

Smartphone addiction and Sleep Quality in adolescents

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ABSTRACT

Objective: To determine the frequency of smartphone addiction and poor sleep in high school adolescents and to evaluate the relationship between phone addiction and sleep, together with demographic characteristics.

Methods: A face-to-face survey was applied to 730 high school students in the Kahta district of Adiyaman, Turkey, between November 2021 and January 2022. The Smartphone Addiction Inventory-Short Form (SPAI-SF) was used to assess smartphone addiction, and the Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality.

Results: The rate of smartphone addiction in adolescents was 41%, and poor sleep quality was 61%. When smartphone addiction increases, sleep quality decreases, and when sleep quality decreases smartphone addiction increases. Smartphone addiction and poor sleep quality were higher in girls compared to boys. As the parents' education level and family income increase, the level of addiction increases, but sleep quality remain the same. We found that as age increases, the risk of smartphone addiction and the risk of deterioration in sleep quality increase.

Conclusion: Smartphone addiction and poor sleep quality trigger each other in a vicious circle. The COVID-19 pandemic may have made smartphone addiction the most common addiction in the world. This addiction can increase the risk of substance addiction by impairing the quality of sleep in adolescents and lead to many physical, social, and mental problems. A multidisciplinary approach is vital for solving the problem.

Keywords: Smartphone addiction, sleep quality, adolescent, problematic phone use, screen time

INTRODUCTION

Depending on the development of technology, smartphones have become an indispensable part of daily life. Mobile phones with smartphone features have made it easy to access information and entertainment since they can be connected to the internet anywhere. The complete experience offered through various applications, especially social media, opens the door to a different world for people of all ages. However, this ease and comfort provided to people also bring difficulties (1).

Smartphone addiction, or in other words, problematic phone use (PSU), is spending time with a smartphone excessively and uncontrollably in daily life (2). In addition to physical disorders, this addiction can lead to many mental problems, such as decreased sleep quality, depression, anxiety, attention deficit, and social communication disorder. Adolescence, which is the most sensitive for all types of addiction, is also the riskiest for smartphone addiction (1,3).

The COVID-19 pandemic has affected the whole world and has increased the time spent at home and phone use, especially for adolescents, due to worldwide restrictions. As a result, the pandemic has caused an increase in the risk of smartphone addiction and addiction-related daytime sleepiness and a decrease in sleep quality in adolescents (4).

Spending excessive time with a smartphone before going to sleep shortens young people's sleep time, impairs their sleep quality, and causes adolescents to be unproductive while listening to lectures or studying. In addition, students' phone use at school reduces their school success by reducing their interest in lessons and distracting them (1).

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Adequate and quality sleep is vital for one's physical and mental well-being, and decreased sleep quality has been shown to cause daytime sleepiness and poor academic performance. In addition, insufficient and poor-quality sleep may lead to obesity and cardio-metabolic diseases in adolescents due to less physical activity (5).

Uncontrolled use of smartphones is a significant problem that affects the physical, mental, and academic quality of life of adolescents due to both excessive screen time and the sleep problems it causes. Decreased sleep quality can lead to long-term sleep deprivation, which may increase the rate of smoking and alcohol use in adolescents (6). Our study aims to determine the frequency of smartphone addiction and poor sleep in high school adolescents in Adıyaman's Kahta district and to evaluate the relationship between smartphone addiction and sleep quality, along with demographic characteristics. This way, contributions will be made to studies that offer integrative suggestions with physiological, psychological, and social dimensions to find solutions to adolescents' problems.

MATERIAL and METHODS

Study Design and Study Group

The research is a cross-sectional and descriptive study. The research population consists of students studying in high schools in the Adıyaman Kahta district center. Data were collected between November 2021 and January 2022. Schools were selected by cluster sampling method. It was planned to take at least 384 people with a 95% confidence level 0.05 margin of error, and 730 students participated in the research. A questionnaire form was used as a data collection tool. After obtaining permission from the National Education Directorate, consent forms were acquired from the students and their parents.

