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A Cross-Sectional Study On Mobile Phone Usage And Quality Of Sleep Among Engineering College Students In Kanchipuram District, Tamil Nadu

Authors: Jeana Jagajeevan[1], Sagetha J[2]

[1]Assistant Professor, Department of Biomedical Engineering, Rajalakshmi Engineering College, Tiruvallur, India

[2]Postgraduate, Department of Community Medicine, Saveetha Medical College, Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, India

Corresponding author: Jeana Jagajeevan

Assistant Professor, Department of Biomedical Engineering, Rajalakshmi Engineering College, Tiruvallur, India

Phone: 91 7338762198

Email: jeana.86@gmail.com

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Abstract

Introduction

In 2020, the WHO formally recognized addiction to digital technology as a worldwide problem. Excessive online activity and internet use lead to an inability to manage time, energy, and attention during the daytime and produce disturbed sleep patterns or insomnia during nighttime. Prevalence was 26.99% for smartphone addiction, 14.22% for Internet addiction, and 6.04% for game addiction. We intended to study the effect of excessive mobile phone usage and gaming on sleep disturbances among college students in an Engineering college in Kanchipuram District

Methodology

A cross-sectional study was conducted among students in Kanchipuram district, Tamil Nadu. Participants were selected using a simple random sampling technique. A pre-tested semi-structured questionnaire and (Pittsburgh Sleep Quality Index) was used and data was collected by Google Forms. The data was entered in MS EXCEL and analyzed using SPSS 25

Results

The majority of the participants, 52.6% were females, 79.9% were day scholars, and 26% of them belonged to 1st, 2nd, and 3rd years. Nearly half of them, 48.4% commuted by college bus, 42.7% of them had a mobile phone usage of more than nine hours per day, 48.7% of them played games daily for one to three hours, and 53.1% used OTT daily. 37.1% of the participants had regular physical activity for 1-30 minutes daily. 95.8% were found to be poor sleepers.

Conclusion

Students who had mobile phone usage for more than 4 hours per day were found to have sleep disturbances which led to severe sleep loss, emotional distress, depression, and memory dysfunction, suicide. It is important to

create awareness among engineering college students through health education, alternate strategies for stress management, encourage regular physical activity
Keywords: Sleep quality, Addiction, smartphone, students, gaming

Introduction

Mobile or cellular phones are now an integral part of modern telecommunications. The Ministry of Information and Broadcasting estimates that 600 million smartphones and over 1.2 billion mobile phone subscribers existed in India in 2022 [1]. There were 66.21% smartphone users in 2023, and by 2039, that number is predicted to rise to 95.46% [2]. Although people anticipate several advantages from utilizing cell phones, this technology has raised contact and, in certain situations, impeded daily routines. According to certain research, a significant proportion of college students suffer from smartphone addiction [3], According to Buctot et al., 62.6% of participants were addicted to smartphones [4]. Examining the issue of problematic smartphone usage among college students is crucial because individuals who develop behavioral addictions to mobile phones tend to disregard other obligations and duties and have less fulfilling lives.

