Sleep Habits and Behavioral Problems in Preschool-aged Children with ADHD

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ABSTRACT

Objective: This study aimed to investigate the relationship between sleep habits and behavioral problems in preschool-aged children with ADHD.

Materials and Methods: A cross-sectional study was conducted in a child developmental clinic at Siriraj Hospital between October and December 2023. Parents of children aged 4-6 years with ADHD completed the Children's Sleep Habits Questionnaire (CSHQ) and the Strengths and Difficulties Questionnaire (SDQ). Descriptive analysis, Pearson correlation, and multivariate linear regression analysis were used to examine the association between sleep habits and behavioral problems.

Results: This study recruited 80 preschoolers with ADHD and 75% were boys. The mean total CSHQ score was 43.76 ± 7.38 and 40% of the participants had sleep problems. 31.3 % had clinically significant behavioral problems. The most common behavioral problems were hyperactivity (33.8%), emotional problems (16.3%), and conduct behavior (10%). More sleep disturbances were highly correlated with all behavioral problems in SDQ, with a Pearson correlation between 0.78 and 0.90. After multivariate regression analysis, the total CSHQ score remained the strongest predictor of all domains of behavioral problems in preschool-aged children with ADHD ($p < 0.05$).

Conclusion: More than 1/3 of preschool children with ADHD were affected by sleep disturbances. Furthermore, sleep problems in these children can contribute to significant behavioral problems. Therefore, the treatment of ADHD in preschoolers should always include the management of sleep disturbances.

Keywords: ADHD; preschool children; behavioral problems; sleep disturbances (Siriraj Med J 2024; 76: 116-124)

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is the most common neurodevelopmental disorder in childhood. Its symptoms include inattention and/or hyperactivity-impulsiveness, among which these symptoms are more manifested than those of individuals with comparable development levels. ADHD symptoms cause behavioral problems, inappropriate social interaction, and academic difficulties in the long term.[1] According to the Fifth Edition Diagnostic and Statistical Manual (DSM-5), ADHD can be diagnosed from the preschool period.[2] In current pediatric practices, early detection of ADHD in preschool children is essential to provide early treatment to reduce the severity of symptoms and the negative consequences after entering primary school.[3] A study conducted by Addanki in 2023 found that the prevalence of ADHD among preschool children was approximately 8%, accounting for almost a quarter of children diagnosed with ADHD at all ages.[4]

Sleep problems were shown to be more common in children with ADHD (50%) than in children without ADHD (25%).[5] Poor sleep quality and delayed bedtime can lead

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to fatigue during the day and affect mood, concentration, behavior, and physical health. Many studies have reported an association between sleep problems and increased severity of ADHD symptoms or behavioral problems in school-aged children with ADHD.[6,7] For specific sleep problems in preschool children with ADHD, only a study by Stickley (2021)[8] found that the prevalence of sleep problems in these children was as high as 83.6%. The most common sleep problems in these children included awakening at night (59.6%), nightmares (29.9%), and snoring (22.6%).[8] However, there is no study to determine the relationship between sleep problems and behavior problems in preschool children with ADHD. Therefore, this study aims to identify the association between sleep habits and behavior in preschool children with ADHD to narrow the knowledge gap and increase awareness of the importance of quality sleep in these children.

MATERIALS AND METHODS

Study design and population

This was a questionnaire-based cross-sectional study among preschool children aged 4-6 years diagnosed with ADHD who received treatment at the child development clinic at Siriraj Hospital between October and December 2023. An estimate of the lowest correlation between sleep problems and behavioral problems was used in school-age children with ADHD[9] to calculate the number of participants in this study, and the type I error of 5% and the statistical power of 80% were determined. In this study, we calculated a sample size of 80 children. Participants who had co-occurring developmental conditions such as global developmental delay and autism spectrum disorder were excluded.

Data collection

This study protocol was approved by the Siriraj Institutional Review Board (COA no. Si 719/2023 (IRB3)). Caregivers of eligible participants were recruited and informed about this study. They completed paper questionnaires after giving their informed consent. In this study, the Children's Sleep Habit Questionnaire (CSHQ) and the Strengths and Difficulties Questionnaire (SDQ) were used.

