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# Promoting a Smartphone-free bedroom environment to enhance sleep quality among University students: A cross-sectional study from Saudi Arabia

*Manal Almalki[1], Manal Abasher Mohamed[2], Ali M. Alzahrani[3]*

**ABSTRACT**

***Objective:*** This study investigates the impact of smartphone usage habits on sleep quality among undergraduate students at Jazan University, Saudi Arabia.

***Methods:*** A cross-sectional study was conducted between April and May 2023 at Jazan University, Saudi Arabia. An online questionnaire included three sections: demographic characteristics, smartphone usage habits, and the Pittsburgh Sleep Quality Index (PSQI) for assessing sleep quality. Descriptive analysis and inferential tests were utilized.

***Results:*** Among 1,153 participants, the average PSQI score of 8.19, indicating poor sleep quality. Nearly three-quarters (73.46%) of participants used smartphones for over six hours daily. Regression analysis revealed three significant predictors of poor sleep: smartphone use in the evening, waking up frequently to check phones, and spending 1-2 hours on a smartphone at bedtime. Smartphone use for two hours or more before bedtime was linked to prolonged sleep latency (31.21%), frequent sleep disturbances (16.67%), increased reliance on sleep medications (4.96%), and notable daytime dysfunction (4.96%). Waking up twice or more to check smartphones had the strongest association with poor sleep quality.

***Conclusion:*** High smartphone use is a risk factor for poor sleep quality among university students. Promoting a smartphone-free bedroom environment is suggested as an effective strategy to enhance sleep hygiene and reduce frequent sleep interruptions.

**KEYWORDS:** PSQI, Smartphone usage, Sleep quality, Undergraduate students, Sleep hygiene.

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## INTRODUCTION

Sleep issues are a significant concern among university students worldwide. A study in China found that 26.64% of 8,457 undergraduate students had poor sleep quality, with older students and those in higher study levels being more affected.[1] In Africa, a systematic review indicated that about 55.64% of medical students experienced poor sleep quality, a rate significantly higher than the general population.[2] In Europe, a study involving Italian college students found that inadequate sleep (less than seven hours per night) was common, which negatively impacted their well-being and mental health.[3]

In Saudi Arabia, many studies indicate a high prevalence of poor sleep quality among university students across regions. For example, in the southern region, a study revealed that 64% of undergraduate students experienced poor sleep quality.[4] In the middle region, a study focusing on medical students found that 75.93% reported poor sleep quality.[5] In the eastern region, 30.9% had significant sleep quality disorders, and 34.9% of students experienced daytime sleepiness.[6] These findings reflect the widespread of sleep-related problems among university students in the country.

Smartphone usage, especially at bedtime, significantly affects sleep quality among university students.[7] In education, smartphones are not merely tools for communication but devices that enhance learning experiences, providing students with access to information, educational apps, and organizational aids.[8] However, prolonged smartphone use before sleep is associated with difficulty falling asleep, reduced sleep duration, and frequent interruptions during the night.[9] Activities such as social media, gaming, or watching videos can keep the brain active, making it harder to fall asleep.[10] In addition, blue light emitted by smartphones can disrupt the sleep cycle.[11]

Poor sleep quality can lead to cognitive deficits, mood disturbances, and decreased academic achievement.[3] Students who slept poorly, perform worse on exams, solve problems less effectively, and achieve lower academic results.[12,13] Lack of sleep is also linked with deteriorating physical health[14] irregular exercise[4] high consumption of caffeine or energy drinks[10] and unhealthy dietary.[15] This creates a vicious cycle, where poor sleep exacerbates unbalanced lifestyle habits, further impairing sleep quality. Therefore, this study aims to investigate the influence of smartphones usage habits on sleep quality of undergraduate students in Saudi Arabia. Understanding this relationship can lead to tailored interventions to improve students' sleep hygiene, enhance their learning capacity, and boost academic performance.

