RESEARCH PAPER

A cross-sectional study to evaluate sleep patterns and impulsivity among university students with smartphone addiction.

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Introduction

In recent years, smartphones have become essential in daily life. People use them widely for communication, social networking, entertainment, education, and professional activities. Affordable smartphones and Internet services have increased use across age groups, especially adolescents and young adults. Although smartphones offer convenience, excessive, uncontrolled use has emerged as a public health and psychological concern. This condition, commonly referred to as smartphone addiction or problematic smartphone use, is characterised by compulsive checking, prolonged screen exposure, difficulty limiting usage, and significant interference with daily functioning and well-being. Recent global reports indicate that smartphone ownership and daily screen time continue to rise, especially after the COVID-19 pandemic [1,2].

Sleep is an important factor affecting physical and mental health. Adequate sleep is necessary for cognitive functioning, emotional regulation, memory, and overall well-being. However, increased smartphone use, especially at night, has been linked to delayed sleep onset, reduced duration, poor quality, and daytime fatigue. Blue light from smartphone screens may suppress melatonin secretion and disturb the normal sleep–wake cycle.[3]

Recent Indian studies have reported a growing prevalence of smartphone addiction among college students and adolescents, with significant associations observed between excessive smartphone use, poor sleep quality, stress, anxiety, and reduced academic performance [3,4]. A study among Indian medical students reported that excessive smartphone usage was significantly associated with poor sleep quality, daytime dysfunction, and impaired concentration [5]. A cross-sectional, observational study found that problematic smartphone uses among Indian youth contributed to behavioural disturbances, irritability, impulsive traits, and poor academic performance [6].

Smartphone addiction is acknowledged as an issue among adolescents and young adults due to uncontrolled smartphone engagement. Studies show problematic smartphone use is associated with anxiety, depression, reduced academic performance, and impaired functioning [7, 8]. Sleep research suggests nighttime smartphone exposure and blue-light emission may affect circadian rhythms and melatonin secretion, contributing to poor sleep outcomes [9]. Extended use is linked to disrupted sleep patterns, reduced sleep quality, delayed sleep onset, and fatigue.[10] Excessive smartphone usage may contribute to impulsive behaviours, impaired emotional regulation, and diminished self-control. Indian research highlights that nighttime smartphone use among university students is linked to insomnia, daytime sleepiness, and emotional dysregulation, emphasising the health burden in India.[11]

Impulsivity is another important psychological factor that has been associated with smartphone addiction. Impulsivity refers to a tendency to act quickly without adequate thought or consideration of consequences. Individuals with high impulsivity may have difficulty controlling urges and are more likely to engage in excessive smartphone use. Previous studies have suggested a significant relationship between problematic smartphone use, poor sleep quality, and impulsive behaviour. [12]

Impulsivity constitutes a critical psychological factor that may contribute to the development and maintenance of addictive behaviours, thereby exacerbating problematic smartphone use. Contemporary behavioural studies have highlighted impulsivity as a strong predictor of compulsive digital behaviours and reduced self-regulation among smartphone users [10]. The combined effects of sleep disturbances and impulsivity may negatively influence academic achievement, mental health, interpersonal relationships, and overall quality of life. Studies conducted in India have further demonstrated that higher impulsivity traits are significantly associated with problematic smartphone use among adolescents and young

adults, suggesting the need for culturally relevant investigations into these behavioural patterns.[13]
Understanding the relationship between smartphone addiction, sleep patterns, and impulsivity is important because these factors can negatively affect mental health, academic performance, and quality of life. Therefore, this study aims to assess sleep patterns and impulsivity among individuals with smartphone addiction and explore the association between these variables.

Objectives

- To assess and evaluate sleep patterns and impulsivity among students with smartphone addiction
- To analyse the association between sleep disturbances and impulsivity in students.

Methodology:

This cross-sectional observational study was conducted among university students in the Department of Psychiatry, MMIMSR, Mullana, a tertiary care teaching hospital in Ambala, Haryana, after obtaining approval from the institutional ethics committee. All the participants provided informed consent before the questionnaire survey.

Participants

The study population comprised students of various courses, including BDS, MBBS, postgraduate (MD/MS), and pharmacy programs. A convenience sampling strategy was used to recruit participants. The study included participants aged 18 to 30 who met criteria for smartphone addiction or problematic smartphone use and provided informed consent. Patients with severe psychiatric illness or cognitive impairment, severe medical or neurological disorders affecting sleep, or those unwilling to participate in the study were excluded. A total of 115 participants completed the questionnaire.