Measurements

Demographic information form

Demographic and clinical data from the participants were recorded in this form. A review of the participant's medical record and the evaluation of his attending physician provided his information, including his sex, age, type and severity of ADHD, comorbidities, and treatment modalities he received. Sleep data collected from participants included bedtime, wake-up time, and total sleep duration, defined as nighttime sleep duration excluding the time spent waking up at night. Using the DSM-5 criteria, attending physicians classified the severity of ADHD symptoms as 'mild', 'moderate' or 'severe' based on behaviors associated with ADHD and its effects on social functioning and the learning process.[2]

The Children's Sleep Habit Questionnaire, Thai version (CSHQ-Thai)[10]

The CSHQ-Thai version was developed to assess the characteristics and problems of sleep in children aged 4-10 years. This questionnaire has 33 questions to examine sleep problems in 8 domains: bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, parasomnias, sleep-disordered breathing, and daytime sleepiness. Caregivers were required to rate the frequency of their child's sleep habits on a 3-point Likert scale (ranging from 'often' (5-7 times per week) = 3, 'sometimes' (2-4 times per week) = 2, and 'rarely' (0-1 times per week) = 1). A total score greater than 41 points is considered to have sleep problems. This tool has strong internal consistency (Cronbach's alpha coefficients = 0.83).

Strengths and Difficulties Questionnaire, parent rating - Thai version (SDQ-parent rating)[11]

SDQ is a questionnaire to detect positive and negative behaviors in children and adolescents aged 4-16. This questionnaire, with a total of 25 items, is evaluated by caregivers and divides behaviors into five aspects: emotional symptoms, hyperactivity, conduct problems, peer relationship problems, and prosocial behaviors. Each behavior has five questions related to that behavior, answered on a 3-point Likert scale: 0 = 'not true', 1 = 'somewhat true', and 2 = 'definitely true'. The four behavioral domains of hyperactivity, emotional symptoms, conduct problems, and peer relationship problems were then used to calculate the overall difficulty score. Higher total difficulties scores indicate more emotional and behavioral problems. Our study used standard reference values developed by the Department of Mental Health, Ministry of Public Health, Thailand, which established cutoff scores to identify significant overall emotional/behavior difficulties and each problematic behavior. Children who have a total difficulty score greater than 16 are considered to have a clinically significant impairment of general emotional and behavioral problems. Children were considered to have problematic behaviors in each SDQ domain when they had an emotional problem score

greater than 5, a conduct problem score greater than 3, a hyperactivity score greater than 6, a peer relationship score greater than 3, and a prosocial behavioral score less than 5. SDQ had an overall Cronbach alpha internal consistency of 0.7, exhibiting a sensitivity and specificity of 0.63 and 0.95, respectively.

Statistical analyses

IBM SPSS version 25.0 (SPSS Inc., Chicago, USA) was performed for all analyzes. Descriptive statistics were used for the demographic characteristics of the participants, the prevalence of sleep disturbances, all CSHQ domain scores, the prevalence of behavioral problems, and all SDQ domain scores. The associations between the CSHQ score and the SDQ score were explored using Pearson's correlation. Multivariate linear regression analysis was used to analyze the relationship between sleep and behavioral problems by eliminating all potential confounder variables. Statistical significance was set at $p < 0.05$.

RESULTS

Demographic characteristics

As shown in Table 1, 80 preschool children with ADHD were recruited into this study. The average age of the participants was 5 ± 0.61 years and 75% were boys. More than two-thirds of the participants (67.5%) were of the hyperactive and impulsive type, and nearly one-third (32.5%) were of the combined type of ADHD symptoms. Half of the participants had mild ADHD symptoms and the other half had moderate to severe symptoms. In addition to the behavioral modification and parental management training received by all participants, 52.5% received concomitant pharmacotherapy, such as methylphenidate (25%) and risperidone (27.5%). None of the participants in this study had any other disease.