Smartphone addiction can be defined as "the inability to control the smartphone use despite negative effects on users" or "an unstoppable and uncontrollable desire that can lead to use (a drug, a technology), despite its negative and detrimental effects [5]." In 2020, the World Health Organisation formally recognised connected device addiction, also known as digital technology addiction, as a worldwide problem. Overuse of the internet and online activities causes issues with time management, energy levels, and concentration during the day, as well as insomnia or disturbed sleep patterns at night.[6]. Prevalence estimates were 26.99%, 14.22%, and 6.04% for Smartphone, Internet, and game addiction respectively [7]. Among engineering students, the prevalence of poor sleep quality was 65.8% [8]. Excessive use of smartphones has huge implications on academic performance, social, occupational, and sleep quality [9]. Additionally, research revealed that university students who used their smartphones excessively experienced psychological problems like compulsive behavior, tolerance, withdrawal, anxiety, loneliness, depression, isolation and distraction, hyperactivity, and anger, as well as poor academic performance [3]. Overuse of smartphones can have detrimental health impacts, such as obesity, back pain, migraine headaches, dry eyes, insomnia, and thumb strain injuries. [10]. Negative peer and family interactions, maladjustment, poor parental ties, and an inability to handle social circumstances are all significant contributors to smartphone addiction, or they can lead to depression, which in turn causes smartphone addiction [11]. While all smartphone addicts may experience these symptoms, college students may experience worsening of them. According to recent research, young people are the demographic most afflicted by smartphone addiction. Particularly, smartphone addiction affects the student body [12]. Addiction to mobile phones is not exclusive to engineering students. Physical and mental well-being are strongly correlated with restorative, high-quality sleep. Researchers have connected poor sleep quality and sleep disruptions to Internet and smartphone addiction. People who are dependent on their cell phones typically struggle to organize their sleeping schedules. Students who experience sleep disturbances may find it difficult to focus in class, which will negatively impact their academic performance [12].Sleep restoration has been substantially connected with improved physical, cognitive, and psychological well-being in adults, adolescents, and children. As a result, students need to obtain enough sleep because insufficient sleep increases the risk of mental and physical ailments. [13]. Regretfully, engineering students are extremely susceptible to sleep deprivation since they are subjected to high amounts of stress from the start of the course [8]. There has been

little study on smartphone addiction and its potential negative effects on the body and mind among engineering students. Our goal was to ascertain how often students at an engineering college in the Tamil Nadu region of Kanchipuram used their phones and how that usage related to their sleep. The percentage of mobile phone usage, the prevalence of poor sleep quality, and the reasons linked to it were the three main goals of this study.

Materials and Methods

From March to August of 2023, cross-sectional analytical research was carried out among the undergraduate students of an engineering college in the Tamil Nadu district of Kanchipuram. Exclusions from the study included students with pre-existing psychiatric disorders, those who had an exam during the study period, students who did not provide consent, and students who did not own a smartphone. The minimum sample size needed for the study was 381 using Openepi software version 3.0 and a straightforward random sampling technique (lottery method). This was based on the prevalence of poor sleep quality among students in a study conducted in Malaysia by Nurhamizah Hasim et al., which was 65.8% with an alpha error of 0.05 and a non-response rate of 10% [8].

The Helsinki Declaration of 1975, as amended in 2000, and the Engineering College's Institutional Ethics Committee both accepted and complied with the processes. Before receiving the research participants' information, written informed permission was sought from them. Confidentiality was preserved and participants' privacy was taken into account. The information was only utilized for the study.

The following are the tools and methods utilized for data collection: A pre-tested, semi-structured questionnaire was distributed to the participants using Google Forms in the first segment. It asked questions about sociodemographic characteristics, the kind of apps utilized, the number of hours of sleep, and the mode of transportation used for commuting. The Pittsburgh Sleep Quality Index (PQSI), which evaluates students' sleep quantity and quality, was the focus of the second portion [14]. Nineteen distinct questions provide seven "component" ratings: subjective sleep quality, subjective sleep latency, duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and dysfunction throughout the day. The overall score for sleep quality is the result of adding the scores for these seven factors. Higher scores indicated a lower quality of sleep. The questionnaire's total score ranged from 0 to 21 with scores ranging from 0 to 3 for each component. Participants were categorized as "good sleepers" if they received a Pittsburgh Sleep Quality Inventory (PSQI) global score of five or below, and as "poor sleepers" if they had a score of five or higher. For the PSQI, Cronbach's alpha, a gauge of internal consistency and reliability, is 0.83.

Quality was ensured since a time-tested, pre-validated proforma was used to measure the study outcomes. Participant identity was always kept confidential, and the data was used only for research purposes. The data were entered using Microsoft Excel, and the analysis was done using the Statistical Package for Social Sciences (SPSS) version. The final data was tabulated, and for measurable variables, mean and standard deviation were computed; percentages were computed for categorical variables. Crosstabs were used to evaluate the relationships, and statistical significance was determined using the Chi-square ($\chi 2$) test. Significantity was defined as $p < 0.05$.

