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Prevalence of Problematic Internet Use and Related Factors in Children with Attention Deficit Hyperactivity Disorder and Non-Attention Deficit Hyperactivity Disorder

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ABSTRACT

OBJECTIVE: To compare the prevalence of problematic internet use (PIU) in attention deficit hyperactivity disorder (ADHD) and non-ADHD children and explore the related factors and effects of PIU in children.
METHODS: A cross-sectional study was done. ADHD and non-ADHD participants aged 7-15 years old with current internet use were enrolled. A self-report questionnaire collected child and parental demographic data, internet use, and related data. An internet addiction scale was used.
RESULTS: A total of 127 participants were enrolled, including 56 ADHD participants and 71 non-ADHD participants. The rate of possible PIU and PIU (possible PIU/PIU) in the ADHD group was 60.7% and 61.5% in the non-ADHD group. In the ADHD group, internet usage time ≥ 21 hours per week was a significant related factor to possible PIU/PIU (adjusted odd ratio 27.08, 95% confidence interval 2.35 – 312.04). Male was significant related factor to possible PIU/PIU in the non-ADHD group (adjusted odd ratio 4.25, 95% confidence interval 1.25 - 14.47). School level, grade, online gaming or social media exposure, and parental internet restriction were non-significant related factors in both groups. Children with possible PIU/PIU had significantly more positive depressive symptoms than the normal internet use group (p = 0.006).
CONCLUSION: The results indicate a higher rate of possible PIU/PIU in both groups and a significant relation with depressive symptoms. In routine practice, we should clarify this issue and provide education to families and children with or without ADHD to prevent internet related problems.

KEYWORDS: attention deficit hyperactivity disorder, internet addiction, problematic internet use, social media exposure

INTRODUCTION

Problematic internet use (PIU), or internet addiction (IA) is a condition of over and uncontrollable internet use that affects a person's function. Previous studies found that some online users were becoming addicted to the internet similar to drug or alcohol addiction, which resulted in academic, relationship, financial, and occupational impairment[1-2]. The negative impacts of excessive internet use or IA can include difficulty to complete homework assignments[1], sleep problems[1,3-4], or psychiatric problems[5-7]. There is no definite consensus for a diagnostic criterion of PIU, but previous studies have used some instruments to measure or describe PIU such as the IA test, the compulsive internet use scale, or the Chen IA scale. Prevalence of PIU or IA was 1.5- 47.4 %, and a high prevalence was shown in southeast Asia country[3,5-6,8-9].

In Thailand, the National Statistical Office Thailand reported the incremental use of

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information technology among children aged 6 years and above. In 2004, the proportion of children using the internet and a mobile phone were 11.9% and 28.2%[10] and gradually increased to 52.9% and 88.1%, respectively, in 2015[11]. In 2021, the proportion of children aged 6-11 years who used internet was 92.6%, while 92.9% had a mobile phone[12]. The most common online activity is social networking, including the use of Facebook, Twitter, Line, and Instagram (88.6%), downloading pictures, music, movies, games, and playing online games (87.4%), uploading pictures or video (59.1%), and emailing (44.6%). A previous study found that the prevalence of PIU in secondary school children in Chiangmai was 3.7%[13].

The factors increasing the risk of PIU are being male[14-15], school achievement[14], exposure time[7,13,16], psychological disorders including depression, anxiety, and attention deficit hyperactivity disorder (ADHD)[5-6,14-15,17-18], and family factors, especially socioeconomic status[4,6,8,14,19-20]. Previous research reported primary school children who were diagnosed with ADHD had behaviors that were similar to PIU 33%[18]. The prevalence of PIU in ADHD children was 21.7-32% and were significantly greater than non-ADHD children[21]. A previous review and meta-analysis showed a moderate association between IA and ADHD. The authors pointed out that ADHD children were easily bored, did not wait for rewards, and the internet responded fast enough for them. Due to the lack of dopamine secretion in the dopamine circuit, playing online games resulted in the activation of dopamine secretion. The poor self-control and organization factors of ADHD also lead to PIU[15,18].

In the current situation, most children use internet via mobile phone or tablet in routine activities and there are scanty of studies about the prevalence of PIU, especially in ADHD children. This study aimed to explore the prevalence of PIU among ADHD and non-ADHD children and compare the related factors and effects of PIU in children.