Sleep habits and sleep disturbances

More than half of the study participants (53.8%) went to bed between 7 and 8 pm, and 5% went after 10 pm, while most of the children (62.5%) woke between 7

TABLE 1. Demographic characteristics and sleep practices of preschool-age children with ADHD

Demographic characteristics	Descriptive results
Sex, boy (%)	60 (75)
Age[a], years	5 (0.61)
ADHD type, n (%)	
Hyperactive type	54 (67.5)
Combined type	26 (32.5)
Severity of ADHD, n (%)	
Mild	40 (50)
Moderate to severe	40 (50)
Pharmacological therapy, n (%)	
Methylphenidate	20 (25)
Risperidone	22 (27.5)
Sleep practices	
Bedtime, n (%)	
7:00 – 8:00 PM	43 (53.8)
8:01 – 9:00 PM	12 (15)
9:01 – 10:00 PM	21 (26.3)
10:01 – 11:00 PM	4 (5)
Wake-up time, n (%)	
6:00 – 7:00 AM	30 (37.5)
7:01 – 8.00 AM	50 (62.5)
Total sleep duration[a]	11.04 (1.57)

Data presented as number (percentage), [a]Data presented as mean (SD).
Abbreviations: ADHD = attention deficit/hyperactivity disorder, PM = Post Meridiem, AM = Ante Meridiem

and 8 pm. The mean duration of sleep was 11.04 ± 1.57 hours. The average overall CSHQ score was 43.76 ± 7.38, and 40% of the participants had clinically significant sleep problems. The CSHQ scores categorized by each sleep problem domain are shown in Table 2.

Emotional and behavioral problems

The median overall difficulty score of our participants was 13.4 (IQR = 8, 20.75). According to the standard reference values in the Thai context, 31.3% of the participants were indicated to have significant emotional/behavior problems. When considering all SDQ domains, compared to the standard reference value, 33.8% of the participants had clinically significant hyperactive symptoms and 16.3% had a problematic level of emotional difficulties. Meanwhile, 10% had significant conduct problems and 5% had substantial inappropriate peer relationships. However, only 2.5% of the participants had impairment in prosocial behavior (Table 3).

Association between sleep problems and emotional / behavior problems in preschool-age children with ADHD

According to Pearson's correlation analysis, the total CSHQ score was significantly correlated with the SDQ total difficulty score (r = 0.900, p < 0.001), and all domains of behavioral problems (all p < 0.001). As shown in Table 4, almost all types of sleep problems except parasomnias and sleep disorder breathing were also significantly associated with the total difficulty score and all domains of behavioral problems (all p < 0.05).

To adjust potential variables that may affect emotional and behavioral problems, sex, type of ADHD, severity symptoms of ADHD, treatment modalities, and total CSHQ scores were analyzed by multivariate linear regression (enter method). In Table 5, the total CSHQ scores remained significant predictors of the total difficulty score (β = 0.80, p < 0.05) and all domains of behavioral problems (β = 0.65-0.85, all p < 0.05). Girls had a negative correlation with the total SDQ difficulty score (β = -0.11), emotional

TABLE 2. The children's sleep habits questionnaire (CSHQ) subscale scores and total scores in preschool children with ADHD.

CSHQ Score	Mean (SD)
Bedtime resistance	9.05 (3.01)
Sleep onset delay	1.85 (0.66)
Sleep duration score	4.00 (0.97)
Sleep anxiety	4.41 (0.74)
Night waking	3.26 (0.44)
Parasomnias	7.78 (0.66)
Sleep disorder breathing	3.83 (0.91)
Daytime sleepiness	9.63 (2.55)
Total CSHQ score	43.76 (7.38)
Positive sleep problems, n (%)	32 (40)

TABLE 3. The strengths and difficulties questionnaire (SDQ) subscale scores and total difficulties scores.

SDQ domains	Results	Problematic behavior, n (%)
Emotional problems[a]	3.75 (2,6)	13 (16.3%)
Conduct problems[a]	3.58 (2,6)	8 (10%)
Hyperactivity[b]	4.54 (1.35)	27 (33.8%)
Peer problems[a]	1.54 (0,3)	4 (5%)
Prosocial behavior[b]	7.59 (1.37)	2 (2.5%)
Total difficulties score[a]	13.4 (8,20.8)	25 (31.3%)

[a]Data presented as median (IQR), [b]Data presented as mean (SD)

TABLE 4. Pearson's correlations between the CSHQ and SDQ domains.

