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Effect of frequent smartphone use on children's cognitive function: An observational study

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Abstract

Background – Children and teenagers use smartphones more actively than adults, they are more prone to get addicted to smartphones. Furthermore, studies show that excessive use of smartphones can lead to psychosocial and physical symptoms in children between age group of 5-15 years.

Psychosocial symptoms include decline in cognitive function and Physical symptoms includes faulty habitual posture and temporomandibular disorders.

Purpose of the study – To find the effects of frequent smartphone use on children's cognitive function.

Methodology– A self-constructed e-questionnaire based on “Digital Addiction Scale for Children” and “Cognitive Flexibility Scale” was sent randomly to various social groups through various social media platforms. A total of 50 parents responded to the survey and were included in the analysis.

Results – From the responses we found out that 23% children use smartphones for more than 4 hours a day and out of them cognitive function was affected in 66.7% of children and faulty cervical posture is seen in 72.2% children.

Conclusion – The study concluded that prolong smartphone usage affects cognitive function in children below 15 years of age.

Keywords: Smartphone usage; Smartphone addiction; Cognitive function; Digital addiction

1. Introduction

Over the last decade, there has been a significant surge in smartphone usage, and these devices have seamlessly integrated into today's communication systems. They provide users with access to extensive information and a wide range of educational opportunities, all while serving as a central hub for daily activities. This surge in smartphone use has ignited a widespread debate about whether these devices have genuinely made daily tasks more efficient and improved the convenience of meeting everyday needs. With the ability to function as phonebooks, appointment calendars, internet gateways, tip calculators, maps, gaming devices, and a multitude of other functions, smartphones appear to have the potential to carry out an extensive array of cognitive tasks for us and fulfill a variety of our emotional desires [1,2].

It's predicted that the number of people using mobile phones will keep rising annually due to the Internet's explosive growth and other technological advancements. Among kids, smartphones are thought to be the most common

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technological gadget. A survey found that youngsters used cellphones more frequently than tablets and laptops, using them for an average of 28.5 hours each week [3].

According to the literature, mobile phones can have a harmful impact on human health. According to the World Health Organization (WHO), exposure to Radiofrequency Electromagnetic Field Radiation (RF-EMFR) created by mobile phones raises body core temperature and can impair cognition processes. Children exposed to RF-EMF radiation had impaired motor abilities, as well as attention span and working memory, as well as poor attention and focus. Furthermore, the literature acknowledges the negative consequences of smartphones [4].

The widespread use of mobile phones has raised concerns about radiofrequency waves they emit. Radiofrequency signals from cell phones can cause bodily tissues to heat up. In a study, after a 30-min confrontation of a cell phone with brain tissue, the brain temperature increased by 4.5°C [5]. Cell phone use near the head has raised concerns about potential harm to the central nervous system, both in children and adults [6]. The brain is exposed to radiofrequency radiation during phone conversations [7].

At present, children have increasingly come to rely on smartphones for a diverse set of activities. This encompasses attending online classes, communication with peers, indulging in gaming, online shopping, and watching entertainment content. Moreover, children have transitioned from traditional books to using smartphones for reading and academic pursuits. Smartphones provide access to educational resources, enable them to stay in touch with friends and family, and support skill development. This way of life significantly shapes the daily routines of children, potentially fostering a deep attachment to their smartphones that may eventually lead to addiction [8].

2. Material and Methods

The present survey based study was conducted on the children of age group 2-10 years during October 2022 to January 2024. A total of 84 Indian families participated in this study.

Smartphone addiction, cognitive abilities and posture were assessed using specially constructed e-questionnaire in English language. A self-constructed e-questionnaire based on “Digital Addiction Scale for Children” and “Cognitive Flexibility Scale” was sent randomly to various social groups through various social media platforms.

The Digital Addiction Scale for Children is a 25 item self-report instrument that was developed based on nine diagnostic DSM-5 IGD criteria and also mapped onto Griffiths 31 six core addiction criteria (preoccupation, tolerance, withdrawal, mood modification, conflict, and relapse). Added to those were three additional criteria (i.e., problems, deception, and displacement). The problems criterion refers to life necessities that could become uncontrollable due to digital addiction such as sleep, discord with parents, money management, and academic achievement. Deception refers to how children lie to their parents about the amount of time and what they do on their DDs. Displacement refers to parents feeling disconnected from their children, which results in the compromising of the family unit [9].

The Cognitive Flexibility Scale is a parent/caregiver report measure developed to assess the multidimensionality of flexibility in youth. The FS was developed by four executive function specialists (L.G. Anthony, L. Kenworthy, B. Yerys and G.L. Wallace) through an iterative process. It comprises of 50-items, with a total score as an overall measure of flexibility problems calculated by summing all items, with some positively-worded items reverse scored. Questions present observable day-to-day characteristics/ responses that highlight a child’s cognitive flexibility style [10].

3. Result

Study included children of Age Group between 2-10 years. 82 participants participated in the study. Approximately 58.5% children use mobile phone for more than two hours daily, and about 9.7% children use it for more than 6 hours on daily basis.