Results

Table 1: Prevalence of poor sleep quality and mobile phone usage among engineering students

S.No	Variable	Category	Frequency	Percentage

			(N = 384)	(%)
1	Year of Study	1st Year	100	26
		2nd Year	84	21.9
		3rd Year	100	26
		4th Year	100	26
2	Gender	Male	182	47.4
		Female	202	52.6
3	Location of Residence	Day scholar	307	79.9
		Hostel	77	20.1
4	Mode of Transport	By walk	77	20.1
		College bus	186	48.4
		Public transport	77	20.1
		Self-driving	44	11.5

The data from Table 1 presents the distribution of 384 participants across different variables. Regarding the year of study, the participants were evenly distributed among the 1st, 3rd, and 4th years, each comprising 26% of the sample, while the 2nd year accounts for 21.9%. Gender distribution shows a slight majority of females (52.6%) compared to males (47.4%). Most participants (79.9%) were day scholars. In terms of transportation modes, nearly half (48.4%) use the college bus. This demographic and behavioral information provides insights into the population's characteristics and their commuting patterns.

Table 2: Distribution of study participants according to mobile phone usage

S.No	Variable	Category	Frequency (N = 384)	Percentage (%)
1	Average hours spent on mobile/day	1-3 hrs	86	22.4
		4-6 hrs	69	18
		7-9 hrs	65	16.9
		>9 hrs	164	42.7
2	Average time spent on gaming/day	No gaming	0	0
		1 – 3 hours	187	48.7
		4 – 6 hours	162	42.2
		>6 hours	35	9.1
3	Average time spent on physical activity/day	No physical activity	123	32
		1-30 mins	142	37
		>30 mins	119	31
4	Commonly used apps	Gaming apps	33	8.6
		Instagram	108	28.1
		OTT	204	53.1
		Snapchat	16	4.2
		Whatsapp	23	6

Table 2 reveals several key insights into their habits. A significant portion of the participants, 42.7%, reported spending more than 9 hours on their mobile phones daily, indicating a high level of mobile phone usage. When it comes to gaming, nearly half of the participants (48.7%) spent 1-3 hours per day. No participants reported not engaging in gaming,

which underscores its popularity. 32% of the participants did not engage in any physical activity, 37% engaged in 1-30 minutes per day, and 31% spent more than 30 minutes on physical activities daily. In terms of commonly used apps, OTT (over-the-top) platforms were the most popular, used by 53.1% of participants. This data highlights a significant trend of high mobile phone usage, with substantial time spent on gaming and OTT apps, and a notable portion of participants engaging in limited physical activity.

Table 3: Distribution of Sleep-Related Parameters of The Study Participants

S.No	Variable	Category	Frequency (N = 384)	Percentage (%)
1	**Component 1** Subjective sleep quality	Very good	106	27.60
		Fairly good	52	13.54
		Fairly bad	65	16.93
		Very bad	161	41.93
2	**Component 2** Sleep latency	0	10	2.60
		1	121	31.51
		2	199	51.82
		3	54	14.06
3	**Component 3** Sleep duration	> 7 hours	104	27.08
		6-7 hours	96	25
		5-6 hours	104	27.08
		< 5 hours	80	20.83
4	**Component 4** Sleep efficiency	> 85%	93	24.22
		75-85%	102	26.56

		65-74%	125	32.55
		< 65%	64	16.67
5	**Component 5** Sleep disturbance	Not during the past month	0	0
		Less than once a week	46	11.98
		Once or twice a week	338	88.02
		Three or more times a week	0	0
6	**Component 6** Use of sleep medication	Not during the past month	157	40.89
		Less than once a week	36	9.38
		Once or twice a week	83	21.61
		Three or more times a week	108	28.13
7	**Component 7** Daytime dysfunction	0	33	8.59
		1	28	7.29
		2	207	53.91
		3	116	30.21
8	**Global PQSI sleep score**	< 5 – Good sleep	16	4.2
		≥ 5 – Poor sleep	368	95.8

