

## Correlation between Smartphone Addiction and Sleep Quality Indicators in Male and Female University Students

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### ABSTRACT

**Background:** Addiction to smartphones is a prevalent phenomenon in university students, and could lead to detrimental effects on humans' physical and mental health.

**Objectives:** This study aimed to assess the association between addictions to smartphones and sleep quality and insomnia measures among university students.

**Patients and methods:** A sample of 100 university student addicted to cell phones were included and assigned into two equal groups. Group A consisted of 50 male students while group B included 50 female students. Smartphone addiction level was examined by using the short version of smartphone addiction scale. The Pittsburgh sleep quality index, and the insomnia severity index were employed to assess sleep quality and insomnia severity respectively.

**Results:** The results of correlation analysis revealed a significant positive correlation between smartphone addiction and quality of sleep ( $\rho=0.454$ ,  $p<0.001$ ) with higher values for females compared to males ( $\rho=0.568$ ,  $0.40$  with  $p$  value  $<0.001$ ). Similarly, there was a significant positive correlation between smartphone addiction and insomnia ( $\rho=0.31$ ,  $p<0.001$ ) with female students being significantly higher than males ( $\rho=0.284$ ,  $0.24$ ,  $P<0.001$ ).

**Conclusion:** This study showed that being addicted to mobile phones could negatively impact students as the addiction level increased, the sleep quality affection, and insomnia severity were also increase.

**Keywords:** Smartphone addiction, Sleep quality, Insomnia.

### INTRODUCTION

After the development of the first cell phone, its use has been spread widely across users for different purposes. Firstly, the main aim for using mobile phones is for distant communication between people. Then, after the development of smartphones and due to its lightweight nature, it started to be used for different purposes including browsing social media sites, viewing videos, and playing online games, watching videos and scrolling through social media platforms<sup>(1)</sup>. Students use their smartphones for various uses. For instance, smartphones give students instantaneous, flexible access to many of the same educational benefits as internet connection, file sharing options, online information search, and communication with instructors and other colleagues<sup>(2)</sup>.

Smartphone addiction is a behavioral dependency in which individuals demonstrate an excessive attachment to their smartphones, frequently placing their use of these devices ahead of their duties and personal relationships<sup>(3)</sup>. Someone who is addicted to their smartphone may experience compulsive use, which is characterized by an urgent want to interact with their device<sup>(4)</sup>. The reported prevalence of addiction to cell phones among students varied with different percentages. The average prevalence ranged from 21.7%<sup>(5)</sup> to 52.8% among college students<sup>(6)</sup>, while in Egypt, a previous report showed that 59% of college students addicted to cell phone<sup>(7)</sup>.

Students at universities may be especially susceptible to the undesired effects of frequent smartphone use. Cell phones use among university students has been linked with psychological issues such

as anxiety, depression, and stress as being constantly available to respond to calls and messages leading to increased stress levels and eventually symptoms of depression<sup>(8)</sup>. Over usage of cell phones among students for other purposes such as social networking and other leisure activities have been associated with poor academic achievements as it was reported that using cell phone too much could lead to lower scores compared with individuals who used their phones less frequently<sup>(9)</sup>.

As a consequence of this, researchers have carried out a great number of studies on the factors that predict smartphone addiction as well as the adverse impacts of this addiction in order to provide direction for prevention and intervention<sup>(3)</sup>. Since the reported high rates of smartphone addiction among college students, and its effect on increasing stress levels and deteriorating mental health, which could have a detrimental impact on other life quality measures. Therefore, the present study aimed to investigate the harmful impact of smartphone addiction on sleep quality and insomnia measures in a sample of college students, and to find out if a difference exists between male and female students.

### PATIENTS AND METHODS

**Design of the study:** This cross-sectional observational study aimed to assess the correlation between smartphone addictions and sleep quality indicators in male and female university students.