Study Tools

Short-form Smartphone Addiction Inventory (SPAI-SF) was used for smartphone addiction revised from SPAI by Lin et al. (7,8). The short form of this 26-item scale consists of 10 items. Arpacı et al. conducted the Turkish validity and reliability study in 2018 (9). There are four-point Likert-type options "1= I strongly disagree, 2= I disagree, 3=I agree, 4=I strongly agree. The score range of the scale is between 10-40. The cut-off point of the scale is 24. Those who are 24 and above are determined as smartphone addicts.

The Pittsburgh Sleep Quality Index (PSQI) was used to measure sleep quality. This scale, developed by Buysse et al. in 1989, was adapted into Turkish by Ağargün et al. in 1996 (10,11). The scale evaluates sleep quality and disturbance in the last month and consists of 24 questions. Nineteen questions are self-report questions, and the remaining five are answered by the spouse or friend of the person in the same room. The 18 questions scored consist of seven components: subjective sleep quality perceived by the individual, sleep latency (time from going to bed to falling asleep), sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping pills, and finally, daytime dysfunction. Each component is given a score between 0 and 3. The scale's total score is found by adding the scores from the seven components. Values greater than 5 for the total scale score, ranging from 0 to 21, indicate poor sleep quality.

Statistical Analysis

Analyzes were evaluated in 22 package programs of SPSS (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL). In the study, descriptive data are shown as n and % values in categorical data and mean \pm standard deviation (Mean \pm SD) values in continuous data. Chi-square analysis (Pearson Chi-square) was used to compare categorical variables between groups. The Kolmogorov-Smirnov test evaluated the conformity of continuous variables to normal distribution. Mann Whitney U-test was used to compare paired groups, One Way ANOVA analysis was used for those with normal distribution compared to more than two variables, and the Kruskal Wallis test was used for those who did not. The spearman correlation test was used to examine the relationship between continuous variables. Linear Regression analysis was applied to determine the predictors of the SPAI-SF and PSQI scale. While creating the model, the Enter method was used. Moreover, those with a significant relationship in the correlation test were included in the model. The statistical significance level in the analysis was accepted as $p < 0.05$.

Ethics committee approval was obtained with the decision of The non-Interventional Clinical Research Ethics Committee of Adıyaman University, dated 26/10/2021, and numbered 2021/08-21.

RESULTS

Seven hundred thirty adolescents with a mean age of 15.6 ± 1.3 (min=13-max=18) were included in the study. 36% of adolescents are boys, and 64% are girls. The mother's education level of 68.8% of the participants, and the father of 49.5% is a secondary school or below. The family income level of 42.7% of the adolescents is 3000 TL or less, 41.6% have an income of 3001-5000 TL, and 15.6% have an income of more than 5000 TL. 81.8% of the participants live with their parents, 7.5% live with their parents, and 10.7% live with their dormitory/housemates. 41.5% of the adolescents have a private room, 73.8% have a nuclear family. The average usage time of adolescents is 2.1 ± 1.5 years, and the average daily usage time is 5.0 ± 2.0 hours. 43.2% of adolescents use social media, 28.6% use messaging, 55.3% use games, 22.5% use a smartphone for education, and 16.6% use smartphones to access information. While 41% of adolescents have smartphone addiction, 61% have poor sleep quality (**Table 1**).

The girls' SPAI-SF ($p < 0.001$) and PSQI ($p = 0.001$) scores were found to be significantly higher than the boys' scores. The SPAI-SF scores of those whose mother's education level ($p = 0.019$) and father's education level ($p = 0.028$) were high school and above and were found to be significantly higher than those with secondary school and below. There was a significant difference between the monthly income and SPAI-SF score. The difference was only due to the difference between those who received 3000 TL or less and those who received more than 5000 TL groups ($p = 0.023$). The SPAI-SF score of those who had a private room was significantly higher than those who did not ($p = 0.01$). The SPAI-SF ($p = 0.007$) and PSQI ($p = 0.012$) scores of those who used smartphones for social media were found to be significantly higher.

