in subjects with an age range of 7-12 years, sleep disorders occurred in 22 (66.7%) children with ADHD, the majority being male respondents (25 subjects, 75.8% of all ADHD subjects).¹³

The disorder of initiating and maintaining sleep includes duration of sleep at night, time needed for the child to fall asleep after going to bed, resisting sleep, difficulty sleeping at night, fearing sleep, awakening from sleep more than twice nightly, and difficulty going back to sleep once awake. From the SDSC assessment, 35 (64.8%) subjects experienced sleep disturbances, in with 26 (48.1%) subjects having a disorder of initiating and maintaining, needing 15-30 minutes to sleep since going to bed, and occasionally (1-2 times per week) the children were unwilling and rejected sleep.

Table 3. Bivariate analysis of ADHD type and medication with sleep disorders

Variables	Sleep disorder (n=35)	No sleep disorder (n=19)	P value	OR (95% CI)
ADHD type, n(%)				
Combined	27 (75)	9 (25)	0.027	3.750 (1.33 to 12.41)
Inattention or yyperactive-impulsive	8 (44.4)	10 (55.6)		
Stimulant medication,* n (%)				
Yes	7 (63.6)	4 (36.4)	0.927	0.938 (0.236 to 3.724)
No	28 (65.1)	15 (34.9)		

P-value <0.05 was considered statistically significant; (Chi-square and *Fisher's tests)

Discussion

In this study, the proportion of ADHD among 3 to 6-year-olds and ≥7-year-olds did not widely differ. However, there were more male than female subjects. Based on 19 reviewed studies, the ADHD prevalence was estimated to be 5-10% of school-aged children.¹¹ The estimated male to female ratio was is 3:1 in a population-based study, and 5:1 to 9:1 in clinical samples. Female children with ADHD are reported to have fewer hyperactive-impulsive symptoms and more inattention symptoms when compared to their

LeBourgeois *et al.*, conducted a cross-sectional study on 45 ADHD children aged 6-19 years. They found no distinction between sleep disorders and ADHD subtypes.¹⁴ Mayes *et al.*, carried out a study to understand the link between ADHD subtype and sleep disorders using the *Pediatric Behaviour Scale* (PBS) questionnaire on ADHD children between 6-16 years of age (normal IQ ≥80), which included 271 mixed type and 144 inattention type ADHD children. They reported that mixed type ADHD was more linked to sleep disorders than inattention type ADHD, even though children with inattention type

ADHD experienced frequent afternoon sleepiness.¹⁵ However, in Taiwan, Chiang *et al.* conducted a study on 325 children with ADHD aged 10-17 years using the *Sleep Disturbance* and found no significant difference in subtypes and sleep disorders between combined type and inattention type ADHD.¹⁶ In addition, Yoon *et al.* compared sleep quality in adults aged 19-62 years with combined type ADHD and inattention type ADHD. They used the *Epworth Sleepiness Scale*, *Pittsburgh Sleep Quality Index*, and *Fatigue Severity Scale*. Chi-square, Mann-Whitney U test and MANOVA analyses indicated that subjects with inattention type ADHD had a poorer quality of sleep and fatigue in compared to those with combined type ADHD.¹⁷

Methylphenidate is a psychostimulant class drug that is used to treat children with ADHD. We found that medication was not significantly associated with sleep disturbance ($P=0.927$). But the lack of correlation was probably due to the small number of subjects taking stimulant drugs. We also did not review dosage and length of administered therapy as variables. Parents of children who received stimulant drugs reported a high prevalence of sleep disorder (29%) and complaints of difficulty sleeping at night or insomnia, potentially aggravating the ADHD symptoms.¹⁸ A cross-sectional study using the *Sleep Behavior Questionnaire and Child Behavior Checklist* was done to compare children with ADHD who had received stimulant drugs and those who had not. In 142 children aged 4-18 years, more children who received stimulant drugs experienced severe sleep disorders compared to those who did not receive therapy (29% vs. 10%, respectively).¹⁹

Sleep hygiene is the adjustment of various behaviors and environments that influence the process of initiating and maintaining sleep. Many children with ADHD tend to encounter difficulty achieving adequate sleep habits, such as forming daily routines, regular sleep schedule, and regular waking times.²⁰ Restoring sleep hygiene steps has been proven to improve quality of sleep and effectively resolve sleep disorders in ADHD children. Sleep hygiene involves developing consistent behavior around bedtime to enhance productive and comfortable sleep. In children, factors that may improve sleep include calm sleep routines and regular sleep and wake times. Of these interventions, the most important one is

a regular waking schedule.²¹ Behavioral practices to shape good sleep hygiene (adapted from the *American Academy of Sleep Medicine*, 2008), include: organizing regular and consistent sleep schedules, relaxing sleep routines, creating comfortable bedroom setting, using the bedroom for sleep only, minimizing before-bed activities and electronic use, avoiding emotionally disruptive conversations and activities, not consuming caffeine less than 6 hours before sleep, structuring a consistent wake time, avoiding afternoon naps, exercising during the day or afternoon, relaxing activities (such as yoga) before bed, as well as avoiding drugs that may interfere with sleep (such as decongestants and certain asthma medication).²¹

In conclusion, the proportion of sleep disorders in children with ADHD is relatively high, at 64.8%. The most common sleep disorder is initiating and maintaining sleep (48.1%). Children with combined type ADHD and poor sleep hygiene have a higher risk of sleep disorders. We found no correlation between use of stimulant medication and sleep disorders in children with ADHD. In children diagnosed with ADHD, sleep disorder assessments are needed to allow for earlier management. Education and sleep hygiene remain the initial therapies for tackling sleep disturbances in children with ADHD.

Conflict of Interest

None declared.

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