**Subjects:** The study involved one hundred university student distributed into two equal groups: Group A,

consisted of male students (50 participants), and group B, consisted of female students addicted to smartphones (50 participants).

**Inclusion criteria:** Students aged between 18 and 25 years old, smartphone addicts' students with scores of  $\geq 31$  for males and  $\geq 33$  for females, body mass index of 18.5-24.9 kg/m<sup>2</sup>. Participants with mental or psychological illness or any other diseases affecting sleep quality measures.

**Assessment instrumentation**

**Smartphone Addiction Scale-Short Version (SAS-SV):** The Smartphone Addiction Scale (SAS) was developed to assess the symptoms of addiction to smartphones. It consists of ten elements answered on a six-point Likert scale, distributed from one (strongly agree) to six (strongly disagree). There were six main components that are considered in the questionnaire including, overuse, tolerance, pleasant anticipation, withdrawal, cyberspace-oriented relationships, and everyday life disturbances. Students were required to rate on a 6 points dimensional scale their degree of affection, (1 “strongly disagree” to 6 “strongly agree”). It is a valid and reliable measure to assess addiction to phone level among adolescents <sup>(10)</sup>.

**Sleep quality:** The Pittsburgh Sleep Quality Index (PSQI) enables a complete evaluation of several aspects of sleep quality and disruptions. It consists of 19 self-rated question that are grouped into seven aspects that assess different sides of sleep, such as subjective sleep quality, sleep latency; duration required to fall asleep, duration of sleep, habitual sleep efficiency; the total amount of time spent sleeping relative to the amount of time spent in bed, disturbances of sleep, the use of medications to sleep, and dysfunction in the daytime. Each one of these components is given a score on a scale that varies from 0, which means no difficulty to 3, which means extreme difficulty.

Each point indicates the degree of difficulty that is associated with that particular area. After that, the overall score is produced by adding the seven component scores together with higher values indicating a significantly lower overall quality of sleep. It is valid and reliable for research purposes <sup>(11)</sup>.

**Insomnia:** The Insomnia Severity Index (ISI) is a self-reported survey that is extensively used to evaluate the severity of insomnia symptoms and its influence on everyday lives. It consists of seven questions, each is scored on a Likert scale with five points, ranging from 0 (no problem) to 4 (extremely severe problem). A number of important aspects of insomnia are measured by the questionnaire. These aspects included difficulty staying asleep (sleep maintenance), trouble falling asleep (sleep onset), early morning awakenings, unhappiness with sleep, interference with everyday functioning, and the emotional effect of sleep issues. The severity of insomnia can be determined with the use of a grading system, which could assist in determining the degree of affection. Using the ISI, a global score is generated that can range with higher values suggesting more severe cases of insomnia. It is a valid and reliable instrument in evaluating insomnia severity <sup>(12)</sup>.

**Ethical considerations:** An approval of The Ethical Committee Review Board of the Faculty of Physical Therapy, Cairo University was achieved prior to starting the study with a registration number of (P.T.REC/012/005444). Additionally, before the beginning of evaluation, each student filled a consent form to accept participation in the study.

**Statistical analysis**

Statistical measures were carried out by using SPSS software version 27.0 for windows. Descriptive statistics were utilized to address socio demographic variables of included participants in the form of mean  $\pm$  SD. The association between variables was analyzed using spearman correlation coefficient. Fisher's exact test, paired sample t-test, Chi-square test, and independent samples t-test were all conducted. P-values were classified as extremely significant (<0.001), inconsequential (> 0.05), and significant ( $\leq 0.05$ ) depending on their significance.

**RESULTS**

The overall mean participants' age was  $21.00 \pm 2.00$  years, and for the body mass index was  $20.25 \pm 1.70$ . There was non-significant difference regarding age and body mass index between both groups. The detailed description of participants' baseline data is shown in table (1).

