

# Factors Associated with Attention Deficit Hyperactive Disorder in School-Age Thai Children

Jiranun Weerakul, MD<sup>1</sup>, Pakakrong Patigburt, MD<sup>1</sup>

<sup>1</sup> Department of Pediatrics, Faculty of Medicine, Naresuan University, Phitsanulok, Thailand

**Objective:** To evaluate the associated factors in attention deficit hyperactivity disorder (ADHD) in children.

**Materials and Methods:** The present study was a cross-sectional case-control study. Two hundred thirteen children aged 5 to 12 years were divided into two groups with 71 patients with ADHD and 142 pediatric patients without ADHD.

**Results:** The mean age of participants in the case and control groups was 8.80±1.82 and 7.94±2.20 years, respectively. Notably, several factors exhibited significant differences between the group diagnosed with ADHD and the control group. These included male gender (AOR 5.79, 95% CI 2.54 to 13.2), age categories 7 to 9 years (AOR 4.38, 95% CI 1.61 to 11.86) and 10 to 12 years (AOR 2.89, 95% CI 1.01 to 8.30), screen time exceeding two hours daily (AOR 2.47, 95% CI: 1.05 to 5.83), and a family history of ADHD (AOR 15.66, 95% CI 1.29 to 190.83).

**Conclusion:** The findings of the present study offer significant insights into the factors influencing ADHD. These factors are categorized into inherent characteristics, such as male gender, certain age groups, family history of ADHD, and behavioral-related factors. Among the behavioral factors, limiting screen time emerges as a key actionable strategy. Implementing measures to limit screen time and promoting activities that foster improved focus and concentration could potentially mitigate the risk of ADHD.

**Keywords:** Attention deficit hyperactivity disorder; Associated factors; Breast feeding; Family history; Screen-time

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Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder that affects both children and adolescents. It is characterized by persistent patterns of inattention, hyperactivity, and impulsivity that can interfere with daily life and well-being. The prevalence of ADHD varies widely across different populations, ranging from 0.7% in China to 1.8% in Germany, and up to 8.1% in the United States<sup>(1)</sup>. Research on Thai primary school students in grades 1 to 5 revealed that the national prevalence of ADHD was 8.1%, with a higher incidence among boys at 12% compared to girls at 4.2%<sup>(2)</sup>. Multiple studies have investigated factors that influence ADHD.

Multiple factors contribute to the development

of ADHD in children, include neurobiological factors such as decreased dopamine and noradrenaline levels in the brain, genetic and epigenetic factors, and younger maternal age<sup>(3-6)</sup>. Other known risk factors also include maternal history of intrauterine fetal trauma, abortion, unintended pregnancy, smoking, alcohol consumption, pre-eclampsia, cesarean delivery, and formula feeding in infancy, as well as maternal diabetes type 1, type 2, or gestational requiring medication<sup>(7,8)</sup>. The impact of maternal alcohol use on offspring with ADHD remains inconclusive<sup>(9,10)</sup>. Socioeconomic status and parental history of ADHD were also identified as significant risk factors for ADHD<sup>(11)</sup>. Similarly, shorter breastfeeding duration was correlated with higher ADHD incidence, consistent with another study suggesting that breastfeeding for over three months may reduce the risk of childhood ADHD<sup>(12-14)</sup>. Given the complexity of ADHD and the presence of various contributing factors, the present research aimed to evaluate the factors associated with ADHD in children. The collection of data regarding these contributing factors will play a pivotal role in shaping future policies and the development of service systems for the treatment and prevention of ADHD.

## Correspondence to:

Weerakul J.

Department of Pediatrics, Faculty of Medicine Naresuan University, Phitsanulok 65000, Thailand.

**Phone:** +66-55-965556

**Email:** [jiranunw@nu.ac.th](mailto:jiranunw@nu.ac.th)

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## Materials and Methods

The present study was a cross-sectional study conducted between March 2020 and February 2021. Data were collected from an interview questionnaire administered to patients' parents or guardians. Informed consent was obtained from all individual participants. Two hundred thirteen children were categorized into two groups with 71 patients in the ADHD group as studied case and 142 patients without ADHD as control, with a 1 to 2 ratio, case to control. The sample size was calculated using n4Studies program with case-control study with binary outcome. The present study was approved by the Institutional Review Board (IRB No. P3-0023/2020).

The case group involved patients aged 5 to 12 years diagnosed with ADHD, while the control group consisted of pediatric patients aged 5 to 12 who visited the hospital's outpatient department for acute illnesses, such as colds and diarrhea. Exclusion criteria included autistic spectrum disorder, chromosomal abnormality, epilepsy, learning disorder, global delay development, congenital brain anomaly, and cerebral palsy. Participants in the control group were screened for ADHD, and those who exhibited ADHD-like symptoms were excluded.