Table 1 Demographic Data of Participants

Characterstics	Mean	SD	Minimum	Maximum
Age	6.2	3.2444	1.6	10

3.1. Gender

Table 2 Comparison of Gender in Study.

Male	Female
51	31

About 72% parents agreed that their children spend a lot of time using electronic devices when not at school, and about 51% of children feel upset when not able to use any device, 54.9% children get irritated or aggressive when asked to stop using their device.

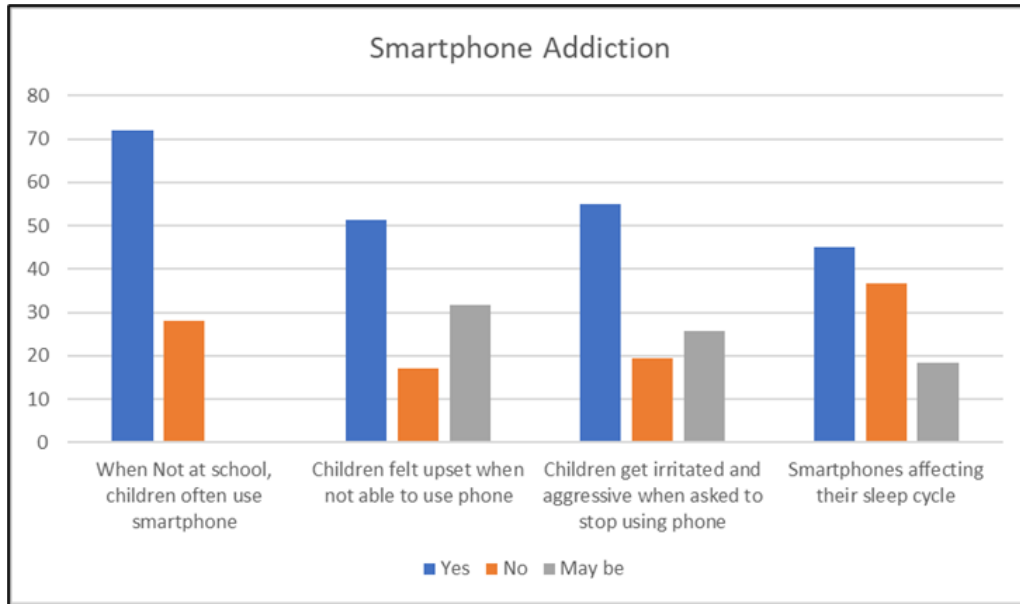


Figure 1 Key points of Smartphone Addiction Scale in Children

About 20% of the children participated in the study were not able to think flexibly to solve new problem using problem solving skills and were not able to gather multiple bits of information at a time.

The participants who exceeded 6 hours of daily usage, in them Cognitive Flexibility Scale score decreases below normal, which turned out to be 66.7% of those who are using phone for more than 6hours.

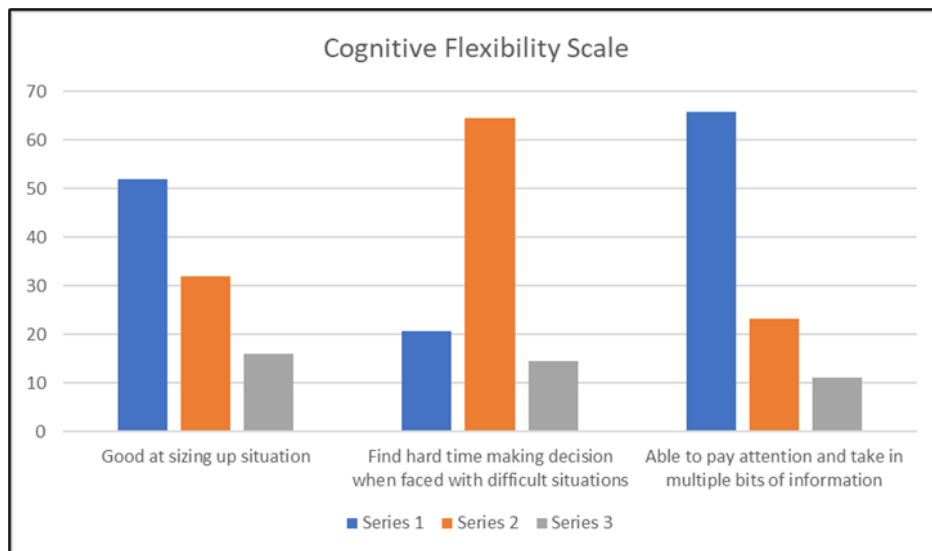


Figure 2 Key points of Cognitive Flexibility Scale in Children

Chi Square Test was performed to statistically check the data obtained from the survey and it showed considerable association between Smartphone addiction and decrease in cognitive ability in Children ($p < 0.001$).

