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Original Article

# Evaluation of the frequency/addiction of smartphone use and its effect on sleep quality in university students

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**Abstract**

**Aim:** In the last century, the use of technological devices has increased rapidly, and smartphones have managed to enter the list of products used by almost everyone because of their various features. Technology addiction, which is the result of misuse or overuse of technology, has entered into the literature in this period and has biological, psychological, and sociological effects. Smartphone addiction is considered as a problem that can affect the youth in university as well as all age groups in every aspect of health. In this study, we aimed to measure the effect of smartphone addiction on sleep quality, which affects the individual's biopsychosocial life.

**Material and Methods:** The study consists of students of the University of Health Sciences, Hamidiye Vocational School of Health Services. The sample group consisted of 161 students selected by the simple randomization method. A questionnaire was used as a data collection tool, Smartphone Addiction Scale - Short Version, Pittsburgh Sleep Quality Index, and the data were analyzed with the SPSS 22.0 Program.

**Results:** According to the findings of the study, all students use smartphones. The smartphone addiction rate was 31.1%, and reduced sleep quality rate was 47.8% among students. There was a significant relationship between smartphone addiction and sleep quality.

**Conclusion:** In our study, considering the importance of quality sleep in terms of biopsychosocial health of the individual, the importance of raising the awareness of young people to use the technology correctly and as necessary was demonstrated.

**Keywords:** Addiction; sleep hygiene; health occupations students; preventive medicine

## INTRODUCTION

Mobile internet technologies are devices that have become widespread, especially in the last decade. Initially, mobile phones were only with the function of sending calls and short text messages, and they were called “smartphones” with the integration of mobile internet technology. Smartphones have increasingly become devices for use in individual and social life with features such as accessing many websites over the internet, mobile application, navigation, taking photos and videos, playing games(1). According to 2019 data, 67% of the world's population uses mobile phones, and 42% uses mobile social media. The difference between the computer market and the smartphone market volume between 2010 and 2016 is shown in Figure 1(2). In our country, internet and smartphone usage rates also showed a parallel trend. While the internet usage rate was 18.8% in 2004, it increased to 75.3% after 15 years(3). Also, in 2019, 98% of adults in Turkey use mobile phones, 77% of them use smartphones, and 53% use mobile social media(4).

In DSM-5 (Diagnostic and Statistical Manual Version 5) dependence is described as “control disorder (searching for more amounts over time, unsuccessful attempts to reduce substance intake, etc.), narrowing of interests and neglect of daily life, continuing to use despite being aware of physiological and psychological harms, experiencing

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tolerance and withdrawal syndrome" and the definition mostly targeted chemicals such as cigarettes and alcohol(5). Although consumption of the substance taken causes problems in the person's life, if consumption is reduced or quit, dependence state, which indicates the occurrence of withdrawal signs, varies according to the object or behavior(6). Today, the use of technology is increasing day by day; technology addiction, which states that the individual misuses the technology or more than it is, has taken its place among the types of addiction after substance addiction. Increasing smartphone usage rates in daily life, such as internet and game addiction, has also brought up the "smartphone use addiction (SUA)" category in the behavioral addictions category(7). Smartphones are the most critical devices in terms of creating a dependency on real-time internet access to many applications, easy portability, and direct communication. The elements defining behavioral dependencies in literature are listed as; loss of control, the establishment of a dependent relationship, development of tolerance, progressive time spent, and devotion, severely affected daily life(8). Although the use of smartphones is not accepted as a separate disease in DSM-5, like other behavioral addictions except gambling addiction in the category of behavioral addictions, studies regarding the diagnosis continue. In the ICD-11 coding published by WHO in 2018, for technological devices, gaming disorders were divided into three categories: "online," " offline," and "not specified (9).

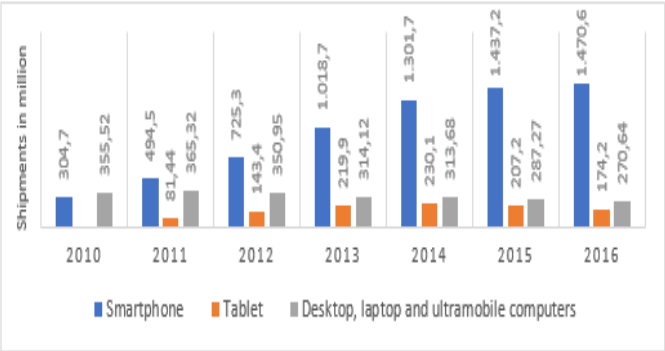


**Figure 1.** Global shipment of tablets, smartphones, and computers (desktop, laptop and ultra-mobile computers) between 2010 and 2016(2)