Initially, 216 children were enrolled and underwent evaluation. Of these, 71 were identified as having ADHD (case group), and the remaining 145 children did not exhibit symptoms of the disease (control group). However, three children were excluded from the analysis due to potential ADHD diagnosis. Data collected comprised various variables, including age, gender, parity, gestational age, birth body weight, route of delivery, and information from an interview questionnaire administered to the participants' parents and guardians. In addition, maternal data and associated factors such as age, pregnancy complication, smoking, alcohol consumption, educational background, duration of breast feeding, age at which the child began using gadgets, daily screen time, total monthly household income, and family history of ADHD were also collected for analyses.

### Statistical analysis

Descriptive analyses, including frequency distribution, mean, and standard deviation, were calculated as percentages. Differences between the case and control groups were analyzed using the chi-square test and independent two-sample test. Logistic regression analysis was used to calculate the odds ratio (OR) for the association between

ADHD and multiple logistic regression was used to calculate the adjusted odds ratio (AOR). A p-value less than 0.05 was statistically significant. Data were analyzed using SPSS Statistics, version 17.0 (SPSS Inc., Chicago, IL, USA).

## Results

Two hundred sixteen children met the enrollment criteria, with 71 children in the case group, and 142 children in the control group. The mean age of participants in the case and control groups was  $8.80 \pm 1.82$  and  $7.94 \pm 2.20$  years old, respectively. Demographic data are shown in Table 1.

Table 2 reveals that there were no significant differences in paternal and maternal factors between the case and control groups. Furthermore, neither mothers in the case group nor those in the control group had a history of maternal alcohol consumption or smoking.

Four significant factors differed between the two groups, gender, age, daily screen exposure, and having a family member diagnosed with ADHD ( $p < 0.05$ ). Six participants in the case group had a family history of ADHD, all of whom had siblings diagnosed with ADHD.

Multiple logistic regression analyses indicated a higher prevalence of ADHD diagnoses in males compared to females (AOR 5.79, 95% CI 2.54 to 13.2,  $p < 0.001$ ). Age was also a significant factor as participants aged 7 to 9 years (AOR 4.38, 95% CI 1.61 to 11.86,  $p = 0.004$ ) and 10 to 12 years (AOR 2.89, 95% CI 1.01 to 8.30,  $p = 0.049$ ) demonstrated increased odds of ADHD diagnosis. Additionally, there was a significant correlation between ADHD and increased screen time (AOR 2.47, 95% CI 1.05 to 5.83,  $p = 0.038$ ). A family history of ADHD also emerged as a statistically significant distinguishing factor between the groups (AOR 15.66, 95% CI 1.29 to 190.83,  $p = 0.031$ ), as illustrated in Table 3 and 4.

## Discussion

The present research collected data from parents or guardians of children aged 5 to 12, revealing that ADHD diagnoses were most common in the 7 to 12 age group. This finding is consistent with a previous study that showed a higher prevalence of ADHD among early elementary school children compared to other age groups<sup>(7)</sup>. In the ADHD group, the present study identified a 5.79-fold higher occurrence in males than in females. This finding is also consistent with the results of the previous studies<sup>(2,7)</sup>.

Multiple logistic regression analysis revealed

**Table 1.** Demographic data of cases and controls

Demographic data	Cases (n=71)	Controls (n=142)	p-value
Age (years); n (%)			0.001*
5 to 6	7 (9.86)	46 (32.39)	
7 to 9	41 (57.75)	57 (40.14)	
10 to 12	23 (32.39)	39 (27.46)	
Sex; n (%)			<0.001*
Male	62 (87.32)	73 (51.41)	
Female	9 (12.68)	69 (48.59)	
Parity; n (%)			0.783
1	48 (67.61)	89 (62.68)	
2	17 (23.94)	38 (26.76)	
3	5 (7.04)	10 (7.04)	
4	1 (1.41)	5 (3.52)	
Gestational age; n (%)			0.296
Less than 36 <sup>+</sup> 6 weeks	8 (11.27)	10 (7.04)	
37 weeks or more	63 (88.73)	132 (92.96)	
Birth weight (g); mean±SD	3,045.96±637.92	2,951.19±454.31	0.223
Route of delivery; n (%)			0.846
Normal delivery	36 (50.70)	74 (52.11)	
Cesarean section & vacuum extraction	35 (49.30)	68 (47.89)	
Age of children who start using media (years); mean±SD	3.08±1.56	3.50±2.00	0.126

SD=standard deviation

\* p&lt;0.05, statistically significance

**Table 2.** Parental factors associated with ADHD in children

Paternal and maternal factors	Cases (n=71)	Controls (n=142)	p-value
Paternal age (years); mean±SD	31.7± 8.47	32.24±6.58	0.611
Paternal smoking; n (%)			0.171
Yes	26 (36.62)	39 (27.46)	
No	45 (63.38)	103 (72.54)	
Paternal education; n (%)			0.626
Less than bachelor's degree	41 (57.75)	77 (54.23)	
Bachelor's degree and higher	30 (42.25)	65 (45.77)	
Maternal age (years); mean±SD	28.52± 6.96	29.08±5.65	0.532
Pregnancy complication; n (%)			0.158
No	58 (81.69)	126 (88.73)	
Yes	13 (18.31)	16 (11.27)	
Maternal education; n (%)			0.621
Less than bachelor's degree	30 (42.25)	55 (38.73)	
Bachelor's degree and higher	41 (57.75)	87 (61.27)	

SD=standard deviation

\* p&lt;0.05, statistically significance

no significant association between the duration of breastfeeding and the incidence of ADHD. This result contradicts the findings of previous research<sup>(12-14)</sup>. Subsequent longitudinal investigations are necessary to validate or challenge these findings and explore potential mechanisms underlying this association.