Data Collection and Procedures

The participants completed various self-report questionnaires. Socio-Demographic and Clinical Performa- A specifically developed questionnaire was utilised to collect sociodemographic characteristics of the participants, including name, gender, age, marital status, religion, educational qualification, occupation, monthly family income, family type, residence type, address, Contact Number, and Socioeconomic Status. A separate section was included to collect Clinical Details of the respondents, including any primary Diagnosis, Presenting Complaints, history and duration of presenting illness if present, Past Medical and surgical History, Family medical History, Current Medications or substance use, allergies, and Hospitalization History. Vital Signs were monitored. Investigations/reports/treatment plans were recorded for respondents with a history of illness.

Measurement

Insomnia Severity Index

The Insomnia Severity Index (ISI), developed by Bastien et al. [11], is a self-assessment questionnaire that contains seven items, rated on a 5-point scale ranging from 0 (not at all) to 4 (very much). The total score ranges from 0 to 28, with classifications as follows: no clinically significant insomnia (0–7 points), subthreshold insomnia (8–14 points), moderate insomnia (15–21 points), and severe insomnia (22–28 points).

Barratt Impulsiveness Scale (BIS-11)

The Barratt Impulsiveness Scale (BIS-11), developed by Ernest S. Barratt, is a widely used psychological assessment tool designed to measure the personality/behavioural construct of impulsiveness. The Current Version used here is BIS-11. It consists of 8 items rated on a 5-point Scale. The main Domains assessed are Attention Impulsiveness (difficulty focusing attention and Cognitive instability), Motor Impulsiveness (Acting without thinking and Behavioural impulsivity) and Non-Planning Impulsiveness (Lack of forethought and limited future orientation). Participants were given certain instructions to follow, including that they should answer all items honestly. They were informed that the questionnaire usually took 5–10 minutes to complete, and that confidentiality and privacy should be ensured during administration. Individuals with lower scores generally indicate lower impulsiveness, whereas individuals with higher scores indicate greater impulsive tendencies.

Smartphone Addiction Assessment Performa (SAS)

The Smartphone Addiction Scale Short Version (SAS-SV) [12] was utilised to evaluate smartphone addiction. This is a self-assessment questionnaire consisting of 10 items, evaluated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total score ranges from 10 to 60, with higher scores indicating a higher risk for smartphone addiction. A score >31 for males and a score >33 for females indicate a high risk for smartphone addiction. This version, SAS-SV, was specifically designed for rapid screening in research settings and should not be confused with the original 33-item full SAS, which includes six factors.

Statistical analysis

Data were compiled and entered in Microsoft Excel and analysed using IBM SPSS Statistics version 28 (IBM Corp., Armonk, NY, USA). Categorical variables were assessed using percentages, uniformly distributed quantitative data were assessed using means and standard deviations, and non-uniformly distributed quantitative data were assessed using medians and interquartile ranges.

The chi-square test was used to evaluate associations between smartphone addiction risk (low vs. high) and categorical variables (age group, sex, course, and ISI category). The Mann-Whitney U test was employed to compare age, ISI, and impulsivity scores, while the Kruskal-Walli's test was used for

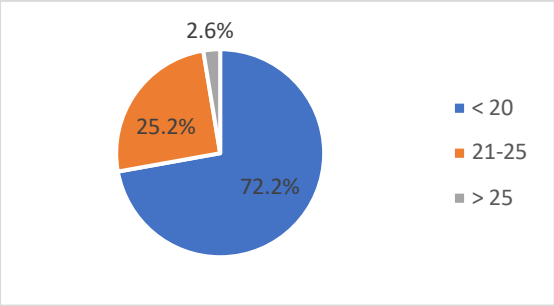
comparisons across ISI categories. Spearman's rank correlation coefficient was utilised to evaluate the relationships among age, SAS, ISI, and impulsivity scores, categorising them as weak (less than 0.30), moderate (0.30–0.50), or strong (greater than 0.50). To explore the link between smartphone addiction and insomnia, controlling for impulsivity, a partial correlation was conducted. The threshold for statistical significance was established at $p < 0.05$.