**Table (1):** Baseline data of included participants

	Overall (N=100)	Group A (N=50)	Group B (N=50)	t-value	Mean difference	P value
		$\bar{X} \pm SD$	$\bar{X} \pm SD$			
Age (years)	21.00 $\pm$ 2.00	21.13 $\pm$ 1.83	21.12 $\pm$ 1.85	0.034	0.012	0.97
Weight (Kg)	66.51 $\pm$ 10.40	70.64 $\pm$ 11.44	62.83 $\pm$ 7.92	4.305	8.26	0.000
Height (cm)	170.15 $\pm$ 10.59	177.02 $\pm$ 9.51	163.28 $\pm$ 6.31	8.51	13.74	0.000
BMI (kg/m <sup>2</sup> )	20.25 $\pm$ 1.70	20.55 $\pm$ 1.94	19.96 $\pm$ 1.37	1.75	0.59	0.08

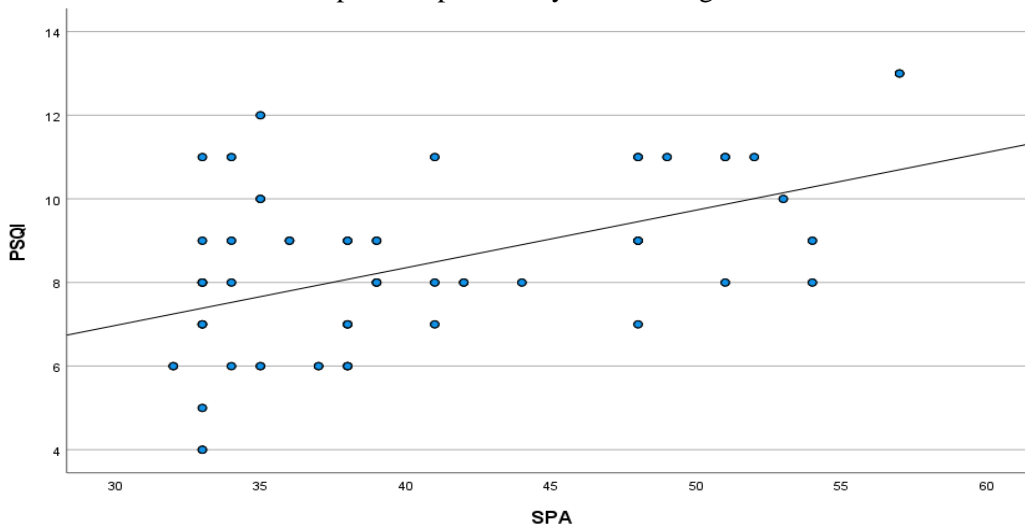
$\bar{X}$  : mean SD: slandered deviation p value; probability value

The correlation analysis between addictions to smartphones and sleep quality index showed moderate positive significant correlation between both variables ( $\rho = 0.454$ ,  $p < 0.001$ ) (Table 2 & figure 1). Comparing both groups correlation coefficient, the correlation coefficient for group 1 (males) was 0.40, while the correlation coefficient for group 2 (females) was 0.568 with  $p$  value  $< 0.001$ . This means that female participants in group 2 had significantly higher value than male participants in group 1 (Table 2 and figures 2 & 3).