Although there is evidence to suggest that screen media use may be related to ADHD, many studies have found little statistical correlation between media use and ADHD-related behaviors<sup>(15-17)</sup>. However, it has been found that children who view fast-paced or violent media content may be more likely to exhibit

**Table 3.** Logistic regression analysis of factors associated with ADHD

Factors	Cases (n=71); n (%)	Controls (n=142); n (%)	OR	95% CI	p-value
<b>Sex</b>					
Male	62 (87.32)	73 (51.41)	6.51	3.01 to 14.01	<0.001*
Female	9 (12.68)	69 (48.59)	1		
<b>Age (years)</b>					
5 to 6	7 (9.86)	46 (32.39)	1		
7 to 9	41 (57.75)	57 (40.14)	4.73	1.94 to 11.52	0.001*
10 to 12	23 (32.39)	39 (27.46)	3.88	1.50 to 10.00	0.005*
<b>Daily screen-time duration</b>					
<2 hours/day	9 (12.68)	38 (26.76)	1		
≥2 hours/day	62 (87.32)	104 (73.24)	2.52	1.14 to 5.56	0.022*
<b>Family history of ADHD</b>					
No	65 (91.55)	141 (99.30)	1		
Yes	6 (8.45)	1 (0.70)	13.02	1.54 to 110.32	0.019*
<b>Duration of breast feeding</b>					
No breast feeding	9 (12.68)	18 (12.68)	1.30	0.53 to 3.18	0.570
Less than 3 months	30 (42.25)	41 (28.87)	1.90	1.02 to 3.54	0.044*
3 months or more	32 (45.07)	83 (58.45)	1		

ADHD=attention deficit hyperactivity disorder; OR=odds ratio; CI=confidence interval

\* p<0.05, statistically significance

**Table 4.** Multiple logistic regression analysis of factors associated with ADHD

Factors	AOR	95% CI	p-value
<b>Sex</b>			
Male	5.79	2.54 to 13.20	<0.001*
Female	1		
<b>Age (years)</b>			
5 to 6	1		
7 to 9	4.38	1.61 to 11.86	0.004*
10 to 12	2.89	1.01 to 8.30	0.049*
<b>Daily screen-time duration</b>			
<2 hours/day	1		
≥2 hours/day	2.47	1.05 to 5.83	0.038*
<b>Family history of ADHD</b>			
No	1		
Yes	15.66	1.29 to 190.83	0.031*
<b>Duration of breast feeding</b>			
No breast feeding	0.98	0.35 to 2.76	0.967
Less than 3 months	1.14	0.56 to 2.32	0.718
3 months or more	1		

ADHD=attention deficit hyperactivity disorder; AOR=adjusted odds ratio; CI=confidence interval

\* p<0.05, statistically significance

one or more ADHD-related behaviors<sup>(17)</sup>. The present study found no significant difference in the age at which children started using media between the case and control groups, but multiple logistic regression

analysis revealed that ADHD was significantly associated with longer daily screen time of five to six hours.

Previous studies have identified common risk factors associated with the development of ADHD, including having blood relatives with ADHD, such as parents or siblings<sup>(18,19)</sup>. Consistent with the results of the present study, it has been observed that siblings of individuals with ADHD are also at an increased risk of developing the disorder. However, studies conducted in rural India have found that none of the children with ADHD had a positive family history of the disorder<sup>(20)</sup>. Therefore, the association between a family history of ADHD and the development of this disorder remains a topic requiring further investigation.

### Limitation

The study has a few important limitations. First, recall bias may have affected the accuracy of data on gestational age, birth weight, and other information obtained from parents or guardians. Second, the small sample size limits the generalizability of the findings to all school-age children with ADHD.

### Conclusion

The present study has identified four significant factors associated with ADHD in children as 1) gender, 2) age, 3) the duration of daily screen time,

and 4) a family history of ADHD. These findings underscore the importance of closely monitoring children with ADHD for these characteristics, in addition to the factors already established in the literature.

### What is already known on this topic?

ADHD is a common neurodevelopmental disorder in primary school-aged children, with a higher prevalence in males than in females. The exact cause of ADHD is unknown, but several associated factors have been identified, including genetics, maternal pre-eclampsia, gestational diabetes mellitus, and short duration of breastfeeding. The relationship between screen media use and ADHD-related behaviors is controversial, with some studies finding a positive association and others finding no association.

### What does this study add?

This study found that a daily screen time duration exceeding two hours per day and a family history of ADHD, particularly among siblings, were correlated with ADHD.

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### Authors' contributions

JW conceptualized the study design and drafted the manuscript. PP contributed to the study design, conducted data collection, and participated in manuscript preparation.

### Conflicts of interest

The authors declare no conflict of interest.

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