Results

Characteristics of Participants

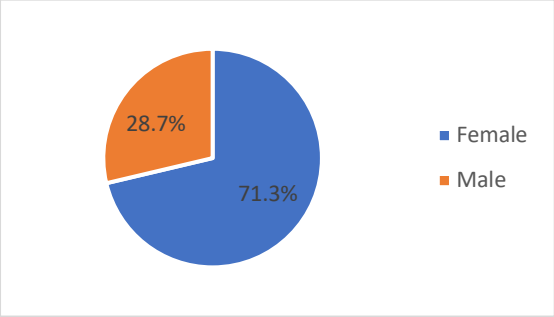
A total of 115 participants were included in this study. The mean age of the included participants was 20.18 years (IQR 19–21, range 18–31), where 72.2% ($n = 83$) were aged under 20, 25.2% ($n = 29$) were aged between 21 and 25, and 2.6%(n=3) were aged above 25 (Figure 1).

Figure 1. Age distribution of the included participants



The sex distribution of the enrolled participants is shown in Figure 2. Among the enrolled participants,71.3% (n=82) were female and 28.7% (n=33) were male.

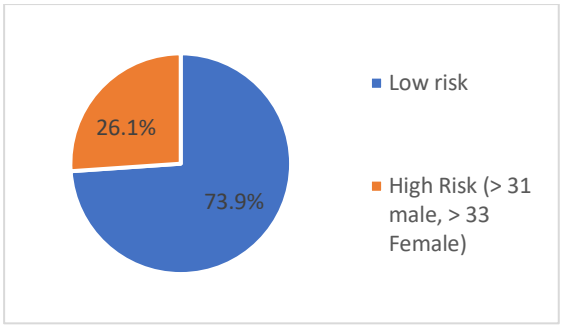
Figure 2. Sex distribution of the included participants



Smartphone addiction and insomnia Score

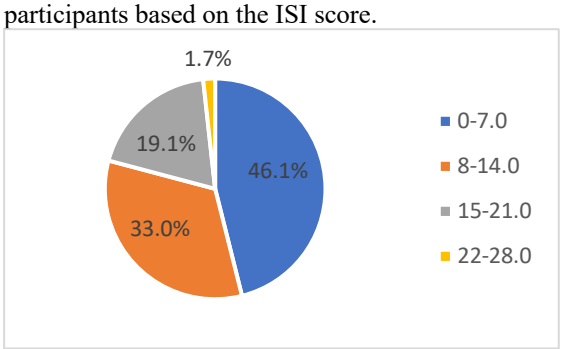
The mean smartphone addiction scale (SAS) score was 25.66 (SD = 10.99). Thirty participants (26.1%) were categorized as high-risk group and 85 participants (73.9%) were classified as low-risk group for smartphone addiction. Figure 3 indicates the frequency of smartphone addiction in university students. Smartphone addiction risk did not differ significantly by age group or sex.

Figure 3: Smartphone addiction risk based on SAS score



The mean Insomnia Severity Index (ISI) score was 9.16 (SD = 5.93), with 1.7%(n=2) of the participants reported severe insomnia, 19.1% (n=22) of the participants reported moderate insomnia and 33% (n=38) reported sub threshold insomnia. Figure 4 demonstrates the ISI score of the participants.

Figure 4: Graphical representation of the participants based on the ISI score.



The Mean total impulsivity score was 23.18 (SD 3.82), with urgency showing the lowest subscale mean (2.30, SD 0.92) and sensation seeking the highest (3.31, SD 1.19). Statistical distributions are shown in Table 1.

Table 1: Statistical distributions of SAS, ISI, impulsivity, urgency, lack of premeditation, lack of perseverance and sensation seeking

Variable	Mean (SD)	Median (IQR)	Range
SAS total	25.66(10.99)	23(18–33)	10-54
ISI total	9.16(5.93)	9(5-14)	1-29
Impulsivity total	23.18(3.82)	23(21-25	16–38
Urgency	2.30 (0.92)	2 (1.5–3)	1–5
Lack of premeditation	2.86 (1.10)	3 (2–4)	1–5
Lack of perseverance	3.12 (1.15)	3 (2–4)	1–5

