













RESEARCH ARTICLE

Prevalence and impact of the use of electronic gadgets on the health of children in secondary schools in Bangladesh: A cross-sectional study

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Abstract

Background and Aims: Use of technological gadgets has rapidly been increasing among adolescents, which may result in health issues and technology addiction. This study focuses on the prevalence of usage of technological gadgets and health-related complications among secondary school-going children of Bangladesh.

Methods: A total of 1803 secondary school students from 21 different districts of Bangladesh participated in the study. The children were asked questions relating to their access to electronic gadgets, time spent on outdoor activities, and whether they experienced any health-complications as an after-effect of the usage. A binary logistic regression model was adapted considering time spent on gadgets as an independent variable and health problems (physical and mental) as the dependent variable.

Results: Among all the gadgets, 67.11% of the participants were reported to use mobile phones on a daily basis. Due to the ongoing COVID-19 pandemic, 24.48% of respondents used electronic gadgets for attending online classes. The participants were reported to use gadgets significantly more ($P < .05$) in 2020 as compared to 2019. Children showed less tendency to spend time in outdoor activities. More than 50% of the participants spend time doing outdoor activities for less than 1 hour daily. An association between gadget use and health problems like headache, backache, visual disturbance, and sleeping disturbance has been observed in our study.

Conclusion: This study demonstrates that different socio-demographic factors have influence on the use of gadgets by children, and this use has greatly been affecting

S M Mahbubur Rashid and Adnan Mannan contributed equally to this work.

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both the physical and mental health of the secondary school-going students of Bangladesh.

KEYWORDS

Bangladesh, gadgets, health complications, secondary school students

1 | INTRODUCTION

The use of technological gadgets is growing at an unprecedented pace all over the world.¹ In present times, not only adults but also children are overly invested in technological gadgets, which raises questions and concerns about their effects on children in terms of physical and mental development.^{2,3} Although technology has its contribution in breaking geographical barriers and making information accessible, however, technology has its own negative records as well.⁴ Today's technology-dependent global population is constantly adopting an unhealthy, sedentary lifestyle, putting them at risk for developing severe diseases and mental disorders.⁵ In regards to the situation in Asia, a previous study conducted on six Asian countries concluded that the adolescent cohort aged 12 to 18 years held 62% ownership of smartphones overall. The easy accessibility to gadgets and the internet in recent years has led to this cohort developing a keen interest about the internet's use, which further developed into an addiction.⁶

In a global review study, it was found that there is a positive correlation between the excessive use of electronic devices like smartphones and computers and psychiatric comorbidity. The effects were more on young children than other age cohorts.⁷ According to the US Centers for Disease Control and Prevention, an average child spends about 8 hours a day watching electronic screens.⁸ Too much screen time and lack of sleep can lead to lack of productivity among children. In worst cases, teens are driven into doing activities defying rules, becoming social delinquents.⁹ Studies also prove that the excessive use of electronic gadgets in early childhood or teenage years can result in different psychological disorders, like attention deficit hyperactivity disorder (ADHD), as well as physiological complications like obesity, myopia, dryness, blurring vision, headache, etc.^{8,10}

At present, the global adolescent population (10-19 years old) is more than 1.2 billion.¹¹ In Bangladesh, adolescents constitute around 22% of the whole population.¹² The majority of them appear indulged in digital devices and technologies.⁴ Through the easy accessibility to the internet, at present, digital devices have become part and parcel of these young people's lives in Bangladesh.^{4,5} A recent UNICEF study has revealed that internet use among adolescents in Bangladesh has skyrocketed to 800 times the scale it was in the year 2000.¹³ Numerous teenagers pass countless times using technological gadgets in Bangladesh similar to other countries.^{14,15} According to a study, 90% of the adolescents in Bangladesh use smartphones.¹⁶ It is notable that this population does not always use their phones, the internet and other gadgets for merely socializing or learning purposes.¹⁵

Hence, owing to the above-mentioned facts, the present study was carried out in various cities of Bangladesh to find out the effect of the use of electronic gadgets on the overall behavior and health of secondary school-going children. Similar types of studies were conducted earlier with children in Western countries and also the countries having a developed society.^{14,15} To the best of our knowledge, this is the first-ever study on this topic in Bangladesh, which aimed to assess the connection between usage of gadgets and health complications of the different classes of secondary school-going children. The principal aim of the study was to comprehend the influence of gadget use and daily screen time on the physical and physiological well-being of secondary school students from various regions across Bangladesh in the year 2020.

