Original Article

Psychophysical and Cognitive Adverse Effects of Smart Phones Overuse on Children and Adolescent

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Abstract

Background: The excessive use of smartphones is seen as a source of child and adolescent violence and probably impacts cognitive function. As the world of mobile phones are continuously evolving, the violence factor is an endless argument. Smart mobile can cause problems other than violence which might be physical, cognitive, or psychological. **Objectives:** The study aims to clarify the dangers of smartphones overuse on psychophysical and cognitive function. **Materials and Methods:** A prospective follow-up study was conducted that included 100 children. A convenient sample of participants and their parents were interviewed directly and were asked about their children's smart phones habit, causes of cellular phone overuse, school performance. Participants behavior was assessed by Modified overt aggression scale, whereas cognitive function by Montreal Cognitive Assessment test was done in 1, 6, and 12 months interval. **Results:** 50% of participants used smartphones for more than 3 hours per day, as well as most of the cases who used smartphones for a longer duration were children (25%) as compared to other age groups, children used smartphones mainly for violent and nonviolent games than in social applications, excessive mobile phone usage for more than 3 hours daily associated with significant health problems like neck pain (68%), headache (52.1%), eye tearing (51%), sleep problems (47.6%), and backache (47.1%). Children and adolescents who used smartphones for less than 1 hour daily show an increment in their scores, whereas those who used smartphones for more than 1 hour daily gradually decreased their scores with the time used. **Conclusion:** Smartphone overuse had a significant impact on behavior, school performance, and cognitive function.

Keywords: Cognitive function, modified overt aggression scale, montreal cognitive assessment test, school performance, smart phones

Introduction

Cellular phones have become a vital and progressively unavoidable part of our daily lives. It must also be a critical part in communication offices, with numerous learning alternatives, and information becomes the source of day-to-day activities. In the last decade, the utilization of mobile phones has expanded and there is an incredible sense among individuals that mobile phones have encouraged their daily occupations and made the needs more reasonable.[1] Exposure to radiofrequency electromagnetic field radiation generated from mobile phones increases body core temperature and can cause cognition disabilities by affecting on the human hippocampus.[2,3] Excessive use of mobile phones was associated with decreased physical activity, lower muscle, and higher fat mass.[4]

There are multiple reasons for smartphone abuse among children and teens, although the chance components are far from true. For the most part, it has been accepted that the causes of abuse are a complex interaction between natural, mental, and social components, especially child-rearing styles, a disappointment in creating a positive parent–child relationship, and successful family communication. Several previous studies have illustrated that sociodemographic variables (e.g., sex, age, home), natural family and social variables (e.g., family connection, peer relationship, school climate) and mental components

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Submission: 10-Jan-2023 **Accepted:** 26-Jan-2023
Published: 09-May-2024

Access this article online

Quick Response Code:

Website: https://journals.lww.com/mjby

DOI: 10.4103/MJBL.MJBL_31_23

How to cite this article: Muhammed NA, Taha MA. Psychophysical and cognitive adverse effects of smart phones overuse on children and adolescent. Med J Babylon 2024;21:46-51.

(e.g., sadness, anxiety, stress) had an imperative impact on cellular phones.[5] Although smartphone addiction is not included in the latest version of the Psychiatric Diagnostic and Statistical Manual, research and social interventions have been carried out to address the detrimental effects of smartphone addiction.[6] The 2019 epidemic of coronavirus (COVID-19) occurred in the period of global digitalization, characterized by the fast connection between people and information around the world,[7] As a result, adults and children spend more time at home, and are increasingly using technology devices.[8] and this reflects the importance of our study in estimating adverse effects of cell phones in Iraqi patients.

Materials and Methods

After obtaining the approval of informed consent from enrolled cases, the parents of the children, and the agreement of Azadi Teaching Hospital, Kiruk, Iraq, a prospective study was conducted for 125 consecutive children and adolescents who presented to the pediatric and neurology department at Azadi Teaching Hospital. After exclusion of participants with incomplete responses to our questionnaire and that we missed our communication with them, 100 children were included in the study, 55 were men and 45 were women with ages ranging between (8–16 years) between July 1, 2020 and January 1, 2022. All cases or their parents were asked to complete a questionnaire that contained questions about participant mobile device usage. Age below 8 years excluded from the study, because it is difficult to apply Montreal Cognitive Assessment (MOCA) scores below these age groups in Iraq, as these assessment tools need a good orientation of the child to time, place, person, serial number subtraction, and a good knowledge of the name of different objects.

