DOI: 10.7860/JCDR/2023/60328.17984

Original Article

Paediatrics Section

Attention Deficit Hyperactivity Disorder and Use of Mobile Phones among Children- Need for Concern?

ABY DANY VARGHESE[1], GEETHU MATHEW[2], CINDERELLA XSON[3]

ABSTRACT

Introduction: The prevalence of Attention Deficit Hyperactivity Disorder (ADHD) is on the rise. Among multiple factors that are linked with ADHD, electronic media use has been gaining considerable attention recently. There is only a limited source of information regarding the burden of ADHD and its association with screen time in the Indian context.

Aim: Screening of the children for ADHD and its association with mobile phone use at an outpatient service in a tertiary care hospital in Kerala.

Materials and Methods: A cross-sectional questionnaire-based study was conducted among 157 children in the outpatient services in a tertiary care hospital in Pathanamthitta district, Kerala, India. School-going children aged between 6 and 11 years were included in the study. ADHD screening was done using Conner's Abbreviated Rating Scale (CARS)

Results: The mean age of children was 8.1±1.9 years. All the participants used mobile phones, and 15 (9.6%) owned one. The mean duration of mobile phone use per day was 1.4±0.7 hours. Among participants, 53 (33.8%) used mobile phones for more than one hour daily. Parents reported that nearly one-fifth of the children use mobile phones late at night (after 10 pm). Among children, 22.9% screened positive for ADHD. The ADHD scores are significantly correlated with the duration of mobile phone use (r=0.368 p<0.001). Among the children who used mobile phones for more than a year, 32.1% screened positive for ADHD (OR=3.21, CI 1.41-7.32). The mean ADHD score was significantly higher among children with >1 hour of mobile phone use/day than those who use <1 hour/day (t-test=-2.27 p-value=0.025). The vast majority, 148 (94.2%), also noticed behavioural changes among children when denied mobile phones. Significant changes included anger (22.9%), sadness (31.8%), withdrawal (20%), frustration (17.8%) and violence (8.9%).

Conclusion: In this study, 22.9% of children screened positive for ADHD. Mobile phone use was found to be significantly associated with ADHD.

Keywords: Attention deficit hyperactivity disorder (ADHD), Children, Mobile phone, Screen time

INTRODUCTION

The ADHD is one of the most common neurological developmental disorders. The prevalence of ADHD in children, adolescents, and adults is increasingly recognised [1-3]. One of the recent reviews showed that the prevalence of ADHD among children and adolescents ranges from 1.30% to 28.9% in India [3]. ADHD commonly exhibits hyperactivity, inattention and impulsivity and distraction. This condition results from complex dealings between genetic, environmental, and developmental traits. The demographic variables such as parents' low education, mother's occupation, low socioeconomic status, male gender, birth order and single parent were all risk factors for ADHD [4,5]. In addition to the demographic variables, family-related factors like maternal smoking and drinking behaviour, caesarean delivery, previous abortion, unwanted pregnancy, two-parent family structure, parental psychiatric disorders, history of head trauma, and epilepsy were all found to be contributing to the risk of ADHD [5,6]. Even though ADHD was primarily considered a disease of children, recent studies have proved it can affect adolescents and adults. Besides learning disabilities, ADHD also contributes to road traffic accidents, antisocial behaviour, and crimes among adolescents, negatively impacting families and society [3].

Evidence from recent research supports the association between screen time such as television and ADHD among children [6]. Electronic devices have become integral to life, including children and youth. Excessive use of devices and exposure to screen time has been linked with many adverse health events, including addiction, depression, anxiety among adolescents and ADHD among children. There is only a limited source of information regarding the burden of ADHD among school-going children and its association with screen time in the Indian context. As ADHD is one of the most common neurodevelopmental disorders with childhood-onset, there is an urgent need to understand the associated factors. In Asian countries like India, age-specific information about the magnitude of ADHD is needed to frame appropriate treatment guidelines. Screening and early diagnosis of this condition will help initiate proper treatment and prevent adverse effects in the long run [3,4]. Excessive screen time among school children needs to be investigated as there is a shortage of evidence regarding the negative impact. In addition, most studies exploring the association between ADHD and screen time were done only among preschool children from western countries. Considering the increasing use of mobile phones in the current pandemic situation and the available literature on the association between these two factors, data on the effect among children could be of public health importance.The primary objective was screening of the children for ADHD at an outpatient service in a tertiary care hospital in Kerala and identifying the pattern of mobile phone use in these children and if any association between the pattern of mobile phone use and the presence of ADHD.