Sensation seeking	3.31 (1.19)	3 (2.5–4)	1–5

		Smartphone addiction scale				Total	Chi-square value	p-value
		No risk	No risk	High Risk (> 31 male, > 33 Female)	High Risk (> 31 male, > 33 Female)			
ISI GROUP	0-7.0	46	54.1%	7	23.3%	53	10.027	0.018
	8-14.0	26	30.6%	12	40.0%	38		
	15-21.0	12	14.1%	10	33.3%	22		
	22-28.0	1	1.2%	1	3.3%	2		
Total		85	100.0%	30	100.0%	115		

SAS- Smartphone addiction scale; ISI-Insomnia Severity Index; SD-Standard Deviation; IQR-Interquartile range

Association between smartphone addiction, insomnia and impulsivity

To evaluate the association between smartphone addiction risk and ISI categories, a chi-square test was performed. The result yielded a χ^2 value of 10.027, with a p-value of 0.018, indicating a statistically significant relationship between insomnia and addiction. Table 2 indicates the association status between smartphone addiction and insomnia. High-risk smartphone users reported higher ISI scores (M = 12.07, SD = 5.87) than low-risk users (M = 8.13, SD = 5.64). Impulsivity scores were also significantly higher in the high-risk group (M = 26.1, SD = 4.12) than in the low-risk group (M = 22.15, SD = 3.14; Z = -4.61, p < 0.001).

Table 2: Association between smartphone addiction and insomnia

Correlational findings

A positive correlation was found between SAS and ISI ($\rho = 0.328$, $p < 0.001$), indicating a significant relationship between smartphone addiction and insomnia severity. Additionally, SAS correlates with impulsivity ($\rho = 0.442$, $p < 0.001$), as well as with urgency ($\rho = 0.477$, $p < 0.001$). Impulsivity exhibited a strong correlation with urgency ($\rho = 0.619$, $p < 0.001$) and sensation seeking ($\rho = 0.581$, $p < 0.001$) but a negative correlation with perseverance ($\rho = -0.512$, $p < 0.001$). This indicates that students who acted more impulsively showed higher urgency and a lack of perseverance. Age was not significantly correlated with any of the variables, including smartphone addiction, insomnia, or impulsivity ($p > 0.05$). These findings highlight that urgency and lack of perseverance have a significant role in smartphone addiction and insomnia. Table 3 shows the correlational findings of the variables.

Table 3: Correlational findings of the measured variables

Spearman's rho		SAS	ISI TOTAL	Impulsive Behaviour scale-8	Urgency	Lack of Premeditation	Lack of Perseverance	Sensation seeking
Age	Correlation Coefficient	0.114	-0.046	-0.004	0.100	-0.159	-0.059	0.096
	p-value	0.224	0.628	0.966	0.287	0.090	0.529	0.307
	N	115	115	115	115	115	115	115
SAS	Correlation Coefficient		0.328	0.442	0.477	0.093	0.167	0.091
	p-value		0.001	0.001	0.001	0.322	0.074	0.331
	N		115	115	115	115	115	115
ISI TOTAL	Correlation Coefficient			0.368	0.374	0.094	0.180	0.059
	p-value			0.001	0.001	0.315	0.055	0.531
	N			115	115	115	115	115
Impulsive Behaviour scale-8	Correlation Coefficient				0.432	0.619	0.581	0.107
	p-value				0.001	0.001	0.001	0.255
	N				115	115	115	115
Urgency	Correlation Coefficient					-0.137	-0.156	0.258
	p-value					0.146	0.097	0.005
	N					115	115	115
Lack of Premeditation	Correlation Coefficient						0.615	-0.413
	p-value						0.001	0.001
	N						115	115
Lack of Perseverance	Correlation Coefficient							-0.512
	p-value							0.001
	N							115

Predictors of Smartphone addiction

Multiple linear regression analysis was used to evaluate the predictors of smartphone addiction. The linear model predicted SAS scores, $F(7,107) = 8.97$, $p < .001$, accounting for 37% of the variance ($R^2=0.370$, adjusted $R^2=0.328$). Urgency ($\beta = .46$, $p < .001$) and lack of perseverance ($\beta = .29$, $p = .008$) were statistically significant independent predictors. Other variables including sex, age, premeditation, sensation seeking, and ISI were not significant predictors. Table 4 indicates the predictors of smartphone addiction

Table 4: Predictors of smartphone addiction

	Sum of Squares	df	Mean Square	F	Sig.
SAS	5090.845	7	727.264	8.966	.000[b]
	8678.929	107	81.111		
Total		114			