2 | METHOD

2.1 | Study area and population

We carried out the descriptive cross-sectional study among 1803 secondary school-going children and adolescents of grades 6 to 10 enrolled in Bangla, English, and Arabic medium schools belonging to 21 districts of Bangladesh from June 2020 to December 2020. The study consisted of respondents from eight major divisional megacities (ie, Dhaka, Chattogram, Sylhet, Khulna, Rajshahi, Mymensingh, Barisal, and Rangpur) as well as from remote rural districts like Bandarban, Tangail, Jamalpur, Bhola, and so on. Here, districts from each division were randomly selected, and all respondents including tribal origins were selected randomly from every class to avoid any biased outcome.

2.2 | Exclusion criteria

Students enrolled in schools below grade 6, and students attending college and universities were not included in this study. We also refrained from conducting interviews in schools that did not provide consent to take part in the interview. Television was excluded from the list of gadgets as gadgets refer to small mechanical or electrical devices, which belong to either one or more following categories, that is, mobile phones, tabs, or any other wireless devices that have novel purposes.¹⁷

2.3 | Data collection

The interviews were conducted based on a preformed questionnaire. An evaluation of the preliminary questionnaire in a piloting study was

made to validate the tools developed by eight experienced epidemiologists, endocrinologists, social science researchers, and pediatricians. The questionnaire consisted of three parts: socio-demographic properties, gadget usage, and physical problems encountered by the participants. The questionnaire was constructed bilingually (English and Bangla, the mother tongue) to make it easily understandable. The interviews were carried out by 37 dedicated, well-trained individuals from life science and medicine backgrounds. The sampling process was both random and purposive where institutions were chosen purposively to maintain diversity, while students were chosen randomly. The field test took place among the children of mentioned grades from multiple regions instead of limiting it to some specific study sites. The interviewers maintained social distancing and hygiene protocols during physical interviews. The consent of school authorities and guardians was obtained for carrying out the research survey, and the motive of the study was explained well to the students before starting the survey. The accuracy of the interviews was monitored by six supervisors and principal investigators.

2.4 | Measurements

The association between various socio-demographic variables and gadget use was drawn by comparing the data obtained from the participants. The average daily screen time and sedentary behavior of the participants were also recorded to observe if these factors influenced their physical and mental wellness. The questionnaire also included the gadget type used by the participants, the time period expended daily usage of gadgets in the years 2019 and 2020. The physical and psychological concerns experienced by the participants such as headache, sleeping difficulties, backache, visual concerns, pain in the limbs, and depression were recorded too.

2.5 | Statistical analyses

The statistical analyses of this study were performed using R (R core team, 2020) software. Pearson Chi-square statistics were used to test the association between gadget use and socio-demographic factors. Test result with less than .05 *P*-value is considered as statistically significant factors for gadget use. Types of gadget use and purpose of gadget use are shown through different graphical presentations. Figures were produced using Graph-Pad Prism (Graph-Pad, San Diego, CA). Besides, the effects of gadget use on different physical and mental health problems were assessed by binary logistic regression. For each case, logistic regression is fitted considering time spent on gadgets as the independent variable and health problems as the dependent variable. In this study, logistic regression model is used to measure the effect of gadget use on different health-related problems. For testing the statistical significance of different categories of gadget use time, 5% level of significance is used. All the analysis was performed in R version 3.6.3.

2.6 | Ethics statement

The ethical approval for this research was taken from the Ethical Review Committee of Chittagong Medical College (Memo no.-CMC/PG/2020/122).