MATERIALS AND METHODS

A cross-sectional questionnaire-based study was conducted in the Outpatient services in a tertiary care hospital in Pathanamthitta district, Kerala, India, from July 2019-September 2019. A pilot study was done before proceeding to the study, and suitable modifications were incorporated. Approval from the Institutional Review and Ethics board was taken before the commencement of the study. (IEC number IEC/2019/05/98).

Inclusion criteria: All school-going children between 6 and 11 years presenting to the outpatient services for non emergeny illness, general check-up, vaccination etc., were included in the study population.

Exclusion criteria: Children with pre-existing neurological diseases were excluded.

The sample size was calculated based on a study done by Venkata JA and Panicker AS. Using a prevalence of 11.3% precision of 5% at 95% CI, the sample size was calculated to be 157 [1].

Data were collected after obtaining written informed consent from the parents. The study tool used was a structured questionnaire that included basic sociodemographic details, the pattern of use of mobile phones and ADHD screening. Variables collected were- age, gender, birth order of the child, socioeconomic status, parents' education, and type of school (private/public). Details regarding mobile phone use, such as duration, purpose, time of use, screen-free days and sleep duration, were collected. ADHD screening was done using CARS [1]. CARS is a rating scale consisting of several behavioural parameters for diagnosing ADHD. A score of more than 15 in CARS was considered suggestive of ADHD. CARS was administered to the parents while waiting in the paediatric OPD and they reported back immediately.

STATISTICAL ANALYSIS

The data collected was coded and entered in Microsoft Excel. All the statistical analysis was performed using Epi info software version 7. Descriptive statistics comprising mean (SD), frequencies and percentages were calculated. The correlation between ADHD scores and the duration of mobile phone use among children was assessed using Pearson's correlation test. Mean ADHD scores are compared between different categories using the independent t-test.

Further based on the cut-off scores of ADHD, children were classified as ADHD/No ADHD and proportions were compared using the Chi-square test. Risk estimates were calculated using Odds Ratio (OR) or with a 95% Confidence Interval (CI). A p-value less than 0.05 was considered to be statistically significant.

RESULTS

Section 1- Basic sociodemographic profile of participants: A total of 157 children were included in the study. Gender distribution was almost equal among the participants, with 82 (52.2%) girls. The majority of the children belonged to higher socioeconomic status. Details are in [Table/Fig-1].

Variable	Categories	Number (Percentage)
Age groups	<10 years	11 (70.7%)
	≥10 years	46 (29.3%)
Mean age (SD)-8.1 (1.9) years		
Gender	Boy	75 (47.8%)
	Girl	82 (52.2%)
Education of Father	High school	5 (3.2%)
	Higher Secondary	20 (12.7%)
	Graduate	119 (75.8%)
	Postgraduate	13 (8.3%)
Education of Mother	High school	6 (3.8%)
	Higher Secondary	48 (30.6%)
	Graduate	93 (59.2%)
	Postgraduate	10 (6.4%)
Type of ration card	APL	123 (78.3%)
	BPL	34 (21.7%)
Birth order of the child	First	86 (54.8%)
	Second	62 (39.5%)
	Third	9 (5.7%)
Type of school	Private	128 (81.5%)
	Government	24 (15.3%)
	Aided	5 (3.2%)

[Table/Fig-1]: Distribution of participants based on sociodemographic variables.
APL: Above poverty line; BPL: Below poverty line

Section 2- Pattern of mobile phone use among children: All the participants used mobile phones, and 15 (9.6%) owned one. Among participants, 76 (48.4%) were using mobile phones for the last year, 52 (33.1%) for 1-3 years and 29 (18.5%) for more than three years. Among 157, 126 (80.3%) had a sleep duration of <8 hours/day. Details of pattern and behaviour of children in relation to mobile phone use is shown in [Table/Fig-2]. Parents reported that 28 (17.8%) of the children prefer to use the mobile phone instead of reading, 40 (25.5%) play indoors, and 13 (8.3%) play outdoors.