The SPAI-SF ($p=0.009$) and PSQI ($p<0.001$) scores of those using smartphones for messaging were found to be considerably higher. The SPAI-SF ($p=0.021$) and PSQI ($p<0.001$) scores of those who used smartphones for gaming were found to be significantly higher. The SPAI-SF ($p=0.048$) and PSQI ($p<0.001$) scores of those using smartphones for educational purposes were found to be significantly lower. The SPAI-SF ($p=0.001$) and PSQI ($p<0.001$) scores of those who used smartphones to access information were found to be significantly lower. The SPAI-SF ($p<0.001$) and PSQI ($p<0.001$) scores of those with smartphone addiction were found to be significantly higher than those without smartphone addiction. Those with poor sleep quality had significantly higher SPAI-SF ($p=0.013$) and PSQI ($p<0.001$) scores than those with good sleep quality (Table 2).

67.6% of smartphone addicts had poor sleep quality, 56.4% of non-smartphone addicts had poor sleep quality, and there was a statistically significant difference between these rates ($p=0.002$) (Figure 1). According to the correlation analysis, there was a positive and significant correlation between the SPAI-SF score and PSQI, age, total phone usage time, daily phone usage time, and monthly income. There was a positive and significant correlation between PSQI and age, total phone use time, and daily phone use time (Table 3).

According to the multiple linear regression analysis, The SPAI-SF scale score was predicted by PSQI ($\beta=.241$, $p=0.011$), age ($\beta=.575$, $p=0.048$), and duration of phone use ($\beta=1.165$, $p<0.001$). The PSQI scale score was evaluated by SPAI-SF ($\beta=.061$, $p=0.013$), age ($\beta=.580$, $p<0.001$), duration of phone use ($\beta=.474$, $p=0.001$), and duration of daily phone use ($\beta=.365$, $p<0.001$) (Table 4).

Table 1. All characteristics of the adolescents included in the study

	Number	%	
Age, Mean \pm SD	15.6 \pm 1.3		
Gender	Male	263	36.0
	Female	467	64.0
Mother's education	Middle school and below	502	68.8
	High school and above	228	31.2
Father's education	Middle school and below	361	49.5
	High school and above	369	50.5
Monthly income (Turkish Liras)	≤ 3000	312	42.7
	3001-5000	304	41.6
	>5000	114	15.6
with whom does he/she live	with mother and father	597	81.8
	with mother or father	55	7.5
	Dorm/housemate	78	10.7
Private room	Yes	303	41.5
	No	427	58.5
Type of family	Nuclear family	539	73.8
	Extended family	191	26.2
Phone usage time (years), Mean \pm SD	2,1 \pm 1.5		
Daily phone usage time (hours), Mean \pm SD	5,0 \pm 2,0		
Smartphone usage purpose*	Social media	315	43.2
	Messaging	209	28.6
	Game	404	55.3
	Education	164	22.5
	Access to information	121	16.6
Smartphone addiction	Addicted	299	41.0
	not Addicted	431	59.0
Sleep Quality	Poor sleep	445	61.0
	Good sleep	285	39.0

*Multiple answers can be selected

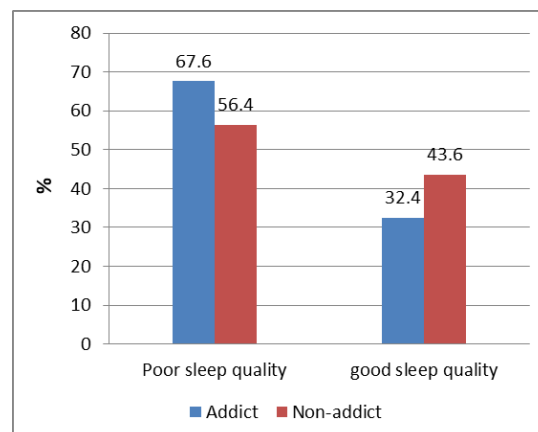


Figure 1. Comparison of sleep quality according to the presence of smartphone addiction