Excessive interest in an object makes individuals disadvantaged; biological, psychological, and sociological consequences of this phenomenon emerge. The studies conducted in the literature reveal the physical and psychosocial effects of smartphone use. Physical symptoms such as muscle pain and rigidity, physical inactivity, weakness, dry eye, blurred vision, itching and redness of the eye are observed and cause macular degeneration, while psychosocial symptoms such as sleep disorders, social withdrawal, loneliness, anxiety, depression can be observed(10, 11). Because telephone addiction causes separation from the real environment of a person's friends, family, and affects social relations negatively. The weakening of social relations may lead to different psychosocial problems.

Adequate sleep is important in terms of growth hormone secretion in young adults as in any age period(12). Mobile phones and computer screens have blue light with short wavelengths (380-495 nm). Exposure to blue light at night reduces the secretion of melatonin hormone, which provides circadian rhythm and sleep quality(13). The use of smartphones before sleep has been found to cause an increase in the latency of the young people (falling asleep time) and a decrease in sleep time(14).

In this study, we aimed to define the smartphone usage and addiction development status of the University of Health Sciences, Hamidiye Vocational School of Health Services students who will work in the health sector in the future, and analyze its effect on sleep quality.

## MATERIAL and METHODS

The study is cross-sectional, and a questionnaire was developed for the face-to-face interview technique. One hundred sixty-one students were selected by a simple randomization method among 913 health technician students studying in 12 programs at the University of Health Sciences, Hamidiye Vocational School of Health Services (VSHS). The questionnaire was asked to the students between 01.01.2018 and 31.01.2018. Students were informed verbally and written informed consent was obtained.

Ethics committee approval was obtained for the study by Okmeydanı Training and Research Hospital dated 05.12.2017 and numbered 779, and administrative permission was obtained from VSHS Directorate.

The questionnaire form, which was developed for data collection of our study consists of three main sections. The first part is the descriptive part of the students' demographic characteristics such as age and gender, and the second part is the Smartphone Addiction Scale-Short Version (SAS-SV), which measures the SUA status, and the last part is from the Pittsburgh Sleep Quality Index (PSQI), which assesses sleep quality.

SAS-SV is a form that first developed in 2013 by Kwon et al. Its short version was also developed in the same year by the group, and validity and reliability of the scale in Turkish was performed in 2015 by Noyan et al.(1, 15, 16). The one-factor model consists of 10 items and is evaluated with a six-point Likert rating. The scale is evaluated with min 10, max 60 points, and as the score increases, the risk of addiction increases. Although there was no cut-off score, it was accepted as a cut-off score of 33 in women and 31 in men in the Korean sample(1). Cronbach's alpha coefficient of internal consistency and concurrent validity of the original form is 0.91. Cronbach's alpha coefficient for the Turkish SAS-SV was found to be 0.86(16).

PSQI; It was developed by Buysse et al. in 1989, and its reliability and validity in Turkish were established

by Ağargün et al. in 1996(17, 18). The scale consists of 18 items and seven components. Component 1 (C1); measures subjective sleep quality and consists of the scoring of the 6th question in the scale. Component 2 (C2); evaluate sleep latency. It consists of the sum of the questions about falling asleep in bed and having difficulty in falling asleep. Component 3 (C3); evaluates the duration of sleep and is calculated by scoring the 3rd question. Component 4 (C4); is the habitual sleep activity and calculated with the formula "the total sleep time/ time spent x100". Component 5 (C5) sleep disturbance is calculated by adding nine sub-questions. Component 6 (C6) scores the use of sleep medication. Component 7 (C7) evaluates daytime dysfunction. As the score on each component increases, the sleep quality indicator measured in the component deteriorates. Each component of the scale is 3 points, and it is evaluated has a total of min. 0 and max. 21 points. 0-5 points indicate good sleep quality, and 6-21 points indicate poor sleep quality(18).