3 | RESULT

3.1 | Respondents' socio-demographic characteristics

A total of 1803 secondary school-going children and adolescents participated in this study. Gender bias was minimized as the male (50.10%) to female (49.90%) ratio was close to 1. The social and demographic characteristics of the participants are presented in detail in Table 1. Regarding gadget use, male children showed high interest (89.25%) than female (85.52%). Most respondents of this study belonged to Bangla medium schools (70.3%) followed by English (12.4%) and Madrasha (17.4%). Most of the participants (>90%) from both the Bangla and English medium schools were using gadgets, while significantly (*P*-value <.001) a big portion of participants (>31%) from Madrasha were far from using gadgets. A pattern of gradual increment of using gadgets (*P*-value = .0002) was observed among the participants living in rural, suburban and urban areas, respectively. Similar patterns of increased gadget use were observed with the increased monthly family income of the participants (*P*-value < .0001). Almost all (>93%) of the participants whose parents were graduates (tertiary level, at least) were found using gadgets. More obese participants (93.58%) were found using gadgets than underweight participants (84.26%).

3.2 | Variation in the use of gadgets

More than 87% of participants were reported to use any form of electronic gadgets (Figure 1A). Smartphones were found to be the prominent one; 67.11% of the participants used this type of gadget on a daily basis for various purposes. About 39% of participants used gadgets for watching cartoons or movies followed by social media (27%) and video games (17%) (Figure 1B). However, 24.48% of the participants also used these devices for participating in online classes due to this ongoing COVID-19 pandemic. A tiny portion of participants (8.74%) used these gadgets for normal communication purposes.

3.3 | Use of gadgets and effect on physical activities and health

Prolonged use of gadgets has been observed among the participants in 2020 compared to the year 2019. While only 33.50% of participants reported spending time on gadgets at least 2 hours per day in 2019, the percentage increased up to nearly 53% in 2020 (Figure 2A).

TABLE 1 Distribution of gadget use by socio-demographic characteristics of the participants (n = 1803)

Variable	Using gadgets		χ^2 test (P-value)
	Yes (%)	No (%)	
Gender			
Male	789 (89.25)	95 (10.75)	5.33 (.021)*
Female	786 (85.52)	133 (14.47)	
Medium of education			
Bangla	1147 (90.52)	120 (9.47)	123.71 (<.001)*
English	213 (95.55)	10 (4.48)	
Madrasha	215 (68.69)	98 (3.13)	
Place of residence			
Rural	717 (84.05)	136 (15.54)	16.25 (.0002)*
Sub-urban	190 (89.20)	23 (10.79)	
Urban	668 (90.63)	69 (9.36)	
Type of population			
Aboriginal	381 (85.61)	64 (14.38)	1.41 (.2349)
Nonaboriginal	1194 (87.9)	164 (12.07)	
Family monthly income			
<10 000 (118 USD)	363 (81.94)	80 (18.05)	35.07 (<.0001)*
10 000-20 000 (118-236 USD)	316 (83.15)	64 (16.84)	
20 000-30 000 (236-354 USD)	375 (89.71)	43 (10.27)	
30 000-50 000 (354-590 USD)	294 (93.63)	20 (6.37)	
>50 000 (590 USD)	227 (91.53)	21 (8.46)	
Father's education			
None	102 (71.83)	40 (28.16)	62.89 (<.0001)*
Primary	384 (83.29)	77 (16.70)	
SSC	330 (86.16)	53 (13.83)	
HSC	269 (90.87)	27 (9.21)	
Graduation	219 (93.58)	15 (6.41)	
Post-graduation	271 (94.42)	16 (5.57)	
Mother's education			
None	111 (74.00)	39 (26.00)	63.46 (<.0001)*
Primary	430 (81.91)	95 (18.09)	
SSC	407 (90.04)	45 (9.95)	
HSC	249 (89.56)	29 (10.43)	
Graduation	198 (95.19)	10 (4.81)	
Post-graduation	180 (94.74)	10 (5.26)	
Body mass index			
Underweight	664 (84.26)	124 (15.73)	13.229 (.0041)*
Normal	727 (89.42)	86 (10.57)	
Overweight	111 (89.51)	13 (10.48)	
Obese	73 (93.58)	5 (6.41)	

* $p < 0.05$.