Table 2. Comparison of scale scores according to all characteristics of adolescents

		SPAI-SF		PSQI	
		Mean ± SD	p*	Mean± SD	p*
Gender	Male	22.7± 7.5	<0.001	6.4±3.2	0.001
	Female	25.6± 8.5		7.7±4.3	
Mother's education	Middle school and below	24.0±8.0	0.019	7.1±4.0	0.071
	High school and above	25.7±8.6		7.6±4.1	
Father's education	Middle school and below	23.8±8.1	0.028	7.1±4.1	0.224
	High school and above	25.2±8.3		7.4±3.9	
Monthly income (Turkish Liras)	≤3000	23.7±7.9 ^a	0.023**	7.2±3.8	0.680**
	3001-5000	24.8±8.4 ^{a,b}		7.4±4.2	
	>5000	26.3±8.4 ^b		6.9±4.0	
with whom does he/she live	mother and father	24.4±8.2	0.737	7.2±4.0	0.409
	mother or father	24.8±7.9		7.9±4.3	
	Dorm/housemate	25.3±8.8		7.3±3.8	
Private room	Yes	25.6±8.7	0.01	7.1±4.1	0.204
	No	23.8±7.8		7.4±4.0	
Type of family	Nuclear family	24.8±8.2	0.163	7.2±4.0	0.530
	Extended family	23.9±8.3		7.4±4.0	
for social media purposes	Yes	25.3±7.9	0.007	7.8±4.3	0.012
	No	24.0±8.4		6.8±3.7	
for messaging purpose	Yes	25.6±8.1	0.009	8.5±4.8	<0.001
	No	24.1±8.3		6.8±3.6	
for game purpose	Yes	25.2±8.4	0.021	7.3±5.1	<0.001
	No	23.7±7.9		7.2±2.1	
for education purpose	Yes	23.0±7.7	0.048	5.8±3.4	<0.001
	No	25.0±8.3		7.7±4.1	
for accessing information purposes	Yes	22.2±7.2	0.001	4.6±4.1	<0.001
	No	25.0±8.4		7.8±3.8	
Smartphone addiction	Addicted	33.1±5.3	<0.001	8.2±4.3	<0.001
	not Addicted	18.6±3.0		6.6±3.7	
Sleep Quality	Poor sleep	25.2±8.4	0.013	9.5±3.4	<0.001
	Good sleep	23.6±7.9		3.7±1.6	

*Mann Whitney U test, **Kruskal Wallis analysis was applied.

Table 3. Correlation of scale scores with various measurement data

		SPAI-SF	PSQI
PSQI	r	.140	
	p	.000	
Age	r	.103	.097
	p	.005	.008
Phone usage time (years)	r	.221	.098
	p	.000	.041
Daily phone usage time (hours)	r	.098	.217
	p	.008	.000
Monthly income	r	.097	-.025
	p	.009	.508

Table 4. Linear Regression Analysis of Factors Associated With SPAI-SF and PSQI

	β	SE	Standard β	t	p
SPAI-SF (R²=0.106; F=11,238; p<0.001)					
PSQI	.241	.094	.125	2.556	0.011
Age	.575	.290	.095	1.981	0.048
Phone usage time (years)	1.165	.265	.210	4.403	<0.001
Daily phone usage time (hours)	.325	.187	.081	1.738	0.083
Monthly income	.859	.527	.076	1.632	0.104
PSQI (R²=0.131; F=17,151; p<0.001)					
SPAI-SF	.061	.025	.119	2.505	0.013
Age	.580	.145	.186	4.001	<0.001
Phone usage time (years)	.474	.136	.165	3.488	0.001
Daily phone usage time (hours)	.365	.094	.176	3.876	<0.001