Variable	Categories	Number (Percentage)
Duration of use/day	1 hour	104 (66.2%)
	2 hours	39 (24.8%)
	3 hours	10 (6.4%)
	4 hours	4 (2.5%)
Mean duration of mobile phone use -1.4±0.7 hrs/day.		
Purpose of mobile phone use	Calls and messages	6 (3.8%)
	Play games	44 (28%)
	Browsing internet	85 (54.1%)
	Others	22 (14%)
Use of mobile phone after 10 pm	Yes	29 (18.5%)
Use of mobile phone during study hours	Yes	22 (14%)
Setting of daily screen time limit for children	Yes	57 (36.3%)
Setting deliberate screen free days for children	Yes	
Behavioural changes when denied mobile phones to children	Anger	36 (22.9%)
	Sadness	50 (31.8%)
	Withdrawal	20 (12.7%)
	Frustation	28 (17.8%)
	Violence	14 (8.9%)
	No behavioural changes	9 (5.7%)

[Table/Fig-2]: Distribution of participants based on pattern and behaviour in relation to mobile phone use.

Parents' perceptions and preferences regarding children's mobile phone use are given in [Table/Fig-3]. It has been reported that nearly one third of the parents encourage children to use screentime to keep them occupied. Even though more than 80% of the children gets <8 hours of sleep, 92.4% of the parents think that their children are getting aqequate sleep.

Variable	Disagree	Neutral	Agree
I feel screen time is my child's favourite thing to do	29 (18.5%)	25 (15.9%)	103 (65.6%)
I worry that screen time stops my child from being physically active	93 (59.2%)	64 (40.8%)	0
I encourage my child to use screen time as it keeps them occupied	79 (50.3%)	25 (15.9%)	53 (33.8%)
I prefer my child spending time on screen than being outside	114 (72.6%)	26 (16.6%)	17 (10.8%)
I think my child is getting enough sleep	0	12 (7.6%)	145 (92.4%)

[Table/Fig-3]: Perceptions of parents regarding the mobile phone use of children.

Section 3- Screening for ADHD and associated factors: The proportion of children screened positive for ADHD was 36 (22.9%) [Table/Fig-4 and 5].

Variable (n=157)	Mean score (SD)
Restless and overactive	1.84 (0.86)
Excitable, impulsive	1.75 (0.78)
Disturbs other children	1.14 (0.36)
Fails to finish things- short attention span	1.48 (0.69)

Constantly fidgeting	1.59 (0.75)
Inattentive, easily distracted	1.48 (0.69)
Demands must be met immediately- easily frustrated	1.74 (0.76)
Cries often and easily	1.62 (0.71)
Mood changes quickly and drastically	1.54 (0.68)
Temper outbursts, explosive and unpredictable behaviour	1.51 (0.65)
Total Mean ADHD score (SD)	15.71 (4.21)

[Table/Fig-4]: Mean scores obtained in CARS scale used for ADHD screening.

Variables		ADHD		Total	Chi-square p-value
		Yes (n=36)	no (n=121)		
Duration of mobile phone use	1 year	13.21% (10)	86.8% (66)	76	χ^2=7.96 p=0.005
	>1 year	32.1% (26)	67.9% (55)	81	
Age group	<10 years	18% (20)	82% (91)	111	χ^2=5.17 p=0.023
	≥10 years	34.8% (16)	65.2% (30)	46	
Gender	Female	22% (18)	78% (64)	82	χ^2=0.093 p=0.760
	Male	24% (18)	76% (56)	75	
Socioeconomic status	APL	22.8% (28)	77.2% (95)	123	χ^2=0.009 p=0.925
	BPL	23.5% (8)	76.5% (26)	34	
Type of school	Private	23.4% (30)	76.6% (98)	128	χ^2=0.009 p=0.925
	Government	20.8% (5)	79.2% (19)	24	
	Aided	20% (1)	80% (4)	5	

[Table/Fig-5]: Factors associated with ADHD among study participants.