The percentage of participants using gadgets (>6 hours) was three times more in 2020 as compared to 2019. Comparatively larger percentage of the participants (47.20%) spend 1 to 2 hours of time on gadgets in 2019; however, by 2020, a greater time spending trait was evident, and only 33.72% of participants of the total spend used gadgets 1 to 2 hours per day.

Along with being occupied with the gadgets, the participants showed less tendency of spending time through outdoor activities including playing games, walking, and doing physical exercises (Figure 2B). Nearly 23% of the participants spent more than 2 hours doing outdoor activities. More than one-fourth (26.46%) of the participants did not spend time outdoors regularly. Only 23.35% of the

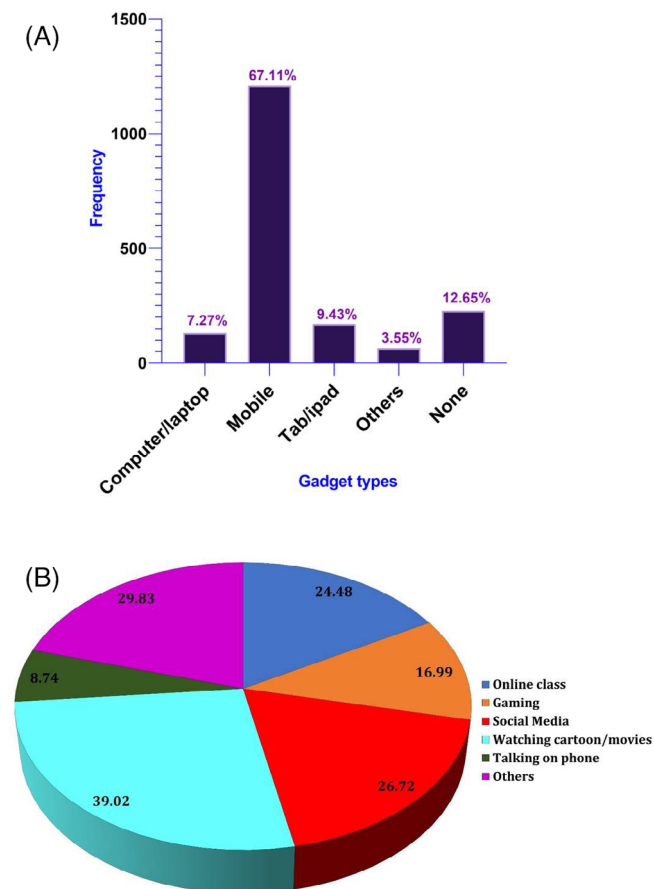


FIGURE 1 Types and purposes of use of gadgets by students; (A) Percentage of participants who used smartphones, tablet devices, desktop computers or laptops, and other types of gadgets. (B) Nature of purposes of use of electronic gadgets by school students

participants followed a good practice of outdoor activities for more than 2 hours. Participants were found to be suffering from headache, sleep disturbances, and backache, pain in limbs, visual disturbance, or depression. 45.26% of headache, 51.11% of sleeping disturbance, 48.18% of backache, 39.81% of limbs pain, 45.51% of visual disturbance, and 52.12% of depression associated participants belonged to the group who use gadgets for more than 2 hours daily. Participants who did not spend time at all with gadgets (0-1 hour) were found relatively healthier with significantly less ($P < .05$) health complications. The use of gadgets for more than 1 hour has detrimental effects as it is shown in Figure 3.

Table 2 has shown the logistic regression analysis to assess the effect of time spent on gadgets on various physical and mental problems. Physical problems like headache (OR = 2.41 for >6 hours), backache (OR = 3.203 for 4-6 hours), visual disturbance (OR = 2.384 for 4-6 hours), and sleeping disturbance (OR = 5.988 for >6 hours) were categorized as regularly occurring physical concerns, but an irregular pattern was observed in the frequency of occurrence. Further, this study also addressed whether the participants feel depressed after using gadgets. Table 2 showed that headache is significantly associated with time spent on gadgets 4 to 6 hours and >6 hours. Those