4. Discussion

The current study aimed to investigate the effects of smartphone addiction on cognitive function in children below 10 years of age. Smartphones (and associated mobile technologies) have the potential to alter a wide range of cognitive areas, however empirical research on the cognitive effects of smartphone technology remains restricted. This is acceptable, considering that the underlying technology is still relatively new and developing. Smartphones, on the other hand, are becoming increasingly ubiquitous in our lives with each passing year. [11]

Although research on the possible cognitive effects of smartphone technology is expanding, the findings are contradictory and ambiguous. The often-contradicting findings imply that not all smartphone usage is created equal; certain applications, multitasking tactics, or notification settings may modify the relationship between total smartphone use and various cognitive functions. [12]

Arns et al. [13] reported that decrease in brain activity was associated with the use of mobile phone. In addition, Kalafatak et al. [14] found that mobile phone usage has a significant negative impact on working memory performance. The effect was noticed even after the 5-minutes use of mobile phone.

In this study, it was identified that excessive smartphone usage deteriorates the cognitive function in children. The results of present study are in line with the results of other studies published in different countries. The present study explored that excessive smartphone usage affects the sleep cycle of children which may result in sleep disorders. Consequently, less sleep duration can lead to impaired cognitive functions.

The parents need to be educated on the proper usage and practice of mobile phones. They need to ensure that mobile phone usage should be for essential tasks so it will not affect the performance of children.

Limitations of the study : Sample size of this study was less so further study can be done on larger population to confirm the current evidence of the role of mobile related cognitive disturbances.

5. Conclusion

Excessive use of mobile phone is associated with cognitive function impairment assessed by Cognitive Flexibility Scale (CFS) score.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] Alhazmi AA, Alzahrani S, Baig M, Salawati E, Alkatheri A. Prevalence and factors associated with smartphone addiction among medical students at King Abdulaziz University, Jeddah. *Pak J Med Sci.* 2018;34(4):984–988. doi: 10.12669/pjms.344.15294.
- [2] Alosaimi FD, Alyahya H, Alshahwan H, Al Mahyijari N, Shaik SA. Smartphone addiction among university students in Riyadh, Saudi Arabia. *Saudi Med J.* 2016; 37:675–683. DOI: 10.15537/Smj.2016.6.14430

- [3] Wilmer, H. H., Sherman, L. E., and Chein, J. M. (2017). Smartphones and cognition: a review of research exploring the links between mobile technology habits and cognitive functioning. *Front. Psychol.* 25, 605. doi: 10.3389/fpsyg.2017.00605
- [4] Al-khlaiwi TM, Habib SS, Meo SA, Alqhtani MS, Ogailan AA. The association of smart mobile phone usage with cognitive function impairment in Saudi adult population. *Pak J Med Sci.* 2020;36(7):1628-1633. doi: <https://doi.org/10.12669/pjms.36.7.2826>
- [5] Develi I, Sorgucu U. Prediction of temperature distribution in human BEL exposed to 900MHz mobile phone radiation using ANFIS. *Appl Soft Comput* 2015; 37:1029-36
- [6] Lindholm H, Alanko T, Rintamäki H, Kännälä S, Toivonen T, Sistonen H, et al. Thermal effects of mobile phone RF fields on children: A provocation study. *Prog Biophys Mol Biol* 2011; 107:399-403.
- [7] Perrin A, Cretallaz C, Collin A, Amourette C, Yardin C. Effects of radiofrequency field on the blood-brain barrier: A systematic review from 2005 to 2009. *C R Phys* 2010; 11:602-12.
- [8] Nasution, M. (2021). Factors affecting smartphone addiction in children. *Proc. Int. Sem. Isl. Stu.* 2, 108-115.
- [9] Kwon M, Lee J-Y, Won W-Y, Park J-W, Min J-A, Hahn C, et al. (2013) Development and validation of a smartphone addiction scale (SAS). *PloS one* 8: e56936. doi: 10.1371/journal.pone.0056936 PMID:23468893
- [10] Hawi, Nazir S., Maya Samaha, and Mark D. Griffiths. "The digital addiction scale for children: Development and validation." *Cyberpsychology, Behavior, and Social Networking* 22.12 (2019): 771-778.
- [11] Wilmer HH, Sherman LE and Chein JM (2017) Smartphones and Cognition: A Review of Research Exploring the Links between Mobile Technology Habits and Cognitive Functioning. *Front. Psychol.* 8:605. doi: 10.3389/fpsyg.2017.00605
- [12] Richtel, M. (2010b). Growing Up Digital, Wired for Distraction. Available at: <http://www.nytimes.com/2010/11/21/technology/21brain.html?pagewanted=all&r=0> [accessed April 16, 2015].
- [13] Arns M, Van Luijtelaaar G, Sumich A, Hamilton R, Gordon E. Electroencephalographic, personality, and executive function measures associated with frequent mobile phone use. *Int J Neurosci.* 2007;117(9):1341-1360.
- [14] Kalafatak F, Bekiaridis-moschou D, Gkioka E, Tsolaki M. Mobile phone use for 5 minutes can cause significant memory impairment in humans. *Hellenic J Nuclear Med.* 2017;20(Suppl):146-154