METHODS

This study was approved by the institutional review board of the Faculty of Medicine Vajira Hospital (certificate of approval 19/2560). In accordance with the declaration of Helsinki, all caregivers and participants provided a written inform consent or/and assent form.

This was a cross-sectional study. We invited and enrolled two groups of participants: ADHD and non-ADHD participants, aged 7-15 years old with current internet use. Participants with ADHD were enrolled from the Vajira Growth and Developmental Clinic. Non-ADHD participants were enrolled from a public primary school near the hospital. In the non-ADHD group, researchers contacted the school principal for permission and explained the research process to the teachers. The teachers then distributed research information and questionnaires to interested parents. Exclusion criteria included autism, mental retardation or intellectual disability, major neurological disabilities such as cerebral palsy, epilepsy, congenital malformation or abnormalities such as Down syndrome, and current or history of depression or anxiety disorder. Participants with a history of ADHD diagnosis or ADHD medication use were excluded from the non-ADHD group. Variables were assessed by a self-reported questionnaire that included child and parental demographic data, internet use, and related data and utilized an internet addiction scale (IAS) and childhood depression screening. The child psycho-emotional effects were collected by parental response (yes/no); examples of the statement: "Associated with child internet using: 1. He/she has any physical effects. (headache, visual disturbance, myalgia, sleep disturbance, over or underweight). 2. He/she has any emotional effects. (easily frustrated, easily annoyed, verbal or physical aggression). 3. He/she .... with family members. (fun to talk, deny talking, spend more time, spend less time, easily fighting or argue).

PIU or addictive internet use was assessed by the IAS which was developed in the Thai language by Wanajak[13]. The IA questionnaire contained 20 items indicating how often the child engaged in the behavior, with responses using a 5 point-Likert scale. The response ranged from "never" = 1 to "always" = 5. Total scores of 70

or higher were classified as PIU (addictive internet use), scores 40-69 were classified as frequent internet use or possible PIU, and scores below 40 were classified as normal internet use. Childhood depression was assessed by the children's depression inventory, which is a self-reported questionnaire with 27 items. The item scores were as follows: 0, 1, and 2 with a total score of 0-54. A score > 15 is associated with depression. Sensitivity and specificity of the test are 78.8 % and 91.3%.

Statistical analyses were performed using the Statistical Package for the Social Sciences software version 22. Continuous variables were expressed as means and standard deviation or median and interquartile range if the data had a non-normal distribution. Categorical variables were presented as count and percentages. Logistic regression analysis was used to compare the related factors for PIU and presented as odd ration with 95% confidence interval. A p-value of < 0.05 was considered statistically significant.

RESULTS

A total of 127 participants were enrolled, with 56 participants in the ADHD group and 71 participants in the non-ADHD group. Table 1 presents the participants' characteristic data. Of the ADHD participants, males accounted for 69.6%, studying in primary school was 69.6%, and 33.9% had internet usage time ≥ 21 hours/week. Non-ADHD participants were 43.7% male, 74.6% were studying in secondary school, and 73.2% were able to access internet at school. Of the 127 participants, only two participants in the ADHD group had an IA score classified at the PIU level (prevalence rate equal 3.5%). The mean IA score of both groups were 43.9 and 43.4, indicating heavy internet usage. The rate of possible PIU/PIU in the ADHD and non-ADHD groups were 60.7% and 60.5%, respectively. The ADHD group were 1.01 times more likely to have possible PIU/PIU than the non-ADHD group, which is not statistically significant (table 2).

Table 1 Participant demographic data (n = 127)

	ADHD (n = 56)	Non-ADHD (n = 71)
	n (%)	n (%)
Sex		
Male	39 (69.6)	31 (43.7)
Female	17 (30.4)	40 (56.3)
School level		
Primary school	39 (69.6)	18 (25.4)
Secondary school	17 (30.4)	53 (74.6)
School performance		
Grade < 3.5 or < 85 %	9 (16.1)	37 (52.1)
Grade ≥ 3.5 or ≥ 85%	47 (83.9)	34 (47.9)
Free time activities[a]		
Game online/social media	23 (41.1)	49 (69.0)
Exercise	20 (35.7)	18 (25.4)
Book reading/music	18 (32.1)	35 (49.3)
Television watching	28 (50.0)	40 (56.3)
Cooking	16 (28.6)	22 (30.9)
Others	9 (16.1)	13 (18.3)
Caregiver characteristics		
Primary caregiver as		
father or mother	37 (66.1)	61 (85.9)
others	19 (33.9)	10 (14.1)