Predictors of Insomnia

A secondary multiple linear regression analysis was performed to assess the predictors of insomnia. This model was statistically significant, $F(7,107) = 3.86$, $p < .001$, explaining 20.1% of the total variance ($R^2=0.201$, adjusted $R^2=0.149$). Here, urgency was the single statistically significant predictor of insomnia. Urgency was the only significant predictor of insomnia severity. Table 5 shows predictors of Insomnia

	Sum of Squares	df	Mean Square	F	Sig.
ISI	808.683	7	115.526	3.855	.001[b]
	3206.500	107	29.967		
	4015.183	114			

Table 5: Predictors for Insomnia severity

Discussion

This study examined the relationship between smartphone addiction, insomnia, and impulsivity among 115 university students. The findings revealed that approximately one quarter (26.1%) of the students fell into the high-risk category for smartphone addiction. One-fifth (19.1%) of the students met the criteria for moderate insomnia. In addition, high-risk students had more severe insomnia and higher impulsivity than low-risk students did. This pattern was also evident in the insomnia severity levels. Insomnia severity significantly increased both smartphone addiction and impulsivity scores.

This significant correlation between smartphone addiction and insomnia and impulse behaviour is consistent with studies demonstrating the prevalence of smartphone addiction and insomnia, especially in college students [3,4]. The positive correlation between the Smartphone Addiction Scale (SAS) Score and the Insomnia Severity Index (ISI) score suggests that excessive smartphone use may negatively affect sleep patterns, resulting in poorer sleep. A study conducted in China among 427 university students reported that smartphone addiction was positively correlated with shorter sleep duration and poorer sleep quality [13].

Notably, while simple correlation matrices signify a direct link between smartphone addiction and poor sleep quality, multiple linear regression analysis revealed urgency as an independent predictor of both smartphone addiction and insomnia. Moreover, insomnia did not independently predict smartphone addiction. These findings suggest that impulsivity (urgency in particular) might be a common linking factor for both smartphone addiction and sleep disturbances in this population. Urgency refers to the inclination to react based on intense emotions without weighing the outcomes, often as a means to temporarily manage negative feelings. This behaviour aligns with the notion that many students turn to their smartphones not merely out of routine, but as a method of emotional coping—grabbing their phones when they feel upset, bored, or anxious, which provides immediate relief but leads to challenges in managing usage over time. This perspective aligns with behavioural models of problematic smartphone use that highlight emotion-driven mechanisms rather than solely habitual ones [10].

Demographic differences

Although smartphone addiction risk didn't differ by demographic variables including age, sex, and course in our study population, this diverges from the findings reported in a few studies citing problematic smartphone use among medical students. A study conducted among medical students in China reported a strong association between smartphone dependence and insomnia ($r = 0.566$) during the COVID-19 pandemic [14]. Similar findings were reported in 2021, with a significant correlation ($r = 0.35$) between smartphone addiction and insomnia severity among medical students [15]. As these studies were performed during and after the COVID-19 pandemic, this could be explained by the fact that quarantine and mobility limitations could have negatively impacted daily schedules, routines, and virtual education. Ultimately, this resulted in an increase in smartphone usage and alterations in sleep habits and patterns, including wake-up times, bedtimes, and total sleep hours. These changes are linked to circadian rhythms that control sleep, leading medical students to experience inadequate sleep.

Limitations

This study has several limitations that must be acknowledged before interpretation. First, owing to the cross-sectional design of the study, conclusions cannot be drawn as data are collected at a given point in time. While smartphone addiction is associated with insomnia and impulsivity, it is difficult to determine which factor preceded the other. Either excessive smartphone use led to sleep problems or pre-existing sleep difficulties increased smartphone use. Longitudinal or experimental studies are needed to clarify directionality. The relatively small sample size and restriction to students from healthcare, particularly from the dental curriculum, limits the generalizability of the findings. Lastly, self-reported questionnaires are subject to recall and social desirability bias.

Conclusion

In conclusion, our study demonstrated that smartphone addiction is associated with both poor sleep quality and impulsivity. These results highlight the importance of the risks associated with excessive smartphone use and the need for intervention measures to reduce smartphone addiction in university students. Future prospective studies with larger sample sizes are critical to confirm these associations.

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