## METHODS

A cross-sectional study was conducted between April and May 2023 at Jazan University, Saudi Arabia. An online questionnaire was constructed using Google Forms and consisted of three sections. The first section covered demographics (e.g., age, gender, marital status, etc.). The second section focused on smartphone usage habits (e.g., average daily use, time spent on smartphone at bedtime, keeping the smartphone close while sleeping, waking up to check the smartphone, etc.). The third section assessed sleep quality using the Pittsburgh Sleep Quality Index (PSQI).[16,17] It includes seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. PSQI scores ≥5 indicate disturbed sleep, and scores ≥9 suggest clinical sleep disturbances. In this study, participants were given the option to complete either the English version or the reliable and valid Arabic-translated version of the PSQI survey.[18] A link to the online questionnaire was posted on social networking platforms such as WhatsApp, Snapchat, Telegram, and X (formerly Twitter). Before completing the questionnaire, participants were informed about

Table-I: Participants' Characteristics.

| *Variables* | *N* | *(%)* |
|---|---|---|
| ***Demographics*** | | |
| ***Age*** | | |
| 18-24 | 1,038 | 90.03 |
| > 24 | 115 | 9.97 |
| ***Gender*** | | |
| Male | 197 | 17.09 |
| Female | 956 | 82.91 |
| ***Marital Status*** | | |
| Unmarried | 994 | 86.21 |
| Married | 159 | 13.79 |
| ***Area of Residence*** | | |
| Village | 728 | 63.14 |
| City | 425 | 36.86 |
| ***Smartphone Usage Habits*** | | |
| ***Average Daily Use of Smartphone (hour)*** | | |
| ≤ 1 | 18 | 1.56 |
| > 1 < 4 | 84 | 7.29 |
| > 4 < 6 | 204 | 17.69 |
| > 6 < 8 | 285 | 24.72 |
| > 8 | 562 | 48.74 |
| ***Time to Use Smartphone*** | | |
| Morning | 298 | 25.85 |
| Afternoon | 407 | 35.30 |
| Evening | 448 | 38.86 |
| ***Keep Smartphone Close While Sleeping*** | | |
| No | 88 | 7.63 |
| Yes | 1,065 | 92.37 |
| ***Wake up to Use Smartphone*** | | |
| No | 640 | 55.51 |
| Yes | 513 | 44.49 |
| ***Wake up to Check Smartphone*** | | |
| Once | 837 | 72.59 |
| Twice | 187 | 16.22 |
| Three times or more | 129 | 11.19 |
| ***Use Smartphone Immediately when Wake up in the Morning*** | | |
| No | 177 | 15.35 |
| Yes | 976 | 84.65 |
| ***Time Spent on Smartphone at Bedtime (hour)*** | | |
| < 1 | 353 | 30.62 |
| 1 – 2 | 518 | 44.93 |
| > 2 | 282 | 24.46 |
| *Outcome* | *Mean* | *SD* |
| Sleep Quality Score | 8.19 | 3.57 |

Table-II: Comparison of Sleep Quality by Participants' Smartphone Usage Habits.

| *Variables* | *N (%)* | *Sleep Quality* | | | |
|---|---|---|---|---|---|
| | | *Mean* | *SD* | *t-value* | *p-value* |
| *Smartphone Usage Habits* | | | | | |
| *Average Daily Use of Smartphone (hour)* | | *Mean* | *SD* | *F-value* | *p-value* |
| ≤ 1 | 18 (1.56) | 7.39 | 3.76 | 5.38 | < 0.001 * |
| > 1 < 4 | 84 (7.29) | 6.86 | 3.28 | | |
| > 4 < 6 | 204 (17.69) | 7.76 | 3.46 | | |
| > 6 < 8 | 285 (24.72) | 8.23 | 3.55 | | |
| > 8 | 562 (48.74) | 8.55 | 3.60 | | |
| *Time to Use Smartphone* | | *Mean* | *SD* | *F-value* | *p-value* |
| Morning | 298 (25.85) | 8.02 | 3.45 | 1.74 | 0.176 |
| Afternoon | 407 (35.30) | 8.04 | 3.69 | | |
| Evening | 448 (38.86) | 8.43 | 3.54 | | |
| *Keep Smartphone Close While Sleeping* | | | | | |
| No | 88 (7.63) | 7.32 | 2.97 | - 2.38 | 0.017 * |
| Yes | 1,065 (92.37) | 8.26 | 3.61 | | |
| *Wake up to Use Smartphone* | | | | | |
| No | 640 (55.51) | 8.00 | 3.56 | - 1.94 | 0.052 |
| Yes | 513 (44.49) | 8.42 | 3.58 | | |
| *Wake up to Check Smartphone* | | *Mean* | *SD* | *F-value* | *p-value* |
| Once | 837 (72.59) | 7.83 | 3.51 | 16.13 | < 0.001 * |
| Twice | 187 (16.22) | 9.02 | 3.31 | | |
| Three times or more | 129 (11.19) | 9.31 | 3.88 | | |
| *Use Smartphone Immediately when Wake up* | | | | | |
| No | 177 (15.35) | 7.80 | 3.53 | - 1.58 | 0.114 |
| Yes | 976 (84.65) | 8.26 | 3.57 | | |
| *Time Spent on Smartphone at Bedtime (hour)* | | *Mean* | *SD* | *F-value* | *p-value* |
| < 1 | 353 (30.62) | 7.43 | 3.45 | 13.03 | < 0.001 * |
| 1 – 2 | 518 (44.93) | 8.37 | 3.50 | | |
| > 2 | 282 (24.46) | 8.80 | 3.70 | | |