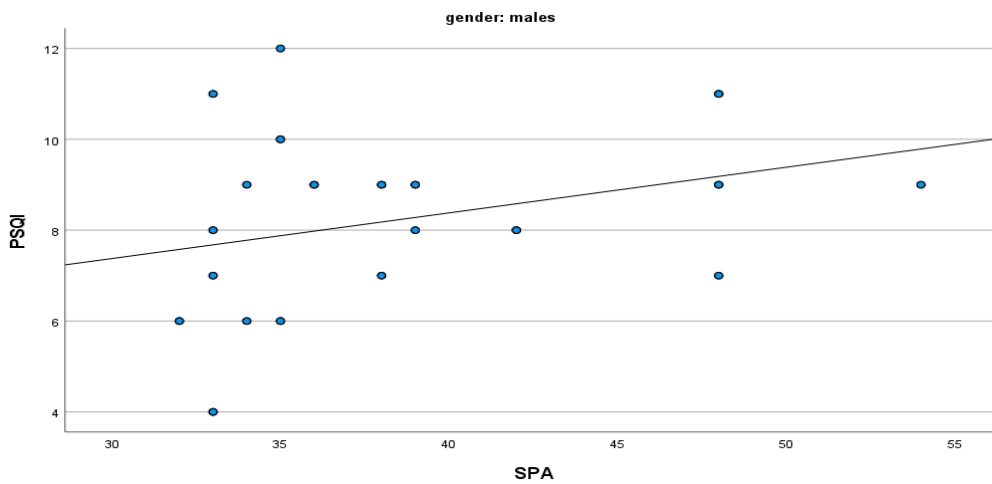
**Table (2):** Correlation analysis between smartphone addiction and sleep quality

SPA	PSQI		
	Overall	Group A	Group B
rho-value	0.454	0.40	0.568
p-value	0.000	0.008*	0.000*
N	100	50	50

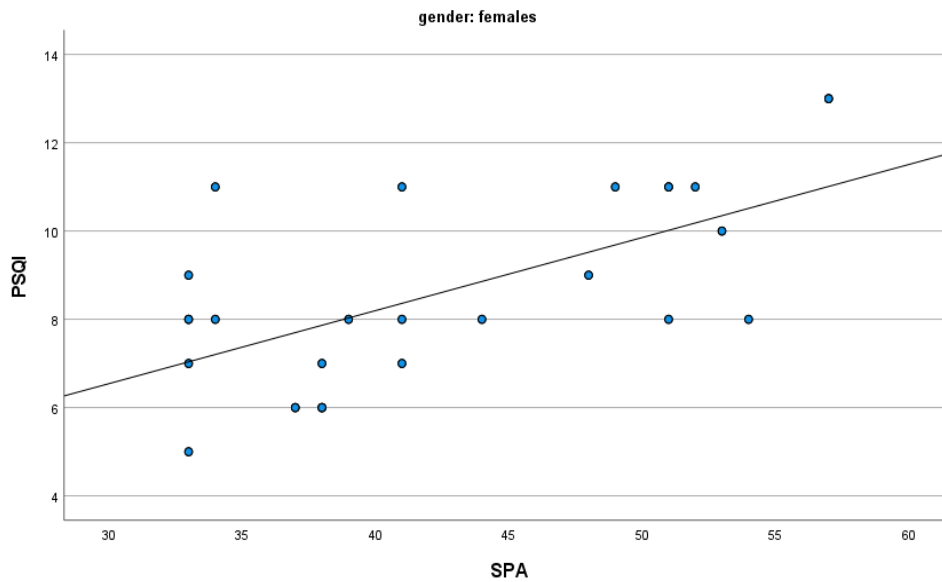
rho value: Spearman correlation coefficient p value: probability value \*: Significant