### Statistical analysis

For statistical analysis of the study, SPSS Statistics 22.0 (IBM SPSS, Turkey) software package was used. The categorical variables in the study are given as frequency, percentage, and continuous variables as mean, standard deviation, median, minimum, and maximum values. The Shapiro-Wilk test examined the suitability of the continuous variables to the normal distribution. One-way ANOVA was used for comparison of variables with normal distribution; the Kruskal-Wallis test was used to compare variables that do not show normal distribution. Mann-Whitney U test was used to compare continuous variables. The chi-square test examined the comparison between categorical variables, and the relationship between continuous variables was analyzed by Spearman correlation analysis. In the study, $p < 0.05$ was considered statistically significant. Sample width of the study; For repetitive measurements, the effect size was 0.3 for the t-test, and the minimum number of people at the 80% test power and 95% confidence level was calculated as 143. Power analysis was performed with the G-Power 3.1.9.4 package program.

## RESULTS

Of the 161 students included in the study, 121 were female (76.4%), and 40 were male (24.8%). The mean age of the students was 18.96±1.72, and 75.8% was18-20 years, 18% was 21-23 years, 3.7% was24-26 years old, and 1.9% was older than 26 years. All students selected by a simple randomization method (100%) were using mobile phones, and 100% were using smartphones.

**Table 1. Distribution of smartphone dependencies by gender**

| | | | Dependency Status | | Total |
|---|---|---|---|---|---|
| | | | Not Dependent | Dependent | |
| Gender | Female | n | 25 | 15 | 40 |
| | | % | 15.5 | 9.3 | 24.8 |
| | Male | n | 86 | 35 | 121 |
| | | % | 53.4 | 21.7 | 75.2 |
| Total | | n | 111 | 50 | 161 |
| | | % | 68.9 | 31.1 | 100.0 |

$x^2=1.032$, df:1, p=0.31

**Table 2. Distribution of responses to the smartphone addiction scale-short version (SAS-SV)**

| | n | % | Cum.Percent | | n | % | Cum. Percent |
|---|---|---|---|---|---|---|---|
| I miss planned work due to smartphone use | | | | I have my smartphone in my mind even when I am not using it | | | |
| Strongly disagree | 30 | 18.6 | 18.6 | Strongly disagree | 35 | 21.7 | 21.7 |
| Disagree | 40 | 24.8 | 43.5 | Disagree | 45 | 28.0 | 49.7 |
| Weakly disagree | 24 | 14.9 | 58.4 | Weakly disagree | 20 | 12.4 | 62.1 |
| Weakly agree | 49 | 30.4 | 88.8 | Weakly agree | 29 | 18.0 | 80.1 |
| Agree | 12 | 7.5 | 96.3 | Agree | 19 | 11.8 | 91.9 |
| Strongly agree | 6 | 3.7 | 100.0 | Strongly agree | 13 | 8.1 | 100.0 |
| Total | 161 | 100.0 | | Total | 161 | 100.0 | |
| I have a hard time concentrating in class while doing assignments, or while working due to smartphone use | | | | I won't give up using my smartphone even when my daily life is already greatly affected by it. | | | |
| Strongly disagree | 28 | 17.4 | 17.4 | Strongly disagree | 27 | 16.8 | 16.8 |
| Disagree | 38 | 23.6 | 41.0 | Disagree | 44 | 27.3 | 44.1 |
| Weakly disagree | 25 | 15.5 | 56.5 | Weakly disagree | 25 | 15.5 | 59.6 |
| Weakly agree | 49 | 30.4 | 87.0 | Weakly agree | 32 | 19.9 | 79.5 |
| Agree | 11 | 6.8 | 93.8 | Agree | 20 | 12.4 | 91.9 |
| Strongly agree | 10 | 6.2 | 100.0 | Strongly agree | 13 | 8.1 | 100.0 |
| Total | 161 | 100.0 | | Total | 161 | 100.0 | |

| I feel pain in the wrists or at the back of the neck while using a smartphone | | | |
|---|---|---|---|
| **Strongly disagree** | 48 | 29.8 | 29.8 |
| **Disagree** | 45 | 28.0 | 57.8 |
| **Weakly disagree** | 18 | 11.2 | 68.9 |
| **Weakly agree** | 24 | 14.9 | 83.9 |
| **Agree** | 19 | 11.8 | 95.7 |
| **Strongly agree** | 7 | 4.3 | 100.0 |
| **Total** | 161 | 100.0 | |

| I constantly check my smartphone so as not to miss conversations between other people on Twitter or Facebook | | | |
|---|---|---|---|
| **Strongly disagree** | 58 | 36.0 | 36.0 |
| **Disagree** | 47 | 29.2 | 65.2 |
| **Weakly disagree** | 15 | 9.3 | 74.5 |
| **Weakly agree** | 22 | 13.7 | 88.2 |
| **Agree** | 12 | 7.5 | 95.7 |
| **Strongly agree** | 7 | 4.3 | 100.0 |
| **Total** | 161 | 100.0 | |