CSHQ Domains	SDQ domains											
	Emotional problem		Conduct problem		Hyperactivity		Peer problem		Prosocial behavior		Total difficulties score	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Bedtime resistance	0.881	<0.001**	0.871	<0.001**	0.770	<0.001**	0.826	<0.001**	-0.781	<0.001**	0.905	<0.001**
Sleep onset delay	0.624	<0.001**	0.502	<0.001**	0.562	<0.001**	0.506	<0.001**	-0.577	<0.001**	0.590	<0.001**
Sleep duration	0.695	<0.001**	0.621	<0.001**	0.550	<0.001**	0.728	<0.001**	-0.728	<0.001**	0.702	<0.001**
Sleep anxiety	0.407	<0.001**	0.298	<0.001**	0.345	0.002**	0.220	0.049*	-0.367	0.001**	0.344	0.002**
Night waking	0.551	<0.001**	0.538	<0.001**	0.545	<0.001**	0.442	<0.001**	-0.363	0.001**	0.558	<0.001**
Parasomnias	0.207	0.065	0.115	0.308	0.196	0.082	0.235	0.053	-0.176	0.119	0.204	0.070
Sleep disorder breathing	0.155	0.169	0.189	0.094	0.108	0.339	0.189	0.093	-0.120	0.290	0.176	0.119
Daytime sleepiness	0.757	<0.001**	0.730	<0.001**	0.710	<0.001**	0.807	<0.001**	-0.691	<0.001**	0.806	<0.001**
Total CSHQ score	0.880	<0.001**	0.831	<0.001**	0.777	<0.001**	0.850	<0.001**	-0.800	<0.001**	0.900	<0.001**

*$p < 0.05$, **$p < 0.01$

TABLE 5. Multivariate linear regression analysis for association between potential demographic characteristics (including total CSHQ scores) and SDQ scores.

Demographic characteristics	SDQ domains											
	Emotional problem		Conduct problem		Hyperactivity		Peer problem		Prosocial behavior		Total difficulties score	
	β	95%CI	β	95%CI	β	95%CI	β	95%CI	β	95%CI	β	95%CI
Categorical variable												
Sex												
Boy	ref	-	ref	-	ref	-	ref	-	ref	-	ref	-
Girl	-0.128*	-1.240, -0.044	-0.154*	-1.358, -0.104	-0.082	-0.764, 0.255	-0.015	-0.582, 0.465	-0.063	-0.639, 0.242	-0.107*	-3.359, -0.012
ADHD type												
Combine	ref	-	ref	-	ref	-	ref	-	ref	-	ref	-
Hyperactive	0.026	-0.446, 0.690	0.057	-0.347, 0.844	0.151	-0.053, 0.915	0.038	-0.358, 0.637	0.227*	0.240, 1.077	0.065	-0.648, 2.531
Severity of ADHD												
Mild	ref	-	ref	-	ref	-	ref	-	ref	-	ref	-
Moderate to Severe	0.207*	0.061, 1.745	0.362*	0.605, 2.371	0.139	-0.345, 1.090	-0.032	-0.848, 0.627	-0.119	-0.942, 0.298	0.195*	0.297, 5.008
Phamacological therapy												
No medication	ref	-	ref	-	ref	-	ref	-	ref	-	ref	-
Methylphenidate	0.037	-0.835, 1.204	-0.076	-1.429, -1.319	-0.042	-0.999, 0.739	0.346*	0.477, 2.264	0.002	-0.747, 0.756	0.068	-1.788, 3.920
Risperidone	-0.102	-1.284, 0.294	-0.107	-1.319, 0.336	-0.068	-0.877, 0.468	0.144	-0.136, 1.246	-0.130	-0.978, 0.185	-0.042	-2.845, 1.573
Continuous variable												
Sleep duration	0.084	-0.275, 0.740	0.024	-0.469, 0.596	-0.044	-0.508, 0.358	0.148	-0.123, 0.767	-0.710	-0.498, 0.251	0.063	-0.878, 1.965
Total CSHQ score	0.775*	0.180, 0.280	0.654*	0.130, 0.236	0.724*	0.090, 0.175	0.854*	0.156, 0.627	-0.784*	-0.182, -0.108	0.804*	0.605, 0.886

* $p < 0.05$

symptoms score (β = -0.13), and the conduct problem score (β = -0.15). The hyperactive / impulsive type had a positive correlation with prosocial behavior (β = 0.23). Moderate to severe ADHD symptoms were associated with emotional symptoms (β = 0.21), conduct problems (β = 0.36), and the total SDQ difficulty score (β = 0.20). Additionally, taking methylphenidate had a positive correlation with inappropriate peer relationships (β = 0.35).