**Figure (1):** The correlation between addiction to smartphone and sleep quality index.



**Figure (2):** The correlation between addiction to smartphone and sleep quality index in males.



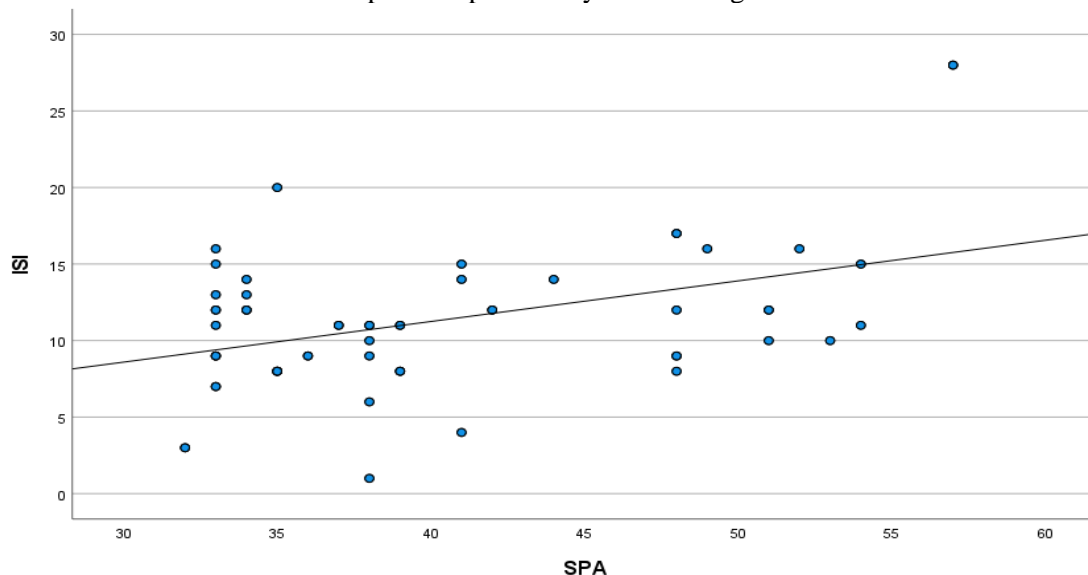
**Figure (3):** The correlation between addiction to smartphone and sleep quality index in females.

The correlation analysis between addictions to smartphones and insomnia severity showed significant moderate positive correlation ( $\rho = 0.31$ ,  $p < 0.001$ ) as shown in table (3) and figure (4). However, when comparing the results of correlation between both variables in both groups, the correlation analysis for the female group (Group B) was significantly higher than male group (Group A) with  $\rho = 0.284$ ,  $0.24$  respectively and  $p < 0.05$  (Table 3 and figures 5 & 6).

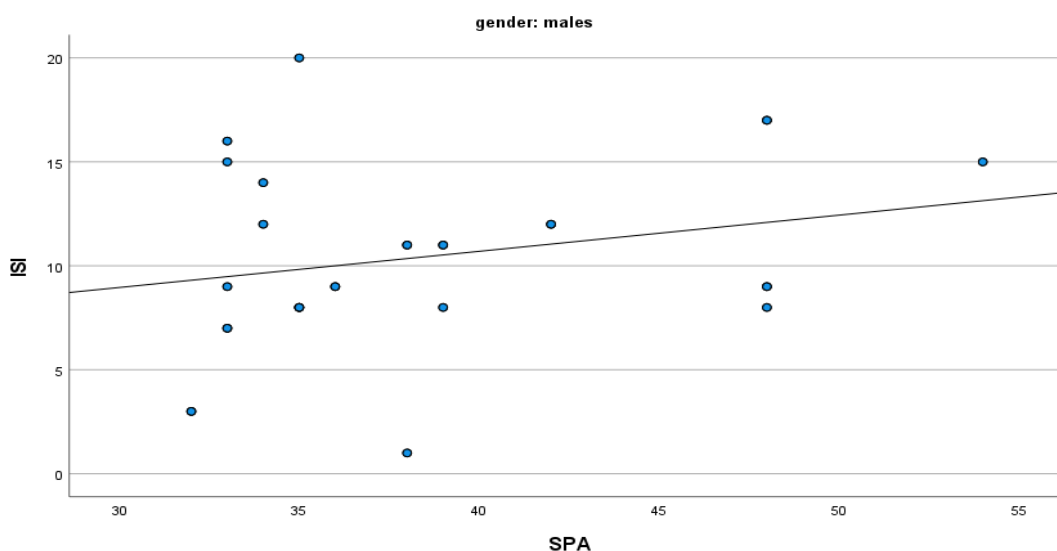
**Table (3):** Correlation analysis between smartphone addiction and insomnia severity