Table 1 Participant demographic data (n = 127) (coutinued)

	ADHD (n = 56)	Non-ADHD (n = 71)
	n (%)	n (%)
Family income		
≤ 50,000 Baht/month	9 (16.1)	35 (49.3)
> 50,000 Bath/month	47 (83.9)	36 (50.7)
Parental internet usage ≥ 2 hours/day	21 (37.5)	31 (43.7)
< 2 hours/day	35 (62.5)	40 (56.3)
Internet usage character		
Access internet via[b]		
Computer/notebook	28 (50.0)	46 (64.8)
Tablet	12 (21.4)	25 (35.2)
Mobile phone	50 (89.3)	66 (93.0)
Internet time limited by		
Parents	45 (80.4)	46 (64.8)
No parents	11 (19.6)	25 (35.2)
Internet access at school		
Able to access	30 (53.6)	52 (73.2)
Unable to access	26 (46.4)	19 (26.8)
Internet usage time ≥ 21 hours/week	19 (33.9)	40 (56.3)
< 21 hours/week	37 (66.1)	31 (43.7)

Abbreviations: ADHD, attention deficit hyperactivity disorder; n, number
[a,b] Participants can respond to more than one choice.

Table 2 Internet addiction scale data of ADHD and non-ADHD participants.

	ADHD n (%)	Non-ADHD n (%)	OR (95%CI)	P-value
Possible PIU /PIU	34 (60.7)	43 (61.5)	1.0 (0.5-2.1)	0.986
Normal internet use	22 (39.3)	28 (39.4)		
Mean internet addiction score ± SD	43.9 ± 12.2	43.4 ± 14.0		

Abbreviations: ADHD, attention deficit hyperactive disorder; PIU, problematic internet use; n, number; SD, standard deviation
Statistical significance: p-value < 0.05

The researchers analyzed relating factors of possible PIU/PIU in both groups, as shown in Table 3. Accessing the internet at school was associated with possible PIU/PIU in the non-ADHD group. In the ADHD group, internet usage time ≥ 21 hours/week were significantly associated with possible PIU/PIU. When controlling for other factors, this association was still significant.

Table 4 compares psycho-emotional effects between the possible PIU/PIU group with the normal internet use group, with the result indicating that 34.5% of the possible PIU/PIU participants (n=19) had depressive scores and a significantly higher proportion of depressive participants than the normal internet use group (p = 0.020).

Table 3 Univariable and multivariable analysis of factors relating with possible PIU/PIU in ADHD and non-ADHD group

Variables	ADHD (n = 56)		Non-ADHD (n = 71)	
	OR (95% CI)	Adj.OR (95% CI)	OR (95% CI)	Adj.OR (95% CI)
Sex				
Male	2.3 (0.7-7.2)	1.9 (0.5-7.4)	2.2 (0.8-5.9)	4.2* (1.3-14.5)
Female	Ref		Ref	
School level				
Secondary school	5.57* (1.3–23.9)	2.26 (0.28–18.3)	1.8 (0.51–6.3)	-
Primary school	Ref		Ref	
School performance				
Grade < 3.5 or < 85%	1.3 (0.3-5.4)	-	1.10 (0.4-2.9)	-
Grade ≥ 3.5 or ≥ 85%	Ref		Ref	
Free time activities				
Free time-game online/social media	2.7 (0.8-8.5)	1.4 (0.4-5.4)	2.5 (0.9-6.9)	3.5 (0.9-12.4)
Free time–no game online/social media	Ref		Ref	
Free time - Exercise	1.3 (0.4-4.1)	-	0.6 (0.2-1.7)	-
Free time–no exercise	Ref		Ref	
Parental internet usage				
≥ 2 hours/day	1.5 (0.5-4.6)	-	1.3 (0.5-3.5)	-
< 2 hours/day	Ref		Ref	
Internet time limited by				
Parents	1.9 (0.5-8.3)	-	1.6 (0.6-4.6)	-
No parents	Ref		Ref	
Internet access at school				
Able to access	1.7 (0.6-5.1)	-	3.9* (1.3-11.6)	5.6* (1.5-20.7)
Unable to access	Ref		Ref	
Internet usage time				
≥ 21 hours/week	23.6** (2.9-196.0)	27.1** (2.4-312.0)	2.5 (0.9-6.6)	2.6 (0.8-8.1)
< 21 hours/week	Ref		Ref	