Among the children with a duration of mobile phone use >1 hour/day, the mean ADHD score was higher (16.8±4.6) compared to those who used <1 hour/day (15.1±1), and this difference was statistically significant (t-test=-2.27 p-value=0.025). Among the children who used mobile phones for more than a year, 32.1% screened positive for ADHD, and this association was statistically significant (OR=3.1, CI 1.38-7.03). ADHD scores were significantly correlated to the duration of mobile phone use among children (r=0.368 p<0.001). Sleep disturbances were reported among those children screened positive for ADHD (OR=3.21, CI 1.41-7.32). Factors such as gender, type of school (private or government), socioeconomic status, or the number of siblings were not significantly associated with ADHD.

DISCUSSION

The ADHD is a behavioural disorder characterised by inattention, impulsivity, and hyperactivity that can significantly impact many aspects of behaviour and performance, both at school and at home [2]. In approximately, 80% of children with ADHD, symptoms persist into adolescence and may even continue into adulthood [2]. This study intended to screen children for ADHD and find the association between mobile phone use and ADHD. A high proportion of children screened positive for ADHD in the present study. A recent systematic review showed a wide prevalence range from 1.3% to 28.9% of ADHD among children [3]. A similar study done among primary school children in Coimbatore showed a prevalence of 11.32% [1]. Higher prevalence was observed in higher age groups, similar to the present study finding.

Hospital-based studies have yielded a higher prevalence of ADHD than studies performed in the community setting [1]. The relatively higher proportion of ADHD in this study could be attributed to that. Even though some studies have found a significant association with gender socioeconomic status, this study did not reveal any such association [1-5]. ADHD has a considerable impact on the individual throughout childhood and well into adult life, mainly if not managed optimally. People with ADHD tend to have a lower occupational status and poor social relationships and are more likely to commit motoring offences and develop substance abuse [7-10]. Hence, considerable prevalence of this condition should receive due attention from parents, teachers and healthcare professionals.

This study revealed that all children used mobile phones, and nearly 10% owned one. It is alarming that more than one-third of children use mobile phones for more than one hour/per day. There is a growing concern regarding screen time and its effect on children's mental health [11,12]. A recent study conducted among children with ADHD showed that more than 80% had screen time of >1 hr/day [13]. A significant association was observed between the duration of mobile phone use and ADHD in this study. Literature has shown that nuclear families, parents' job requirements, and even the current pandemic have resulted in more gadget-based engagement in children than developmentally appropriate activities. Due to their multisensory stimuli, screen-based gadgets can harm their development more among children with ADHD because of their delay aversion and temporal processing impairment [11,13,14].

Another finding of this study is that more than one-third of the parents informed that they encourage the use of mobile phones among children to keep them occupied. Even though technology-based learning is a vital part of the current education system, the potential adverse effects of the same should not be underrated [13]. It is essential to highlight that more than 90% of parents noticed behavioural changes among children when denied mobile phones. This could indicate behavioural addiction's early stages, which need further exploration. A study by Montagni I et al., observed dose-dependent associations between screen time and attention problems and hyperactivity among students [11]. It is interesting to note that another study done in China also noticed behavioural changes among children who had a daily screen time more than an hour. In this study it was revealed that some children prefer to use a mobile phone instead of playing indoors or outdoors, which could lead to physical inactivity, which is again linked to ADHD [15,16].

Even though ADHD usually presents during early childhood, parents limited awareness of this condition often delays the identification of ADHD in their children [10]. In the Indian context, very little information is provided regarding ADHD and mobile phone usage. In this study, it was found that the duration of mobile phone usage and sleep disturbances were associated with ADHD. To find out if there is an association between mobile phones and ADHD is an innovative approach towards the much-unstudied disease. High prevalence of ADHD and the association with the use of mobile phones warranties an early screening and appropriate management of this condition.

Limitation(s)

This was a hospital-based study, and the CARS was administered only to parents. Only the use of mobile phone was considered in this study. Considering other sources of screen time, like television/laptop etc., would help estimate screen time among children.

CONCLUSION(S)

The proportion of children who screened positive for ADHD was 22.9%. Increased duration of mobile phone and age were the factors signatificantly associated with ADHD.There is a need for structured parent training and education sessions regarding screen time. We need further studies based on this preliminary study to establish a causal association between these two.