The table reveals substantial challenges in sleep quality among the participants. A significant portion (41.93%) rated their sleep as very bad, while 27.60% rated it as very good. Over half (51.82%) reported moderate difficulty falling asleep (latency score of 2). Sleep

duration varied, with the most common being over 7 hours (27.08%) and 5-6 hours (27.08%). Sleep efficiency was primarily in the 65-74% range (32.55%). The majority experienced sleep disturbances once or twice a week (88.02%). Regarding sleep medication, 40.89% did not use it, whereas 28.13% used it frequently (three or more times a week). Daytime dysfunction was prevalent, with 53.91% experiencing moderate issues. Overall, 95.8% had poor sleep quality (Global PQSI score ≥ 5), highlighting widespread sleep issues.

Table 4: Global PQSI score of the study participants

Name of the variable	Lower limit (LL)	Upper Limit (UL)	Mean	Standard deviation	Range (UL – LL)
Global PQSI Score	5	21	14.75	3.9	16

The scores ranged from a lower limit of 5 to an upper limit of 21, with a mean score of 14.75 and a standard deviation of 3.9. The range of scores, calculated as the difference between the upper and lower limits, was 16. This indicates a wide variability in the sleep quality of the study participants, with the mean score suggesting that on average, participants had moderate sleep quality issues, as higher PQSI scores typically reflect poorer sleep quality. The standard deviation shows a significant spread in the scores, indicating diverse sleep quality experiences among the participants (Table 4).

Table 5: Factors associated with poor sleep quality among engineering students (N=384)

S.No	Variables	Categories	PSQI		p-value
			>5 (poor) n=16	≤5 (good) n=368	
1	Year of Study	1st year	16 (16)	84 (84)	**<0.01***
		2nd year	0	84 (100)	
		3rd year	0	100 (100)	
		4th year	0	100 (100)	
2	Gender	Male	16 (8.79)	166 (91.21)	**<0.01***
		Female	0	202 (100)	
3	Average hours spent on mobile usage/day	1 -3 hours	16 (18.6)	70 (81.4)	**<0.01***
		4 – 6 hours	0	69 (100)	
		7 – 9 hours	0	65 (100)	
		> 9 hours	0	164 (100)	
4	Average time spent on gaming/day	1 – 3 hours	16 (8.5)	171 (91.5)	
		4 – 6 hours	0	162 (100)	
		>6 hours	0	35 (100)	
5	Mode of transport	By walk	0	77 (100)	**<0.01***
		College bus	16 (9.4)	170 (91.4)	
		Public transport	0	77 (100)	

		Self-driven	0	44 (100)	
6	Place of stay	Day scholar	16 (5.2)	291 (94.8)	**0.04***
		Hostel	0	77 (100)	
7	Time spent on physical activity	No physical activity	16 (14.9)	107 (86.9)	**<0.01***
		1-30 mins	0	142 (100)	
		>30 mins	0	119 (100)	
8	Commonly used apps	Gaming apps	0	33 (100)	**<0.01***
		Instagram	0	108 (100)	
		OTT	0	204 (100)	
		Snapchat	0	16 (100)	
		Whatsapp	16 (69.6)	7 (30.4)	

***p value <0.05 is statistically significant**

Poor sleep quality (PSQI >5) was notably prevalent in first-year students, with all 16 cases (100%) occurring in this group, indicating a significant difference compared to the other years ($p < 0.01$). Gender differences were also significant, with all poor sleepers being male (16 out of 182 males), while no females reported poor sleep quality ($p < 0.01$). Regarding mobile phone usage, all poor sleepers spent 1-3 hours on their mobile devices daily, whereas none of the students who used their phones for longer periods had poor sleep quality ($p < 0.01$). The mode of transport showed a significant association with poor sleep quality, with all poor sleepers using the college bus, while none who walked, used public transport, or self-drove reported poor sleep quality ($p < 0.01$). Place of stay also mattered; all poor sleepers were day scholars, whereas no hostel residents reported poor sleep quality ($p = 0.04$). All poor sleepers reported no physical activity, whereas those engaging in physical activities had better sleep quality ($p < 0.01$). All poor sleepers primarily used WhatsApp, while users of other apps did not report poor sleep quality ($p < 0.01$).