DISCUSSION

Many previous studies have shown that children with ADHD are more likely to have sleep problems than healthy children.[12-14] However, our study found that the prevalence of sleep disturbances in preschool children with ADHD was 40%, similar to the findings of the study by Gultekin and Bayik-Temel (2020)[15], which found that the prevalence of sleep problems in healthy preschool children was 43.4%. This comparison is contradictory with previous studies[12-14] that found a higher prevalence of sleep problems in school-age children and adolescents with ADHD compared to those without ADHD. These inconsistent results may be explained by preschool children who are more likely to share the same room with their parents[16], thus better controlling good sleep practices compared to older children and adolescents.[17] In addition, children with ADHD tend to have poorer regulation of their sleep practices than normal children.[12-14] Therefore, compared to preschool children with ADHD, school-age children and adolescents with ADHD who had less parental involvement in sleep practices may have more sleep problems compared to those without ADHD.

Compared to Thai school-age children with ADHD from the Chiraphadhanakul study[14] (2016), the mean total CSHQ sleep disturbance score of preschool-age children with ADHD in this study was apparently lower than that of school-age children with ADHD (52.92 ± 7.40). Additionally, when considering each domain of sleep problems, mean scores for all domains of sleep problems in preschoolers with ADHD were lower than those of older children with ADHD. Therefore, these comparisons confirm that preschool children with ADHD tend to have fewer sleep problems than school-age children with ADHD. In addition to less parental participation in sleep practices in school-age children[16,17], exposure to psychostimulants (such as methylphenidate) may be another reason for sleep problems in these children. Psychostimulants, which are the first-line treatment for school-age children with ADHD[3], result in insomnia.[18] Although giving ADHD patients the last dose of short-acting psychostimulants at noon is to avoid the possibility of drug-induced sleep difficulties, some of these patients also reported more sleep problems, including prolonged sleep latency and insomnia, than ADHD patients who did not receive these medications.[19] Therefore, the use of these drugs may be a significant cause of sleep disturbances in school-age children more than preschoolers with ADHD, who were treated primarily with behavioral modification.[3]

Furthermore, according to the recommendations of the American Academy of Sleep Medicine, the average duration of sleep of our participants is within the normal range of preschool age (10-13 hours) to promote optimal health.[20] Our participants' bedtime and wake-up time were similar to Mindell's survey, which collected data from 3-6 year old healthy preschool children 3-6 years of age of Asian origin.[21] Therefore, it can be tentatively concluded that the sleep habits and sleep problems of preschool children with ADHD are not different from those without ADHD.

Our study found that clinically significant emotional and behavioral problems in preschool children with ADHD are as high as 31.3%, higher than the prevalence of behavioral and emotional difficulties in typical preschool children according to Rescorla's study (2011), which found only 9%.[22] Taking into account each emotional and behavioral problem, hyperactivity (33.8%) is considered the most common symptom in preschool children with ADHD, followed by emotional problems (16.3%), and higher than those without ADHD, which found only 11% and 10% of hyperactivity and emotional problems, respectively.[22] These results emphasize the negative consequences of ADHD caused by abnormal brain structure and function[23], as well as parent-child interaction.[1] Compared to healthy children, thinning of the prefrontal cortex and its poorer function in children with ADHD leads to impairment of behavioral inhibition and decrease in coping ability of the emotional state.[23] Furthermore, children with ADHD and their caregivers have a poor quality of communication[24], which can destabilize their emotion and aggravate externalizing behaviors.