REFERENCES

[1] Venkata JA, Panicker AS. Prevalence of attention deficit hyperactivity disorder in primary school children. Indian J. Psychiatry. 2013;55(4):338.
[2] Faraone SV, Sergeant J, Gillberg C, Biederman J. The worldwide prevalence of ADHD: is it an American condition? World Psychiatry. 2003;2(2):104.
[3] Joseph JK, Devu BK. Prevalence of attention-deficit hyperactivity disorder in India: A systematic review and meta-analysis. Indian J Psy Nsg. 2019;16:118-25.
[4] Lola HM, Belete H, Gebeyehu A, Zerihun A, Yimer S, Leta K. Attention Deficit Hyperactivity Disorder (ADHD) among children aged 6 to 17 years old living in Girja District, Rural Ethiopia. Behav Neurol. 2019;2019:1753580.
[5] Al Hamed JH, Taha AZ, Sabra AA, Bella H. Attention deficit hyperactivity disorder (ADHD) among male primary school children in Dammam, Saudi Arabia: prevalence and associated factors. J Egypt Public Health Assoc. 2008;83(3-4):165-82.
[6] Lingineni RK, Biswas S, Ahmad N, Jackson BE, Bae S, Singh KP. Factors associated with attention-deficit/hyperactivity disorder among US children: results from a national survey. BMC Pediatrics. 2012;12(1):50. National Institute of Clinical Excellence (NICE). Attention deficit hyperactivity disorder Diagnosis and Management of ADHD in children, young people and adults. London: NICE Clinical Guideline; 2009.
[7] Biederman J. Attention-deficit/hyperactivity disorder: A selective overview. Biol Psychiatry. 2005;57(11):1215-20. Doi: 10.1016/j.biopsych.2004.10.020. Epub 2004 Dec 18. PMID: 15949990.
[8] American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5®). American Psychiatric Pub; 2013 May 22.
[9] Safavi P, Ganji F, Bidad A. Prevalence of attention-deficit hyperactivity disorder in students and needs modification of mental health services in Shahrekord, Iran in 2013. Journal of clinical and diagnostic research: JCDR. 2016;10(4):LC25.
[10] Tekkalaki B, Patil VY, Chate SS, Patil NM, Patil S, Sushruth V. Pediatric referrals to psychiatry in a tertiary care general hospital: a descriptive study. JMHHB. 2017;22(1):40.
[11] Montagni I, Guichard E, Kurth T. Association of screen time with self-perceived attention problems and hyperactivity levels in French students: A cross-sectional study. BMJ Open. 2016;6:e009089.
[12] Mathew G, Varghese AD, Benjamin AI. A comparative study assessing sleep duration and associated factors among adolescents studying in different types of schools in an urban area of Kerala, India. Indian J Community Med. 2019;44:S10-13.
[13] Vaidyanathan S, Manohar H, Chandrasekaran V, Kandasamy P. Screen time exposure in preschool children with ADHD: A cross-sectional exploratory study from South India. Indian J Psychol Med. 2021;43(2):125-29.
[14] Panagiotidil M, Overton P. Attention deficit hyperactivity symptoms predict problematic mobile phone use. Curr Psychol. 2022;41:2765-71.
[15] Xie G, Deng Q, Cao J, Chang Q. Digital screen time and its effect on preschoolers' behaviour in China: results from a cross-sectional study. Ital J Pediatr. 2020;46(1):9.
[16] Sharma P, Gupta RK, Banal R, Majeed M, Kumari R, Langer B, et al. Prevalence and correlates of Attention Deficit Hyperactive Disorder (ADHD) risk factors among school children in a rural area of North India. J Family Med Prim Care. 2020;9:115-18.

PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Paediatrics, Nitte University (Deemed to be), KS Hegde Medical Academy, Mangalore, Karnataka, India.
2. Scientist D, Department of ROHC-NIOH, ICMR, Bangalore Rural, Karnataka, India.
3. Student, Department of Paediatrics, Believers Church Medical College, Thiruvalla, Kerala, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Aby Dany Varghese,
Professor, Department of Paediatrics, Nitte University (Deemed to be), KS Hegde Medical Academy, Mangalore, Karnataka, India.
E-mail: abydany@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Sep 22, 2022
- Manual Googling: Dec 07, 2022
- iThenticate Software: Jan 13, 2023 (9%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Sep 19, 2022**
Date of Peer Review: **Nov 15, 2022**
Date of Acceptance: **Jan 14, 2023**
Date of Publishing: **Jun 01, 2023**