SPA	Insomnia severity index		
	Overall	Group A	Group B
rho-value	0.31	0.240	0.284
p-value	0.006*	0.09	0.04*
N	100	50	50

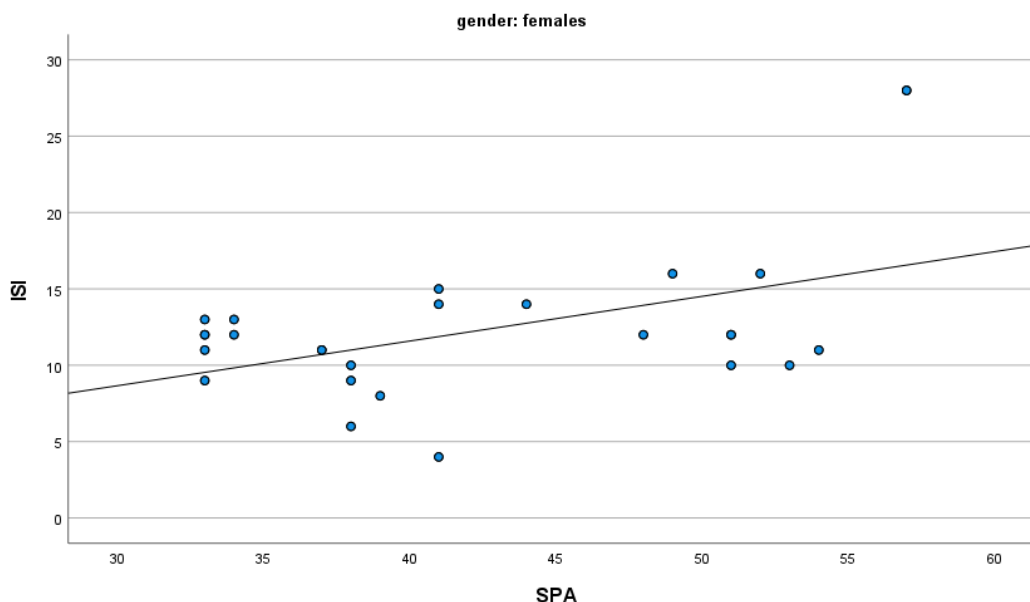
rho value: Spearman correlation coefficient p value: probability value \*: Significant



**Figure (4):** The correlation between addiction to smartphone and insomnia severity index.



**Figure (5):** The correlation between addiction to smartphone and insomnia severity index in males.



**Figure (6):** The correlation between addiction to smartphone and insomnia severity index in females.

## DISCUSSION

Overall, the current study results demonstrated that overdependence on smartphones was positively related to sleep quality and insomnia severity among a cohort of Egyptian university students with female students showing more affection compared to males.

In terms of sleep quality, the findings indicated a significant positive relation between the level of smartphone addiction and sleep quality, as evaluated by the Pittsburgh Sleep Quality Index. In other words, if the level of addiction increased, the sleep quality score would eventually increase. This aligns with the findings of the study done by **Demirci et al.** <sup>(13)</sup> who reported that there was a significant positive correlation between sleep quality and smartphone addiction scores. These associations between smartphones usage and sleep quality are most likely caused by the following reported factors. Time displacement, which involves substituting

sleep and other essential tasks with time spent on screens, media-induced behavioral facilitation, and the effects of device light on circadian cycles, the physiology of sleep, and alertness <sup>(14)</sup>. All of these factors are likely to be the underlying causes. The circadian rhythm and the total amount of time spent sleeping are both impacted by the usage of cell phones, particularly in the moments immediately preceding going to bed. One possible explanation for the causes is that the exposure to electromagnetic fields and blue light from cell phones have the capacity to alter melatonin levels <sup>(15)</sup>.