***Note:*** Comparison made using t-test and ANOVA, * $p < 0.05$.

the study's objectives and provided e-consent. Then data was extracted from Microsoft Excel and transferred to Stata/BE 17.0. Frequency, percentages, means and standard deviation (SD) were utilized. Inferential tests including t-test, ANOVA, chi-square test, and multivariable linear regression were also used to assess associations, with significance set at $P < 0.05$.

***Ethical approval:*** It was obtained from Jazan University's research ethics committee (Reference: REC-44/09/606) dated April 06, 2023.

## RESULTS

A total of 1,153 participants reported using smartphone at bedtime. The majority was in the 18–24 age range (90.03%), female (82.91%), unmarried (86.21%), and living in villages (63.14%). PSQI global score was 8.19, yielded significantly poor sleep quality. Table-I presents the demographics of the participants in this study.

A significant prevalence of smartphone use was found, with 73.46% of participants using their smartphones for more than six hours per day. Nearly three-quarters of the participants reported using their smartphones during the afternoon and evening (74.16%). At bedtime, over two-thirds of participants spent at least one hour on their smartphones (69.38%), and (92.37%) kept their devices close while sleeping. All participants woke up at least once to check their smartphones. The majority (84.65%) used their smartphones immediately when they woke up in the morning.

***Associations between the Sleep Quality Score and Smartphone Usage Habits:*** Significant and positive relationships were identified between the sleep quality score and the various smartphone usage habits, as shown in Table-II. The sleep quality score increased significantly as the average number of hours of daily use of a smartphone increased. For example, those who reported more than eight hours of smartphone use per day had a higher sleep quality score (8.55); indicating poorer sleep quality, compared to those who reported an hour or less of smartphone use per day (7.39).

Using smartphones in the evening had a slightly greater impact on the sleep quality score as opposed to using them in the morning or afternoon. In addition, participants who stated keeping their smartphone close to them while they were sleeping had considerably greater sleep quality scores than those who did not. Similarly, participants who reported checking their smartphones three or more times during the night had significantly higher sleep quality scores than those who only checked them once, reflecting poorer sleep quality.

***The Most Prevalent Sleep Issues Among Smartphone Users at Bedtime:*** The most prevalent sleep issues among three groups of participants in our sample. Group-I, who used their smartphones for less than one hour before bed; Group-II, who used their smartphones for 1-2 hours before bed; and Group-III, who used smartphones for more than two hours before bedtime is highlighted in Table-III.

The first and most significant issue was increased sleep latency, with 31.21% of participants taking more than 60 minutes to fall asleep. Sleep latency was nearly twice as high in Group-III compared to Group-I (15.86%). The second issue was a significant daytime dysfunction. It was reported by 16.67% of participants in Group-III compared to 9.63% by Group-I, indicating considerable impairment in daily functioning due to poor sleep quality. This was followed by a high prevalence of sleep disturbances, with 4.96% experiencing disruptions three or more times a week. Group-III (4.96%) experienced almost twice as many weekly sleep disruptions as Group-I (2.83%). Likewise, the use of sleep medications was another major issue, with 4.96% of participants relying on them three or more times a week. The frequency of taking sleep medications per week was approximately three times higher in Group-III (4.96%) than in Group-I (1.98%).

Regression analysis revealed that increased smartphone usage before bedtime is associated with poorer sleep quality, as reflected in higher PSQI scores. Group-III had the highest average PSQI score of 8.80, indicating the poorest sleep quality among the groups, as shown in Fig.1. Group-II had a moderate average PSQI score of 8.37, reflecting a decline in sleep quality compared to the first group. In contrast, Group-I had the lowest average PSQI score of 7.43, indicating the best sleep quality. Furthermore, Group-III reported having a very bad sleep quality (12.06%) as compared to Group-I (5.38%).