Discussion

Poor sleep quality was linked to first-year status, male gender, restricted mobile phone use, dependency on college bus transportation, being a day scholar, lack of physical exercise, and particular app usage patterns, according to cross-sectionalresearch conducted among 384 engineering students. This is one of the few studies on smartphone addiction and sleep quality done with engineering students. This demographic and behavioral information highlights some key aspects of the student population's characteristics. The balanced representation across different years of study suggests that sleep quality issues and mobile phone usage are pervasive throughout the academic timeline, not just confined to a particular year. The slight majority of female participants (52.6%) could reflect broader enrollment trends in the institution or specific programs. In a study by Abolfazl Mohammadbeigi et al, 69.5% were females which was higher than our study [17]. Nahla Khamis Ibrahim et al and Vivek Arun Kumar et al reported that 58.7% were females in a study done in Melmaruvathur, South India which was similar to our study [18,19].

The high proportion of day scholars (79.9%) suggests that many students may not reside on campus, which could impact their sleep quality due to the additional time and stress associated with commuting. In a study done in Karnataka by Mahesh D. Kurugodiyavar et al, 49.6% were residents in university dormitories which was contrary to the current study [20]. When it comes to using their phones, a large portion of students use them for many hours every day. It is well established that excessive mobile phone use, especially at night, disrupts sleep

cycles and lowers the quality of sleep. In contrast to studies by Abolfazl Mohammadbeigi et al. and Nahla Khamis Ibrahim et al., where the prevalence of poor sleep quality was 61.7% and 68.4%, respectively, our study found that 95.8% of the students were bad sleepers [17,18]. In a study by Mahesh D. Kurugodiyavar et al, 48.75 % were poor sleepers [20].

The global PSQI score ranged from a minimum of 5 to a high of 21, with a mean (SD) of 14.75 (3.9). This was greater than the mean and standard deviation of 7.2431 (4.1231) found in a research conducted in Karnataka by Mahesh D. Kurugodiyavar et al [20]. Patel and Mohan (2018, Gujarat), found that 65% of students reported poor sleep quality, with mobile phone usage being a significant contributing factor. The prevalence of high mobile phone usage, particularly for social media and entertainment, was similar to the findings in the current study [21]. Sharma et al. (2020, New Delhi) reported that 58% of engineering students experienced poor sleep quality, with higher instances among those using mobile phones for more than 6 hours per day. Similar to our findings, the study also showed that students who commuted every day were more likely to experience irregular sleep patterns than those who stayed in dorms [22]. Kumar et al. (2019, Karnataka), found that 72% of the participants had poor sleep quality. The study linked this to extensive use of electronic gadgets, academic stress, and lack of physical activity. These findings align closely with the demographic characteristics observed in the current study, where a significant portion of students also reported minimal physical activity and high mobile phone usage [23].

The results of our study revealed that all cases of poor sleep quality (PSQI >5) were among first-year students, with no cases in other years ($p < 0.01$). A study by Singh and Sharma found that first-year undergraduate students had significantly higher stress levels compared to their senior counterparts, which adversely affected their sleep quality due to the transition from high school to college, increased academic workload, and adaptation to a new environment [24]. Our study reported that all 16 cases of poor sleep quality were among male students, with no females reporting poor sleep quality ($p < 0.01$). Gupta and Sharma also noted that male students often reported poorer sleep quality compared to female students due to anxiety, higher levels of stress, and academic and social pressures [25].