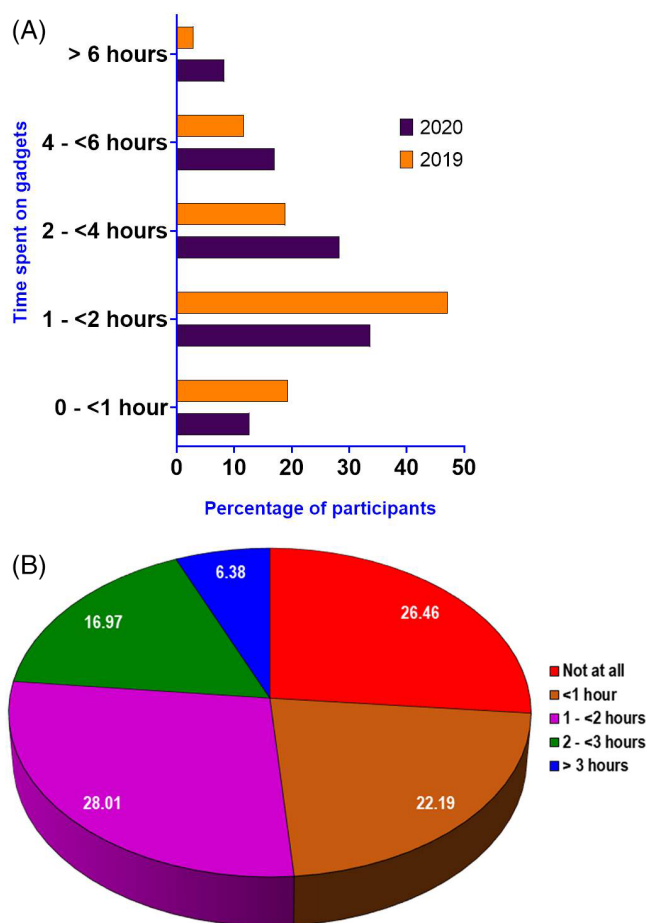


FIGURE 2 Pattern and total time spending on gadgets and outdoor activities. (A) A comparison between 2019 and 2020 on daily time spends on gadgets and (B) pattern of time durations spent in outdoor activities by participants

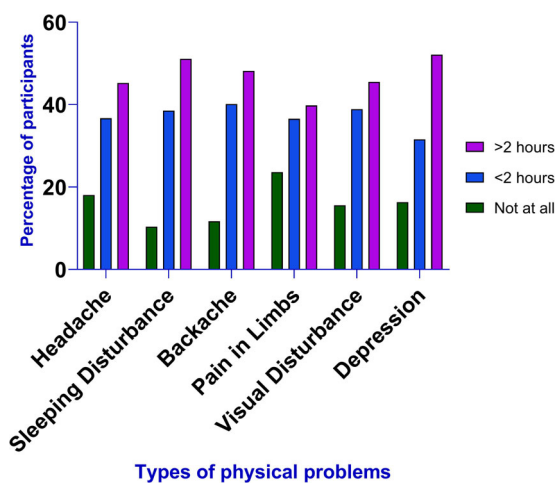


FIGURE 3 Types of physical problems for excessive use of gadgets

who spent more than 6 hours on gadgets are 2.41 times more likely to have regular headaches than those who do not spend time on gadgets (0-1 hour).

TABLE 2 Effects of time spent on gadgets on different physical and mental health

Variable	Odds ratio	SE	P-value
Headache			
Intercept	0.245	0.14	<.001***
Time spent on gadgets			
Not at all (ref)	1		
1-2 hours	1.14	0.178	.46
2-4 hours	1.44	0.206	.07
4-6 hours	1.55	0.202	.03*
>6 hours	2.41	0.347	.011*
Backache			
Intercept	0.080	0.259	<.001***
Time spent on gadgets			
Not at all (ref)	1		
1-2 hours	2.311	0.298	.005**
2-4 hours	2.014	0.343	.041*
4-6 hours	3.203	0.323	.0003***
>6 hours	4.664	0.469	.001**
Pain in limbs			
Intercept	0.246	0.156	<.001***
Time spent on gadgets			
Not at all (ref)	1		
1-2 hours	0.866	0.199	.473
2-4 hours	1.027	0.234	.909
4-6 hours	0.852	0.237	.500
>6 hours	1.052	0.452	.910
Visual disturbance			
Intercept	0.139	0.209	<.001***
Time spent on gadgets			
Not at all (ref)	1		
1-2 hours	1.781	0.251	.021*
2-4 hours	1.665	0.299	.088
4-6 hours	2.384	0.276	.001**
>6 hours	2.601	0.462	.038*
Sleeping disturbance			
Intercept	0.079	0.277	<.001***
Time spent on gadgets			
Not at all (ref)	1		
1-2 hours	2.908	0.317	<.001***
2-4 hours	1.915	0.392	.097
4-6 hours	5.926	0.331	<.001***
>6 hours	5.988	0.497	.0002***
Depression			
Intercept	0.371	0.119	<.001***
Time spent on gadgets			
Not at all (ref)	1		
1-2 hours	1.850	0.141	<.001***