These questions were about sex, age, school performance, daily use of mobile phones, type, and reason for the chosen application that was used, and then parents were asked alone about their child's behaviors according to the modified overt aggression scale (MOAS), the scale consist from 100 score which distributed to main four items: verbal aggressions (e.g., screaming angry and a clear threat), physical aggression against objects or property (e.g., throwing objects, hitting windows, burning fire), physical aggression against self (e.g., minor burns, mutilations, deep cuts, fractures), and physical aggression (e.g., hitting, kicking, kicking, attacking other people). Then all participants were subdivided into groups according to the duration of daily mobile phone use and which application is interesting. All cases were first assessed for cognitive function, after 6 months and 1 year of visit according to the MOCA. The scale consists of a maximum score 30 points and assesses the various cognitive areas of attention and concentration, management functions, memory, language, visual comprehension skills, conceptual thinking, calculation, and direction, with a maximum score of 26 points or more considered as normal cognitive function.[9] All participants evaluated the effect of the smart phone on their health, such as eye problems, neck pain, headache, backache, sleep problems**,** or having no problems at all. For these excessive users, they asked about the underlying causes of their habit. All information was analyzed using SPSS version 22.0 Microsoft Windows 10 Home Single Language. Continuous variables were expressed as mean, and descriptive data were expressed as percentages (%). The variables between different groups were compared using a χ^2 test for all variables in demographic data and physical effects of the smart phone, while the proportions between different groups were compared using a paired *t* test. A *P*-value of <0.05 was considered statistically significant.The study was conducted in accordance with the ethical principles that have their origin in the Declaration of Helsinki. It was carried out with patients' verbal and analytical approval before sample was taken. The study protocol and the subject information and consent form were reviewed and approved by a local ethics committee according to the document number 19 in November 15, 2022.

Results

Most of the cases (50%) used smartphones for more than 3 hours a day. According to age groups, most of the patients who used smartphones for longer periods were children (25%) compared to other age groups (15%) and (10%), respectively, which is statistically significant (*P*-value < 0.001). On the other hand, men who used smartphones had a longer duration (37%) than women (13%), which is statistically significant (*P*-value = 0.001) [Table 1].

Smartphones are used primarily by children more for violent and nonviolent games than in social applications, whereas their usage for learning and music was much less, unlike adolescents who used them mainly for social, learn and music applications, whereas the most popular applications that were used by men are social and violent games, but less for music, learn and nonviolent games, but on the other hand, women used social and non-violent games more than others [Table 2].

Smartphones that were used for more than 3 hours a day suffered mainly from neck pain (68%), headache (52.1%), eye tearing (51%), and sleep problems (47.6%), and these relationships were statistically significant [Table 3].

By evaluation of cognitive function that was done initially, after 6 months and 1 year, children and adolescents who used smartphones for less than 1 hour daily show an increase in their scores and there is statistical significance when compared to their initial score with the last visit, whereas those who used smartphones for more than 1 hour had a gradual decrease in their score with the time

Table 1: Classification of the sample according to the duration of the usage of the smart phone

Study variables (No. 100)		Daily device use (hours per day)			*P*-value
		<1	2–3	>3	
		No. (%)	No. (%)	No. (%)	
Age	8–10 years	6 (6%)	5 (5%)	25 (25%)	<0.001*
	11–13 years old	5 (5%)	10 (10%)	15 (15%)	
	14–16 years old	5 (5%)	19 (19%)	10 (10%)	
	Total	16 (16%)	34 (34%)	50 (50%)	
Sex	Male	6 (6%)	12 (12%)	37 (37%)	0.001*
	Female	10 (10%)	22 (22%)	13 (13%)	
	Total	16 (16%)	34 (37%)	50 (50%)	