| I won't be able to stand not having a smartphone | | | |
|---|---|---|---|
| **Strongly disagree** | 30 | 18.6 | 18.6 |
| **Disagree** | 26 | 16.1 | 34.8 |
| **Weakly disagree** | 27 | 16.8 | 51.6 |
| **Weakly agree** | 35 | 21.7 | 73.3 |
| **Agree** | 18 | 11.2 | 84.5 |
| **Strongly agree** | 25 | 15.5 | 100.0 |
| **Total** | 161 | 100.0 | |

| I use my smartphone longer than I had intended | | | |
|---|---|---|---|
| **Strongly disagree** | 25 | 15.5 | 15.5 |
| **Disagree** | 30 | 18.6 | 34.2 |
| **Weakly disagree** | 24 | 14.9 | 49.1 |
| **Weakly agree** | 47 | 29.2 | 78.3 |
| **Agree** | 23 | 14.3 | 92.5 |
| **Strongly agree** | 12 | 7.5 | 100.0 |
| **Total** | 161 | 100.0 | |

| I feel impatient and fretful when I am not holding my smartphone | | | |
|---|---|---|---|
| **Strongly disagree** | 43 | 26.7 | 26.7 |
| **Disagree** | 37 | 23.0 | 49.7 |
| **Weakly disagree** | 21 | 13.0 | 62.7 |
| **Weakly agree** | 27 | 16.8 | 79.5 |
| **Agree** | 15 | 9.3 | 88.8 |
| **Strongly agree** | 18 | 11.2 | 100.0 |
| **Total** | 161 | 100.0 | |

| The people around me tell me that I use my smartphone too much. | | | |
|---|---|---|---|
| **Strongly disagree** | 49 | 30.4 | 30.4 |
| **Disagree** | 55 | 34.2 | 64.6 |
| **Weakly disagree** | 18 | 11.2 | 75.8 |
| **Weakly agree** | 18 | 11.2 | 87.0 |
| **Agree** | 9 | 5.6 | 92.5 |
| **Strongly agree** | 12 | 7.5 | 100.0 |
| **Total** | 161 | 100.0 | |

When the questions of the SAS-SV were analyzed, the total score of the SAS-SV was 29.15±9.60 ((range, 10-59). As stated in the Korean sample, when 33 points were accepted as the cut-off point in females and 31 points in males, it was seen that the average score was below the addiction level. A total of 50 students (31.1%, 35 female, 15 male) had SUA, and 111 (68.9%, 86 female, 25 male) were not dependent (Table 1). There was no statistically significant difference between being SUA and gender (p=0.31). Table 2 shows the responses to a total of 10 questions on the SAS-SV scale.

When students are asked about their daily smartphone use times, the highest was between 1 and 4 hours (n:86, 53.4%), then more than 4 hours (n:63, 39.1%) and at least (n:12, 7.5%) was less than 1 hour. There was no statistically significant difference between the genders in terms of smartphone usage time (p=0.54).

When asked about the reasons, it was seen that 60.2% of them use social media, 13.7% of them use phone calls, 11.8% of them use the internet, 8.1% of them use other reasons, and 6.2% of them use for games. Again, there was no statistically significant difference between the genders in the reasons for using the phone (p=0.90).

PSQI scale was used to analyze the sleep quality of the students. The total PSQI mean score of the students was 5.49±2.94 (range,0-15). The mean PSQI of the female students was 5.22±2.76, and the mean score of the male students was 6.30±3.35, and the difference between the genders was statistically significant (p=0.01). According to the evaluation of total sleep quality, 52.2% (n:84) of the students had good, and 47.8% (n: 77) of the students had poor sleep quality. There was no statistically significant difference between sleep quality and age groups (p=0.72). The frequency of the subcomponents of the PSQI test is summarized in Table 3.