***Key Predictors of Poor Sleep Quality Among Smartphone Users at Bedtime:*** The multivariable linear regression analysis revealed the three key predictors that were significantly associated with poorer sleep quality, as presented in Table-IV. These predictors were: using a smartphone in the evening, waking up multiple times to check the smartphone, and spending 1-2 hours on a smartphone at bedtime. These habits were linked to higher sleep disturbance scores, indicating a detrimental effect on sleep quality.

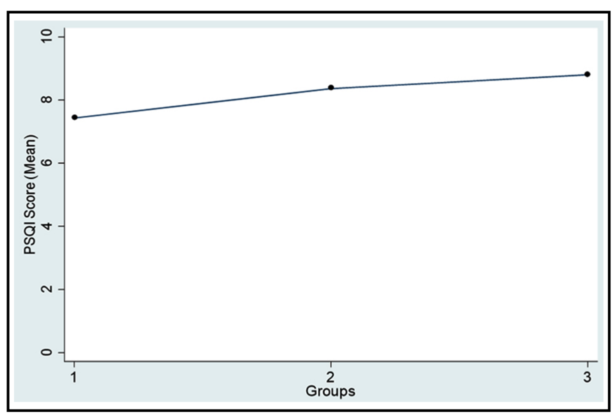


Fig.1: Comparison of Pittsburgh Sleep Quality Index Scores among the Bedtime Smartphone Users' Groups.

Table-III: Components of PSQI among the Bedtime Smartphone Users Groups.

| *PSQI Components* | *Time Spent on Smartphone at Bedtime* | | | *P-value* |
|---|---|---|---|---|
| | *Group-I (< 1 hr.) (%)* | *Group-II (1 to 2 hrs.) (%)* | *Group-III (> 2 hrs.) (%)* | |
| *Subjective sleep quality* | | | | |
| Very good | 33.99 | 24.32 | 25.18 | < 0.001 * |
| Fairly good | 45.04 | 49.81 | 39.72 | |
| Fairly bad | 15.58 | 17.95 | 23.05 | |
| Very bad | 5.38 | 7.92 | 12.06 | |
| *Sleep latency (minute)* | | | | |
| < 15 | 16.15 | 10.42 | 12.41 | < 0.001 * |
| 16-30 | 36.54 | 27.03 | 24.11 | |
| 31-60 | 31.44 | 34.36 | 32.27 | |
| > 60 | 15.86 | 28.19 | 31.21 | |
| *Sleep duration (hour)* | | | | |
| > 7 | 38.81 | 36.49 | 41.84 | 0.143 |
| 6-7 | 15.86 | 15.44 | 9.57 | |
| 5-6 | 30.03 | 34.17 | 31.21 | |
| < 5 | 15.30 | 13.90 | 17.38 | |
| *Habitual Sleep efficiency* | | | | |
| ≥ 85% | 52.12 | 53.28 | 45.39 | 0.215 |
| 75-84% | 9.07 | 8.69 | 8.87 | |
| 65-74% | 9.92 | 8.11 | 7.80 | |
| < 65% | 28.90 | 29.92 | 37.94 | |
| *Sleep disturbance* | | | | |
| Not during past month | 10.20 | 6.37 | 12.41 | < 0.001* |
| Less than once a week | 60.62 | 55.79 | 41.84 | |
| Once or twice a week | 26.35 | 35.14 | 40.78 | |
| Three or more times a week | 2.83 | 2.70 | 4.96 | |
| *Use of sleep medication* | | | | |
| Not during past month | 88.10 | 80.12 | 75.53 | 0.001 * |
| Less than once a week | 5.38 | 10.81 | 14.89 | |
| Once or twice a week | 4.53 | 5.79 | 4.61 | |
| Three or more times a week | 1.98 | 3.28 | 4.96 | |
| *Daytime dysfunction* | | | | |
| No problem at all | 22.38 | 16.41 | 23.40 | 0.004 * |
| Only a very slight problem | 40.79 | 38.42 | 33.69 | |
| Somewhat of a problem | 27.20 | 33.40 | 26.24 | |
| A very big problem | 9.63 | 11.78 | 16.67 | |
| PSQI Score Mean (SD) | 7.43 (3.45) | 8.37 (3.50) | 8.80 (3.70) | |

Table-IV: The multivariable linear regression analysis of individual factors predicting sleep quality score.