*Significant

Table 2: Types of smartphone application usage according to age groups

Study variables (No. 100)		Application type (%)					P-value
		Social	Violent	Non-violent	Learn	Music	
Age	8–10 years	27.40	31.50	31.50	1.40	10.40	<0.001*
	11–13 years old	41.80	14.90	23.90	9.00	10.40	
	14–16 years old	33.70	2.10	6.30	32.60	25.30	
Sex	Male	32.10	22.40	14.90	14.90	15.70	0.553
	Female	36.60	5.00	24.80	17.80	15.80	

*Significant

Table 3: Classification of physical effects of smart phones according to duration of use

Study variables (No. 100)	Duration of the smart phone users (h/d)			Total	*P*-value
	<1	2–3	>3		
Neck pain	7 (14.0%)	9 (18%)	34 (68%)	50 (50%)	0.001*
Eye tearing or pain	8 (14.5%)	19 (34.5%)	28 (51%)	55 (55%)	<0.001*
Headache	11 (15.5%)	23 (32.4%)	37 (52.1%)	71 (71%)	<0.001*
Backache	4 (23.5%)	5 (29.4%)	8 (47.1%)	17 (17%)	0.649
Sleep problems	7 (33.4%)	4 (19%)	10 (47.6%)	21 (21%).	0.033*
Nothing	4 (17.4%)	6 (26.1%)	13 (56.5%)	23(23%)	0.664

*Significant

Table 4: Classification of the Montreal Cognitive Assessment (MoCA) test score according to the duration of mobile device use

Duration of mobile use (h/d)	MOCA score initially	MOCA score at 6 months	MOCA score at 1 year	*P*-value
<1	28.62	28.81	29.06	0.005*
2–3	29.24	28.38	27.82	0.004*
>3	28.08	26.48	24.86	<0.001*

* Significant

used, as when compared to their initial score with their last, it shows statistical significance [Table 4].

Children and adolescent who used smartphones for less than 1 hour were less aggressive with the MOAS score (4.44) with good to very good school performance (68.8%) and (31.2%), respectively, unlike those who used smartphones for more than an hour, were more aggressive (16.24, 51.68) and borderline (76.5%, 4%) to poor (2.9%, 40%) school performance, which means that with long-duration usage of smartphones will result in more aggression and low school performance [Table 5].

The most causes of children's excessive mobile phone usage are occupying the emptiness between the parents and children (31%), parents unaware of the mobile use danger (20%), getting rid of kids' annoyance (19%), whereas escape from reality (15%), imitating parents (10%), and finally bragging about their kids owing those devices (4%) [Figure 1].

Table 5: Classification of school performance and behavioral effects Modified Overt Aggression Scale (MOAS) of smart phone users according to the duration of use

Duration of mobile use (h/d)	MOAS score	School performance			
		Very good	Good	Border line	Bad
<1	4.44	11 (68.8%)	5(31.2%)	0 (0%)	0 (0%)
2–3	16.24	7 (20.6%	26 (76.5%)	1 (2.9%)	0 (0%)
>3	51.68	5(10%)	2 (4%)	23 (46%)	20 (40%)