**Table 3. PSQI sub-component score frequency of students by gender**

| | Gender | | Total | |
|---|---|---|---|---|
| | **Female n (%)** | **Male n (%)** | **N** | **n (%)** |
| **C1: Subjective sleep quality** | | | | |
| Very good | 16 (9.9) | 11 (6.8) | 27 | 16.8 |
| Fairly good | 73 (45.3) | 15 (9.3) | 88 | 54.7 |
| Fairly bad | 23 (14.3) | 7 (4.3) | 30 | 18.6 |
| Very bad | 9 (5.6) | 7 (4.3) | 16 | 9.9 |
| Total | 121 (75.2) | 40 (24.8) | 161 | 100.0 |

| | | | | |
|---|---|---|---|---|
| **C2: Sleep Latency** | | | | |
| 0 | 29 (18.0) | 8 (5.0) | 37 | 23.0 |
| 1-2 | 49 (30.4) | 11 (6.8) | 60 | 37.3 |
| 3-4 | 33 (20.5) | 13 (8.1) | 46 | 28.6 |
| 5-6 | 10 (6.2) | 8 (5.0) | 18 | 11.2 |
| Total | 121 (75.2) | 40 (24.8) | 161 | 100.0 |
| **C3: Duration of sleep** | | | | |
| >7 hours | 82 (50.9) | 18 (11.2) | 100 | 62.1 |
| 6-7 hours | 23 (14.3) | 9 (5.6) | 32 | 19.9 |
| 5-6 hours | 12 (7.5) | 8 (5.0) | 20 | 12.4 |
| <5 hours | 4 (2.5) | 5 (3.1) | 9 | 5.6 |
| Total | 121 (75.2) | 40 (24.8) | 161 | 100.0 |
| **C4: Habitual sleep activity** | | | | |
| 0 | 115 (71.4) | 35 (21.7) | 150 | 93.2 |
| 1 | 6 (3.7) | 4 (2.5) | 10 | 6.2 |
| 2 | 0 (00) | 1 (0.6) | 1 | 0.6 |
| Total | 121 (75.2) | 40 (24.8) | 161 | 100.0 |
| **C5: Sleep disturbance** | | | | |
| 0 | 9 (5.6) | 3 (1.9) | 12 | 7.5 |
| 1 | 96 (59.6) | 29 (18.0) | 125 | 77.6 |
| 2 | 14 (8.7) | 8 (5.0) | 22 | 13.7 |
| 3 | 2 (1.2) | 0 (0.0) | 2 | 1.2 |
| Total | 121 (75.2) | 40 (24.8) | 161 | 100.0 |
| **C6: Use of sleep medication** | | | | |
| Never | 113 (70.2) | 36 (22.4) | 149 | 92.5 |
| Less than once a week | 4 (2.5) | 2 (1.2) | 6 | 3.7 |
| Once or twice a week | 1 (0.6) | 1 (0.6) | 2 | 1.2 |
| Three or more times a week | 3 (1.9) | 1 (0.6) | 4 | 2.5 |
| Total | 121 (75.2) | 40 (24.8) | 161 | 100.0 |
| **C7: Daytime dysfunction** | | | | |
| 0 | 40 (24.8) | 15 (9.3) | 55 | 34.2 |
| 1 | 44 (27.3) | 12 (7.5) | 56 | 34.8 |
| 2 | 24 (14.9) | 8 (5.0) | 32 | 19.9 |
| 3 | 13 (8.1) | 5 (3.1) | 18 | 11.2 |
| Total | 121 (75.2) | 40 (24.8) | 161 | 100.0 |

When the relationship between bedtime, which is included in PSQI, and sleep quality was examined, it was seen that there was a positive relationship, and the quality of sleep decreased as the bedtime increased (p=0.001, r=0.377). It was seen that there was a positive relationship between the time elapsed after going to bed and sleep quality, and the sleep quality decreased as the time increased (p =0.001, r=0.567).

When the correlation between sleep quality and smartphone addiction is analyzed, it is seen that the effect of smartphone addiction on sleep quality is statistically significant (p=0.014, r=0.193). PSQI score increases as SUA increases, which means sleep quality decreases (Figure 2).

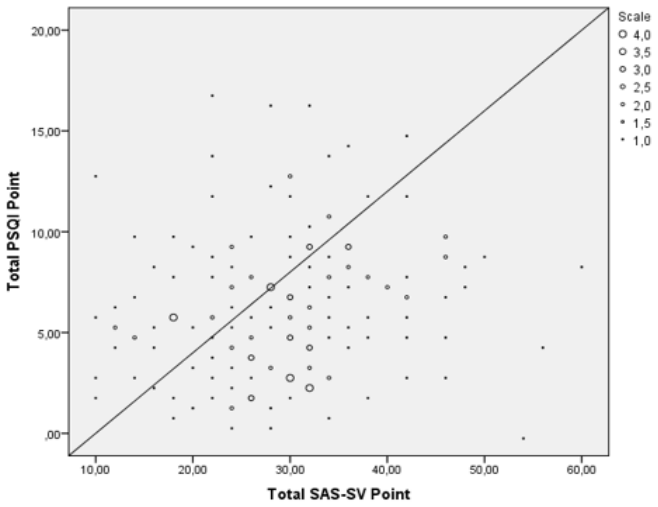


**Figure 2.** Correlation between smartphone addiction scale short version (SAS-SV) and PSQI total score. r: 0.193, p=0.014.