According to **Demirci et al.** <sup>(13)</sup>, exposure to electromagnetic fields at night can have an effect on the function of the brain, particularly the pineal gland. This exposure can alter the blood flow of the brain and its electrical activity, which can lead to a decline in the quality of sleep. More screen time and phone use was

associated with later bedtimes and poorer overall sleep for adolescents.

In addition, due to the fact that everyone possesses a smartphone, there is an ability to access information virtually anywhere and at any time. It is believed that one of the possible explanations for an overall low sleep quality scores in young adults is their experience of a phenomenon known as sleep texting, which is characterized by the fact that the chance to communicate with other people does not end when they go to bed. Sleep texting is the term used to describe the situation in which an individual responds to or sends an online message while they are asleep. The quality and duration of the individual's sleep are negatively influenced by this habit, which may occur only once or several times throughout the course of the sleep cycle on a single occasion or multiple occasions <sup>(5)</sup>.

Similarly, the results of **Zhang et al.** <sup>(16)</sup> showed that smartphone addiction resulted in a decrease in the overall sleep quality. According to the hypothesis of technology addiction, college students who are addicted to their mobile phones would use them excessively, which will surely result in less sleep. Furthermore, using mobile phones too much at night can have a natural impact on the activity of the pineal gland in each person. This can influence the melatonin secretion, which can therefore negatively impact the sleep quality. Using mobile phones too often will produce several stimuli for people, such as cognitive, behavioral, and physiological stimuli. This will eventually rise the arousal level and result in a drop in sleep quality <sup>(17)</sup>.

The findings of the impact of addiction to smartphones on insomnia severity score revealed a significant positive correlation between both measured variables. This means that an individual's likelihood of experiencing symptoms of insomnia is increased when they have a higher addiction level to their smartphones. These symptoms include difficulties with falling asleep, issues with staying asleep, and early morning awakenings. The delay in the onset of sleep that is linked with using a smartphone at night is one of the primary factors that appears to be contributing to the documented connection between smartphone addiction and insomnia. Participants who scored higher on the addiction scale reported spending longer periods of time using their electronic devices before going to bed. These participants frequently scrolled through social media or consumed content from the internet. In addition to delaying the time when one should go to bed, this practice also encourages cerebral stimulation and emotional engagement, both of which are detrimental to the process of falling asleep successfully. Moreover, excessive use of smartphones while in bed may condition the brain to link the bedroom with being awake rather than rest, which further exacerbates the challenges associated with falling or staying asleep <sup>(18, 19)</sup>. This is consistent with the result of **Liu et al.** <sup>(20)</sup> who discussed that our usage of cellphones impacted insomnia severity due to various reasons. First, using a

smartphone too much before might delay or disrupt the process of falling asleep. Second, excessive use of cellphones often leads to greater mental stress, which can also have a detrimental effect on the overall physical recovery and sleep. Third, exposure to screens gives out blue light that could have an impact on melatonin levels, which could in turn affect sleep and wakefulness affecting both the overall sleep quality and insomnia.

Concerning the difference between both genders, it is more common for females to utilize their phones for the purpose of entertainment and making social connections, such as posting images and videos from their daily lives and exploring the lives of other people. Young females may find that taking photographs provide them with a pleasant opportunity to interact with new people, record their lives, and share their individual points of view to the rest of the world suggesting a more frequent use of their phones which could explain why female students had a poorer sleep quality and insomnia severity scores <sup>(21)</sup>.

## LIMITATIONS

Despite the mentioned results of the present study had several limitations. Due to the type of the study design, which was a correlational study, the causative effect of smartphone addiction on sleep quality measures could not be approved. Data collected from included student were self-reported, so it is subjected to recall bias from the included sample.

## CONCLUSION

Findings of the present study showed that addiction to smartphones among students could negatively impact their sleep habits resulting in symptoms of poor sleep quality and insomnia. As the smartphone addiction increased, the level of insomnia severity and sleep quality would also increase. Therefore, taking into account smartphone addiction phenomenon among students is crucial to protect their mental health and academic achievements.

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