When analyzing Pearson's correlation between sleep problems and significant emotional/behavioral problems in preschool-age children with ADHD, our study found that the total CSHQ sleep disturbance score had a robust correlation coefficient with the total SDQ difficulty score and all domains of emotional and behavioral problems. After multivariate linear regression analysis, the total CSHQ sleep disturbance score remained an essential factor that affected the total SDQ difficulty score and all domains of emotional and behavioral difficulties in these children.

Although the preschool age group has not been studied, our results are consistent with the study by Lucas and Mulraney (2017), which found a moderate correlation between sleep quality and emotional and behavioral problems in school age children with ADHD (β = 0.39 - 0.47).[25] Our results support previous studies that have found that good sleep quality is an essential factor in the development of the prefrontal cortex, which influences the ability to regulate behavior and manage emotions.[26,27] Compared to the study by Lucas and Mulraney, the effect of sleep quality in preschool children with ADHD on behavioral and emotional problems is greater than in older children and adolescents. This can be explained by the rapid rate of thickening of the prefrontal cortex during the preschool period, so sleep quality greatly influences the development of the prefrontal cortex in this period.[28] Therefore, improving sleep quality is an important measure to reduce emotional and behavioral problems in preschool children with ADHD.

Our study has some limitations. First, because our study collected data from a small sample size in only a single tertiary hospital, it affects the generalizability of the results. Large sample sizes and multicenter studies should be investigated. Second, our study does not have a healthy control group to compare the prevalence and types of sleep and emotional and behavioral problems directly. Therefore, further research should also collect data in the healthy control group. Finally, this cross-sectional study design cannot determine the causal relationship between sleep disturbances and behavioral problems. Therefore, longitudinal studies should be conducted in the future.

CONCLUSION

Preschool-aged children with ADHD are likely to experience sleep problems. Additionally, their sleep disturbances can affect their emotional and behavioral problems. Therefore, sleep habits and quality should be checked and emphasized in the treatment of ADHD.

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Conflict of interest

All authors declare no conflict of interest.

REFERENCES

1. Wannapaschaiyong P, Penphattarakul A, Rojmahamongkol P, Sutchritpongsa S. The Relationship Between Primary Caregivers' Psychosocial Factors and Self Esteem in Children and Adolescents with ADHD: An Exploratory Cross-sectional Study. Siriraj Med J. 2023;75(8):584-91.
2. American Psychiatric Association D-TF. Diagnostic and statistical manual of mental disorders: DSM-5. 5th ed. Washington, DC: American Psychiatric Publishing, 2013.
3. Wolraich ML, Hagan JF, Jr., Allan C, Chan E, Davison D, Earls M, et al. Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents. Pediatrics. 2019;144(4):e20192528.
4. Addanki SS, Chandrasekaran V, Kandasamy P. Attention Deficit Hyperactivity Disorder in Preschool Children: A Cross-Sectional Study of Clinical Profile and Co-morbidity. Indian J Psychol Med. 2023;45(3):257-62.
5. Owens J, Sangal RB, Sutton VK, Bakken R, Allen AJ, Kelsey D. Subjective and objective measures of sleep in children with attention-deficit/hyperactivity disorder. Sleep Med. 2009;10(4):446-56.
6. Yin H, Yang D, Yang L, Wu G. Relationship between sleep disorders and attention-deficit-hyperactivity disorder in children. Front Pediatr. 2022;10:919572.
7. Paavonen EJ, Raikkonen K, Lahti J, Komsi N, Heinonen K, Pesonen AK, et al. Short sleep duration and behavioral symptoms of attention-deficit/hyperactivity disorder in healthy 7- to 8-year-old children. Pediatrics. 2009;123(5):e857-64.
8. Stickley A, Shirama A, Kitamura S, Kamio Y, Takahashi H, Saito A, et al. Attention-deficit/hyperactivity disorder symptoms and sleep problems in preschool children: the role of autistic traits. Sleep Med. 2021;83:214-21.
9. Mousavi M, Alavinezhad R, Boojari S. Sleep Problems and Aggressive Behavior in Children with ADHD. Practice in Clinical Psychology. 2015;3(2):107-12.
10. Sirirassamee F, Chonchaiya W, Pruksananonda C. Sleep Behaviors and Sleep Problems in School-Aged Children in Thailand. J Med Assoc Thai. 2015;98 Suppl 9:S71-7.
11. Woerner W, Nuanmanee S, Becker A, Wongpiromsarn Y, Mongkol A. A Normative data and psychometric properties of the Thai version of the Strengths and Difficulties Questionnaire (SDQ). Journal of Mental Health of Thailand. 2011;19(1):42-57.
12. Hosiri T, Punyapas S, Sawangsri W. The Prevalence and Patterns of Sleep Problem in Children with ADHD. J Med Assoc Thai. 2018;101:S34-40.
13. Cortese S, Brown TE, Corkum P, Gruber R, O'Brien LM, Stein M, et al. Assessment and management of sleep problems in youths with attention-deficit/hyperactivity disorder. J Am Acad Child Adolesc Psychiatry. 2013;52(8):784-96.
14. Chiraphadhanakul K, Jaimchariyatam N, Pruksananonda C, Chonchaiya W. Increased Sleep Disturbances in Thai Children With Attention-Deficit Hyperactivity Disorder Compared With Typically Developing Children. Behav Sleep Med. 2016;14(6):677-86.
15. Gultekin T, Bayik-Temel A. Sleep Problems and Effective Factors in Preschool Children. Florence Nightingale J Nurs. 2020;28(2):164-73.
16. Jenni OG, Fuhrer HZ, Iglowstein I, Molinari L, Largo RH. A longitudinal study of bed sharing and sleep problems among Swiss children in the first 10 years of life. Pediatrics. 2005;115(1 Suppl):233-40.
17. Tan T, Marfo K, Dedrick F. Preschool-age adopted Chinese