Abbreviations: ADHD, attention deficit hyperactive disorder; Adj.OR, adjusted odd ratio; CI, confidence interval; n, number; OR, odd ratio; PIU, problematic internet use; Ref, reference; SD, standard deviation
Statistical significance: *p-value < 0.05, **p-value significant ≤ 0.001

Table 4 Comparing psycho-emotional effects between possible PIU/PIU with average internet use for children with ADHD and non-ADHD

Effects	Possible PIU/PIU (n=77) n (%)	Normal internet use (n=50) n (%)	P-value
Physical health problems	23 (29.9)	20 (40.0)	0.239
Aggressive/easily frustration	32 (41.6)	17 (34.0)	0.393
Sleep disturbance/insomnia	19 (24.7)	12 (24.0)	0.931
Decreased family relationship	33 (42.9)	22 (44.0)	0.899
Depression (CDI score > 15)	25 (34.7)	5 (11.6)	0.006*

Abbreviations: CDI, childhood depression index; n, number; PIU, problematic internet use
Statistical significance: *p-value < 0.05

DISCUSSION

This study found the prevalence of PIU to be around 3.5%, all PIU participants had ADHD. Comparing the prevalence of possible PIU/PIU, 60.7% in ADHD group and 61.5% in non-ADHD group, there were no statistical differences (p = 0.986). In non-ADHD group, there was high percentage of using internet ≥ 21 hours per week and playing online games or social media during free time, this may be the reasons for having the prevalence of possible PIU/PIU in non-ADHD equal as ADHD group. Our result for the PIU prevalence was in line with Dib et al. which found that 4.5% had severe internet use[16], but our finding is lower than other studies, especially studies from Southeast Asia countries[3,7-9]. Because we classified possible PIU with a lower score than other studies (IAS ≥ 40 vs ≥ 50), the possible PIU/PIU prevalence in this study was higher than the previous studies which found 7.4-46.4% [3, 17, 20].

Like other studies, we found internet exposure time was significantly associated with possible PIU/PIU in the ADHD group. For example, a 2021 study among university students showed internet time exposure was a risk for having PIU (OR 1.3, 95% CI 1.1-1.3)[7], while another study revealed using the internet ≥ 5 hours/day was significantly associated with PIU (OR 4.8, 95% CI 2.0-11.6)[16]. However, the exposure time was not a significant associated-factor for internet addict-gamers (IAS ≥ 71)[22].

In the non-ADHD group, a significant risk factor for possible PIU/PIU was the ability to access the internet at school. As we knew, the exposure time was the one of risk factors for PIU, when the child used internet at school, the internet exposure time and frequency of internet use was expanded. In this point, future case-control studies should explore the robustness of this factor. However, our results did not show a relation between gender, school performance, or parental internet restriction with possible PIU/PIU in both groups, like previous studies[19-20].

We analyzed the psycho-emotional effects of possible PIU/PIU compared with normal internet use, and our results were similar to previous studies[7,17] that participants in the possible PIU/PIU group had a significantly higher percentage of depression than normal internet users (34 % vs 11.6%, p 0.006). Sleep disturbance/ insomnia did not show a significant effect like in the literature[3-4]. The previous studies stated the PIU had greater anxiety than the non-PIU group[7,16], but this issue was not explored in the present study.

This study presents the prevalence, associated factors, and psycho-emotional effects of internet use in both ADHD and non-ADHD groups among Thai school-aged children. There are several limitations such as only current internet users were enrolled, so this prevalence cannot be generalized in normal population and the recall bias of measurement by self-reported questionnaire, may be result in over or underestimated of outcomes. Finally, due to the study design, it is not possible to identify the causes and effect of the psychological outcome. Further studies should include family socioeconomic status to adjust the outcomes or explore anxiety effects in a cohort or case-control design.

CONCLUSION

The present study showed a high prevalence of possible PIU/PIU. The highest risk factor for the ADHD group was exposure time more than time ≥ 21 hours/week and for the non-ADHD was the ability to access internet at school. In the digital era, families and schools should be educated about internet exposure time limiting and signs of depression should be evaluated in possible PIU/PIU children.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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DATA AVAILABILITY STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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