| *Variables* | *Coefficient (β)* | *SE* | *t-value* | *p-value* |
|---|---|---|---|---|
| *Smartphone Usage Habits* | | | | |
| *Average Daily Use of Smartphone (hour)* | | | | |
| ≤ 1 | *Ref* | | | |
| > 1 < 4 | - 0.67 | 0.909 | - 0.74 | 0.461 |
| > 4 < 6 | 0.15 | 0.862 | 0.17 | 0.861 |
| > 6 < 8 | 0.45 | 0.854 | 0.53 | 0.596 |
| > 8 | 0.54 | 0.844 | 0.64 | 0.524 |
| *Time to Use Smartphone* | | | | |
| Morning | *Ref* | | | |
| Afternoon | 0.21 | 0.272 | 0.78 | 0.435 |
| Evening | 0.54 | 0.268 | 2.02 | 0.044 * |
| *Keep Smartphone Close While Sleeping* | | | | |
| No | *Ref* | | | |
| Yes | 0.65 | 0.395 | 1.64 | 0.102 |
| *Wake up to Use Smartphone* | | | | |
| No | *Ref* | | | |
| Yes | - 0.32 | 0.245 | - 1.30 | 0.192 |
| *Wake up to Check Smartphone* | | | | |
| Once | *Ref* | | | |
| Twice | 1.09 | 0.301 | 3.63 | < 0.001 * |
| Three times or more | 1.33 | 0.375 | 3.55 | < 0.001 * |
| *Use Smartphone Immediately when Wake up* | | | | |
| No | *Ref* | | | |
| Yes | 0.07 | 0.305 | 0.22 | 0.824 |
| *Time Spent on Smartphone at Bedtime (hour)* | | | | |
| < 1 | *Ref* | | | |
| 1 – 2 | 0.64 | 0.249 | 2.58 | 0.010 * |
| > 2 | 0.83 | 0 .309 | 2.68 | 0.007 * |

SE= Standard Error; REF= Reference Group, * P < 0.05.

Based on the regression analysis, the factor that produced the poorest quality of sleep was waking up to check smartphones twice or more. Compared to those reported waking up once to check their smartphones, the sleep quality score increased by 1.09 and 1.33 points for those reported waking up twice or three time or more, respectively, (all *p*'s <0.001). Similarly, the sleep quality score was 0.64 and 0.83 points higher among those spent 1-2 hours (*p*=0.010) or more than two hours (*p*=0.007) on their smartphones at bedtime, respectively, compared to those spent less than one hour. Finally, compared to those reported using their smartphone in the morning, the sleep quality score increased by 0.54 points for those reported using it in the evening (*p*=0.044).

## DISCUSSION

Smartphone usage habits are key predictors of poor sleep among undergraduate students. In this study, the average PSQI score was 8.19, indicating significantly disturbed sleep quality, with many participants using their devices for more than two hours at bedtime. These findings are consistent with previous research showing that extensive smartphone use before bed adversely affects sleep, often resulting in PSQI scores exceeding five.[1,10,19]

In this study, all participants woke up at least once to check their smartphones, and this behaviour had the most significant negative impact on sleep quality. Regression analysis also revealed issues like prolonged sleep latency, frequent disturbances, reliance on sleep medications, and daytime dysfunction among those with extensive smartphone use before bedtime. Similar studies suggest that the presence of smartphones in the bedroom contributes to stress and anxiety due to notifications, calls and text messages, and the pressure to stay connected.[3,20,21]

Despite the severe consequences of prolonged bedtime smartphone use, limited research addresses solutions for these sleep issues among university students.[22,23] Thus, more studies are needed to develop effective interventions to mitigate the negative impacts of smartphone use on sleep health among university students. Creating a smartphone-free bedroom environment can be one of the effective strategies to enhance sleep hygiene.[24] By eliminating screens from the bedroom, students can maintain natural melatonin production, promoting a more natural sleep cycle.[25,26] Furthermore, a smartphone-free bedroom contributes to better cognitive functions and academic performance by ensuring students are well-rested and maintaining consistent bedtime routines.[2,27]

***Limitations:*** The strengths of this study include the large sample size, the use of validated and reliable scales, and exploring various factors associated with sleep quality. However, a limitation is that the data relied on self-reported information from participants.

## CONCLUSION

High smartphones use negatively impacts sleep quality. Educating students on its effects, especially at bedtime, is essential. Future research should focus on strategies to encourage technology-free bedrooms that foster a relaxing environment and consistent bedtime routines like reading or meditating.

***Conflict of Interest:*** None.

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### *Authors' Contribution:*

**MA & MAM:** Acquisition of data. **AMA:** Software and data analysis. **AMA & MA:** Interpretation of data. All authors are conceived, designed, and drafted the manuscript and approved the final version. They are also accountable for the integrity of the study.