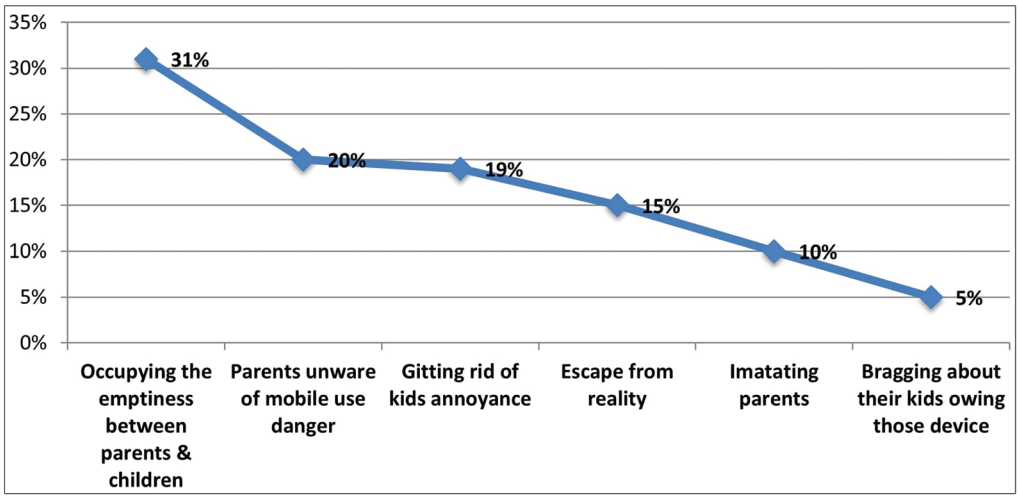

Figure 1: Causes of children's tendency for mobile phone use

Discussion

In recent years, smartphones have become something that some will not survive without[1]; in our city, their use has steadily increased among children and adolescents, especially after the COVID-19 pandemic, leading them to spend more time at home and with the main use of technological tools. In our study, we classified the sample into three groups according to the duration of mobile phone use and its impact on cognitive and psychophysical health status; furthermore, we clarified the underlying causes of the tendency of children to use smartphones, also.

In our study, the prevalence of excessive mobile phone use was observed, which was higher than that of young people in other countries such as Japan (26.4%),[10] the United Kingdom (38.9%),[11] but was similar to the study[12] that mentioned the prevalence rate of mobile phone users of 59.6%. This discrepancy found between studies may be due to economic and cultural differences between different countries.

In the present study, we found a significant association between sex and those with excessive use of mobile phones. Some studies mentioned that women were more likely to use mobile phones compared to men,[10-12] whereas other studies found that men are more likely to be at risk of overuse of mobile phone overuse.[13,14] Meanwhile, some studies did not find gender differences in cell phone overuse.[15,16] These inconsistent findings between studies warrant further enrollment of large samples to see whether gender may play a role in smartphone addiction.

In this study, the majority of participants were more likely to use their mobile phones for more than 3 hours daily, as well as use them primarily for violent and nonviolent games and social networks. Similarly, the literature suggests that spending more time on a high-frequency mobile phone is more likely to increase the risk of addiction to mobile phone addiction.[17]

Our study shows that excessive mobile phone users were more likely to experience pain in their neck (68%), headache (52.1%), tearing and pain in the eyes (51%), and backache (47.1%). Similarly, the literature showed that neck and hand pains[18,19] and visual fatigue[20] were associated with excessive mobile use. Additionally, addiction-induced neck and shoulder pain may cause musculoskeletal disorders.[21] The continuous use of a cell phone can also cause defective postures that cause pain in different parts of the body.[19,22]

Regarding sleeping patterns, according to previous studies,[23,24] the results of these investigations showed that excessive use of cell phones was more likely to sleep less than 6 hours a day, compared to our study, most of them (47.6%) had disturbances in sleep. This could be

because smartphone users may find it difficult to stop using smartphones before going to bed, and this may lead to shorter sleep duration and poorer sleep quality.[25] Furthermore, the blue light emitted by a smartphone can have a negative effect on the circadian rhythms of an individual, leading to negative sleep consequences, such as going to bed later than intended, reducing overall sleep time.[26]

In addition to these physical consequences on health, excessive use of mobile phones can potentially lead to impairment of cognitive functions, such as impaired specific attention domains, low inhibitory control, impaired working memory, reduced numerical processing capacity, and change in social cognition.[1] As our results supported that excessive cellular phone users were less likely to have very good or good academic performance compared to nonusers, this finding indicates that smartphone addiction can lead to lower academic achievement among students, as mentioned,[27] one explanation could be that smartphone addiction can distract students' attention away from academic tasks.[28]

Our findings suggest that occupying the emptiness between parents and children (40%) and parents unaware of mobile use (20%) are significant risk factors for cell phone dependency among children and adolescents, which is in agreement with the study which has documented that family communication and parental neglect are related to smartphone addiction.[29]

Conclusion

Smartphone overuse has had a significant impact on decreasing cognitive abilities; these are those who imagine reasoning actions, solve simple questions, make decisions, and exercise judgments, it can be subtly interpreted as bad school performance and lack of understanding. In addition to cognitive decline, it has had psychologically harmful effects that those children have become more aggressive than others, in addition to its physical adverse effects that presented as headaches, neck pain, poor sleep, and eye problems.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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