## DISCUSSION

In our study, we aimed to measure the effect of increasing the frequency of smartphone use on the quality of sleep in young people. We aimed to analyze the relationship between SUA and, based on the importance, the sleep quality of Vocational School of Health Services students who will become health technicians in the future. Therefore, after questioning the daily smartphone use and purpose, we analyzed SUA levels with SAS-SV and sleep quality with PSQI. We observed that sleep quality decreased as smartphone use increased.In our study, 161 VSHS students selected by simple randomization methods were all using mobile phones, and all of them had smartphones. The smartphone addiction rate of the students was found to be 31.25%. The rate of dependence was higher compared to many studies conducted targeting young people in the world. It was found 16.9% in a study by Haug et al. in Switzerland, 29.8% among medical faculty students in a study by Chen et al. in China, 12.77% among nursing school students in a study by Yahyazadeh et al, in Iran(19-21). As it is observed, especially in countries such as South Korea and China, where technology is produced, the prevalence of dependence is higher. In studies conducted with university students in our country, the rate was between 30.6 and 52.7%(22-24). Although our country is not at the level of China and South Korea in technology production, it was observed that our SUA rates are high. The dependency rates in our study are consistent with national data.

In our study, no significant difference was found between gender and age groups in terms of SUA levels. In the study conducted by Tateno et al. in Japan and Kim et al. in South Korea, smartphone addiction of female students was

found to be statistically significant(25, 26). In the study of Hamutoğlu et al., no difference was found between the genders in terms of smartphone addiction(27). The results of our study were similar to those of our country.

It was observed that the students frequently used smartphones (53.6%) for 1-4 hours a day, and there was no significant difference between these genders. In Haug's study, it was found as 1-2 hours with 33%, in Hanafı et al.'s study in Indonesia as more than 6 hours, and Matar et al.'s study in Lebanese university students as more than 5 hours with 48(19, 28, 29). In the study of Tok et al., the highest rate of use was in a 3-5 hours group, and in the study performed by Bağcı et al., it was in more than 5 hours group with a rate of 34.9%(30, 31). The rates of using smartphones in our study are similar to those of our country.

In our study, it was seen that students used their phones most frequently for social media. In the study of Hanafı, communication and social media, respectively, (29) and Silva et al.'s study with medical school students, social media, and search, respectively, were found as the features frequently used (32). In our country, in the study performed by Hamutoğlu et al., it was observed that the first purpose was a phone call (27). In our study, it was observed that students most frequently used social media and search features, respectively.

The mean PSQI score of the students was 5.49 (F: 5.22, M: 6.30). The sleep quality of males was worse than females. When we evaluated the sleep quality of the students with PSQI, it was found that 52.2% (n: 84) of the students had good and 47.8% (n: 77) of the students had poor sleep quality. In a meta-analysis, it was found that sleep quality was reduced in 25% of Chinese medical students, and this was not affected by gender and class differences(33). In a similar study conducted in Ghana, 56% of the students had poor sleep quality, and 53.4% in Spain had poor sleep quality(34, 35). In studies conducted in our country, it was found that the frequency of poor sleep quality between university students was as high as 56%(36), 74.5%(37), 88.7%(38).

## CONCLUSION

In our study, it was found that sleep quality deteriorated as the SUA status of the students increased. In the study performed by Matar et al., it was observed that sleep quality decreased, and daytime sleepiness increased as SUA increased(28). In studies conducted with nursing school students in India, it was observed that sleep quality was affected by SUA(39). In the study of Demirci et al. in our country, it was observed that sleep qualty decreased as SUA increased(40).

In terms of adequate physical and psychosocial development of the students, it is becoming more and more important to take measures to ensure that they use smartphones consciously both during the education and holiday periods.

*Limitations: The fact that the study was conducted with a university's vocational school of health care services (VSHCS) students constitutes the limitation of our study.*

*Competing interests: The authors declare that they have no competing interest.*

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*Ethical approval: Ethics committee approval was received for this study from the Ethics Committee of the Okmeydani Training and Research Hospital.*

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