TABLE 2 (Continued)

Variable	Odds ratio	SE	P-value
2-4 hours	1.077	0.161	.646
4-6 hours	4.321	0.171	<.001***
>6 hours	3.911	0.314	<.001***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

4 | DISCUSSION

This study has demonstrated a significant level of association between the use of electronic gadgets and the socio-demographic characteristics of secondary school-going students from Bangladesh. Based on the results of the study, among the secondary school-going children in Bangladesh, male participants are the dominant users of electronic gadgets. It was reported that there is no gender bias nowadays in accessing the technological facility in terms of electronic gadget uses.^{18,19} As per the previous literature, there is a lack of consensus with regard to gender and mobile/internet addiction, with some studies reporting higher prevalence in males²⁰⁻²² and some reporting higher prevalence in females.^{23,24} However, recent studies showed that male students are more likely (three times) to develop technology addiction as compared to female students and males tend to use gadgets for prolonged periods of time compared to females.^{1,13,25} In addition, among the Vietnamese youths, it has been reported that susceptibility of excessive gadgets/internet use has a significant relationship with their socio-demographic characteristics.²⁶

The percentage of using gadgets was greater for both Bangla and English medium school students compared to the Madrasha students. The reason behind this higher prevalence could be the fact that all the students of English medium²⁷ and a significant number of students of the Bangla medium schools in Bangladesh come from families with solvent financial status²⁸ and they have easy accessibility to the internet on their mobile phones or PCs.²⁹ This is consistent with the study, which reported that students who come from upper-income schools use more gadgets and even can afford personal cell phones than the students who come from lower-income schools.³⁰ In addition, many parents feel that the uses of such devices are beneficial for their children.³¹ It can be assumed that parents' involvement into and concern toward their children's education and well growth are some of the notable reasons behind gadgets addiction of their children.^{3,18} This is well supported by our observation that the use of gadgets is significantly related to increased monthly family incomes and parents' education.

This present study observed a very significant difference among students from urban, rural, and suburban areas. The prevalence of gadget usage is higher among urban students, while in Bangladesh, many rural areas are still deprived of many basic needs, so having access to the internet or other modern gadgets except for mobile phones is difficult on their part. This fact is supported by another study, which concluded that the urban environment imposes a bad influence on

children than in rural areas and significant differences prevail between urban and rural areas in the use of gadgets.³²

In this study, mobile (smart) phones are found to be the mostly used gadget followed by different forms of tablet devices, as expected, because of their user-friendliness and easy to carry/handle.³³⁻³⁵ Close to 13% of participants were reported not to use any gadget. Similar to the findings of a study on Malaysian elementary school students, here in this study, the participants were observed to use gadgets for watching movies/cartoons and social media interactions predominantly.³³ Unlike before, about one-fourth of the participants were found to use gadgets for participating in online classes, a new adaptation of the educational system for the ongoing coronavirus disease 2019 (COVID-19) pandemic crisis. Supporting this matter, an Asian study depicted that interpersonal influences result from different online activities (eg, gaming, online classes, social media) have a formidable effect on becoming partial to the gadgets use or the internet addiction and showing apathetic behavior towards outdoor activities.³⁶

A number of previous studies have reported concerns over the use of gadgets by children and adolescents that may affect their social, physical, and emotional functions negatively.^{19,25,35,37,38} Our study suggests that secondary school-going children are spending more time with gadgets in the year 2020 compared to the year 2019. It is an area of major concern as Liu et al suggested that the use of electronic gadgets for more than 2 hours daily has a detrimental effect on a person's physical and mental status.³⁸ A previous study on the pattern and susceptibility of excessive internet use among students reported that internet addiction creates a tendency of staying up late, which was significantly associated with different mental and physical discomforts.