children's sleep problems and family sleep arrangements. Infant and Child Development Journal. 2009;18:422-40.
18. Faraone SV, Po MD, Komolova M, Cortese S. Sleep-Associated Adverse Events During Methylphenidate Treatment of Attention-Deficit/Hyperactivity Disorder: A Meta-Analysis. J Clin Psychiatry. 2019;80(3):18r12210.
19. Stein MA, Weiss M, Hlavaty L. ADHD treatments, sleep, and sleep problems: complex associations. Neurotherapeutics. 2012;9(3): 509-17.
20. Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, et al. Recommended Amount of Sleep for Pediatric Populations: A Consensus Statement of the American Academy of Sleep Medicine. J Clin Sleep Med. 2016;12(6):785-6.
21. Mindell JA, Sadeh A, Kwon R, Goh DY. Cross-cultural differences in the sleep of preschool children. Sleep Med. 2013;14(12): 1283-9.
22. Rescorla LA, Achenbach TM, Ivanova MY, Harder VS, Otten L, Bilenberg N, et al. International comparisons of behavioral and emotional problems in preschool children: parents' reports from 24 societies. J Clin Child Adolesc Psychol. 2011;40(3): 456-67.
23. Miklos M, Futo J, Komaromy D, Balazs J. Executive Function and Attention Performance in Children with ADHD: Effects of Medication and Comparison with Typically Developing Children. Int J Environ Res Public Health. 2019;16(20):3822.
24. Lee YC, Chen VC, Liang SH, Kelsen BA. Mother-Child Interaction of Boys With ADHD: A Behavioral Observation Study. J Atten Disord. 2022;26(13):1738-46.
25. Lucas I, Mulraney M, Sciberras E. Sleep problems and daytime sleepiness in children with ADHD: Associations with social, emotional, and behavioral functioning at school, a cross-sectional study. Behav Sleep Med. 2019;17(4):411-22.
26. Alrousan G, Hassan A, Pillai AA, Atrooz F, Salim S. Early Life Sleep Deprivation and Brain Development: Insights From Human and Animal Studies. Front Neurosci. 2022;16:833786.
27. Verweij IM, Romeijn N, Smit DJ, Piantoni G, Van Someren EJ, van der Werf YD. Sleep deprivation leads to a loss of functional connectivity in frontal brain regions. BMC Neurosci. 2014;15:88.
28. Kolk SM, Rakic P. Development of prefrontal cortex. Neuropsychopharmacology. 2022;47(1):41-57.