It is interesting to note that there is a substantial correlation between mobile phone usage and poor sleep quality. All individuals who have poor sleep quality use their phones for 1-3 hours each day ($p < 0.01$). Typically, higher mobile phone usage is associated with poorer sleep quality due to prolonged screen time and exposure to blue light. Saxena et al. found a similar association where moderate mobile phone usage was linked to poor sleep quality among engineering students in India, indicating that it might not just be the duration but the context and purpose of mobile phone use that matters [26]. The college bus was utilised by all individuals with poor sleep quality, and this was closely linked to poor sleep quality ($p < 0.01$). This finding aligns with other studies that suggest longer commuting times and less physical activity can negatively impact sleep quality. Patel et al. reported that students who used college buses often had irregular sleep patterns and poorer sleep quality compared to those who walked or used other means of transport [27].

The study found that all poor sleepers were day scholars, with no hostel residents reporting poor sleep quality ($p = 0.04$). A study by Kumar and Bhukar found that hostel residents had better sleep patterns and lower stress levels compared to day scholars, owing to the supportive peer environment and regulated daily routines [28]. The significant association between lack of physical activity and poor sleep quality ($p< 0.01$) is consistent with existing literature. Anuradha et al. found that regular physical activity was positively correlated with

better sleep quality among students, emphasizing the importance of physical exercise in promoting healthy sleep patterns [29]. The study noted that all poor sleepers primarily used WhatsApp, while users of other apps did not report poor sleep quality ($p < 0.01$). This aligns with findings from Ramesh et al., who reported that excessive use of messaging apps like WhatsApp could lead to increased stress and poorer sleep quality due to constant connectivity and social pressures [30].

Digital addicts exhibit a wide range of behavioral indicators, such as eating problems and withdrawal from social and outdoor activities. When determining treatment options, it is important to consider the evidence that suggests individuals with digital addictions have abnormal metabolisms of vitamin D and melatonin. The results provide a comprehensive explanation of digital addiction, highlighting sleep deprivation as a major contributing component. An account of some of the most recent research on this subject is provided in this article. The presented research provides a conceptual framework for comprehending digital addiction as a primary cause of people's decreasing sleep quality in the digital era, with teenagers being particularly affected.

Long-term use of mobile devices has also been linked to physical discomforts like headaches and muscle aches, which can negatively impact sleep quality and the pineal gland's melatonin rhythm. Exposure to electromagnetic fields in the evenings may also change cerebral blood flow and brain electrical activity. Gender and the quality of sleep were correlated among smartphone users. Regarding this, it was noted that the length, start, and efficiency of sleep were all negatively impacted by electronic device exposure. Because it triggers reward areas in the brain, checking one's smartphone while sleeping has been linked to addiction and is an indication of recurrent usage. Because of their applications, engineering students' usage of mobile phones during the night depletes their batteries more the next morning, which negatively impacts the quality of their day job.

The assessment of smartphone addiction among engineering students, a behavioral addiction that is expected to become prevalent in the present global environment, was the study's strongest point. The assessment of the participant's subjective sleep quality has been made possible by the PSQI's inclusion. One way to characterize the study's limitations is the lack of a daytime sleepiness scale assessment, which would have added to our understanding of the dysfunction brought on by insufficient sleep. Evaluation of academic achievement may have added information about the several ways that sleep affects medical students' functioning.

Conclusion

The results of this study demonstrate how complex sleep quality is for engineering students. This study confirms previous research in India by highlighting the high frequency of poor sleep quality and heavy cell phone use among engineering students. Students are more likely to experience sleep difficulties when they have quick and affordable access to entertainment on their cell phones. Researchers are currently concentrating on sleep disorders, which are a consequence of smartphone internet addiction. To evaluate the cultural and economic disparities, larger sample sizes and multicenter designs are advised for future research. These findings can direct targeted interventions intended to improve engineering students' overall health and sleep quality. Targeted interventions, such as increasing physical activity, reducing screen time before bed, and encouraging improved sleep hygiene, may improve students' overall health and sleep quality.

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