According to the studies of Liu et al and Wahyuni et al, this type of practice can invoke serious health (physical and mental) issues.^{35,38} Another study conducted by CDC has also reported that this type of physical inactivity can lead to energy imbalance and can also enhance the risk of becoming obese and overweight.³⁹ In consistency with these claims, we have observed an increased occurrence of physical and mental problems in the secondary school-going participants of this study. Nearly 50% (on average) of the participants who reported using gadgets more than 2 hours daily were suffering from any form of headache, sleeping disturbance, backache, pain in limbs, visual disturbance, or depression.

Similar studies were reported earlier where the participants were suffering from headache, backache, and eye strain due to excess smartphone use. Some studies have found that physical exercise significantly helps to reduce the risk of myopia.⁴⁰ This could be the reason behind the association of 45.51% visual problems in our participants who happened to use gadgets for more than 2 hours daily. Moreover, a study in Indonesia revealed that long use of gadgets is capable of affecting eyesight.⁴¹ This research supports our findings quite well where we found a significant association between visual impairment and gadget usage.

Most of the participants who extensively use electronic gadgets stated that they experience sleeping difficulties and anger/depression in regular life. Many studies have been conducted on sleep quality

and technology use observed that gadgets especially mobile phone use trigger sleep disorders and disturbances among adolescents.^{42,43} Our finding was supported by another study, which concluded that more than 40% of their study population had insufficient sleep, which had a significant association with spending more than 2 hours per day using gadgets.⁴⁴ Prior study also mentioned that the study participants were either sleeping less (85%) or having sleep difficulties (26.7%) due to their excessive addiction toward the internet.⁴⁵ Activities include but are not limited to late-night texting, a watching spree of web series or movies and often gaming.⁴⁶⁻⁵¹ Several studies have proven the co-relationship between mental health problems and electronic media usage.^{19,25,35} Similar results such as increased risk of psychiatric comorbidity and mental discomfort have been observed among patients who engage in more screen time followed by internet addiction in few studies.²⁵

The present study has several limitations. A first limitation is that it might have recall bias due to the younger age of the participants. Second, we were unable to collect data on several contributing factors, such as the outcome of excess use of gadgets, effect on academic performance, and surrounding factors that could be relevant to gadget use. Finally, selection bias could be a possibility as a convenience sampling technique was used due to the lack of a sampling frame for the gadget users in Bangladesh.

In summary, the results of our study comply with the findings of previous studies in other regions that the overuse of gadgets imposes severe health effects among adolescents. We also found that socio-demographic determinants and factors often influence the excessive use of gadgets.

5 | CONCLUSION

According to this study, there is a significant relation of electronic gadget use with the level of education and gender. Male students are more prone in using gadgets than female students. Use of gadgets also depends on the easy access to the internet and relevant online facilities, which could differ based on respondents' socio-economic status. This same reason applies to finding higher use of gadgets in urban areas compared with the students of rural areas. Unfortunately, gadgets have shown a notable effect on physical and mental health status. With the enormous amount of entertainment options, children tend to stick to their gadgets in their free time. The more frequent tendency of gadget use among adolescents is increasingly contributing to several physical health complications (eg, headache, sleeping disorder). To ensure the health of the present generation and upcoming ones, parents should be more aware of their children's gadget use limits. Students should be more encouraged to spend time on physical activities and outdoor games. Different health-related awareness programs can be promoted to initiate counseling of the students at both home and school. Proper time management lessons need to be imparted among the school-going children. More studies need to be carried out regarding this issue in order to address the problem more precisely and strengthen the strategies further for the near future.

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CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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All authors have read and approved the final version of the manuscript.

Adnan Mannan had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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TRANSPARENCY STATEMENT

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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