DISCUSSION

Many studies indicate that phone addiction is high and sleep quality is low in adolescents compared to other age groups (1,3,4,12). Smartphone addiction was found in 41% of the adolescents participating in the present study, and poor sleep quality in 61%. These rates are higher than the rates in the literature. In a study conducted by Açıkgöz et al. in 2022, when they examined the use of smartphones by adolescents, they found 72.4% to be standard, 19.2% to be problematic, and 8.4% to be pathological (13). They found low sleep quality in 58.7% of adolescents. In a study by Chen et al. in 2017 (14), the smartphone addiction rate in adolescents was 29.8%, and Soni et al. found 33.3% (15). In the study conducted by Zou et al. in 2019, they found smartphone addiction in 27.5% of adolescents and sleep problems in 15.6% (16).

Boumosleh & Jaalouk in 2017 and Deveci in 2021 stated that gender did not affect smartphone addiction (12,17). However, in the present study, phone addiction in girls was higher than in boys, which supports most studies (1,3,5,13,18,19). In line with most studies, we found the sleep quality in girls to be lower (5,6,13,18,19). However, in his study, Deveci stated that gender did not affect sleep quality either (12).

In the present study, the risk of smartphone addiction was found to be higher in those whose parents had higher education levels. In his study, Deveci stated that the mother's education level affected addiction, but the father's education level did not make a significant difference (12). In the study conducted by Al-Barashdi et al. in 2015, they did not find a relationship between the parents' education level and smartphone addiction (20).

In the present study, no relationship was found between the parents' education level and quality of sleep. Deveci, on the other hand, stated in his study that sleep quality differs significantly according to the parents' education level (12). On the other hand, Açıkgöz et al. stated that the mother's education level had no effect (13). However, the adolescents' sleep quality increased as the father's education level increased.

Similar to the study of Al-Barashdi et al. (20), we also found that the risk of smartphone addiction increases as the monthly income increases. JH Kim, in his study in 2021, stated that smartphone addiction is higher in adolescents with a low family economic level (21).

Açıkgöz et al. and Philbrook et al. reported in their study that sleep disorders were more common in adolescents with low-income family economic status (13,22). In a study by Lima et al. in 2014, they showed no relationship between the economic status of the family and the sleep quality of adolescents (23). Our study did not find a relationship between the family's economic level and sleep quality.

As most studies show, a significant correlation was found between smartphone addiction and poor sleep quality in adolescents (4-6,12,13). However, in a study conducted in 2014, Park argued that although smartphones cause a delay in sleep time, they do not cause sleep disorders (24).

The study by Park et al. in 2022 determined that the risk of both phone addiction and deterioration in sleep quality

increases with age in adolescents (6). A study by Kim et al. in 2020 and Chen et al. in 2017 showed that smartphone addiction increases with increasing age in adolescents (14,25). Lin et al. and Andrade et al. stated that age is not associated with adolescent smartphone addiction (8,26). Our study found that both the risk of smartphone addiction and poor sleep quality increase with increasing age in adolescents.

Our study revealed that smartphone addiction is more common in adolescents with private rooms, showing that parents should regularly check children at a regular frequency.

CONCLUSION

In the present study, high rates of smartphone addiction (41%) and poor sleep quality (61%) were detected in adolescents who are sensitive to all addictions. It has also been found that the risk of poor sleep quality is higher in those with smartphone addiction. Similarly, it was observed that the risk of smartphone addiction was higher in those with poor sleep quality. In short, both situations trigger each other in a vicious circle. The COVID-19 pandemic may have made smartphone addiction the most common addiction in the world. This addiction can increase the risk of other substance addictions by impairing the quality of sleep in adolescents and can also lead to many physical, social, and mental problems. A multidisciplinary approach is vital for solving the problem.

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Ethical approval: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions. Informed consent or substitute for it was obtained from all patients for being included in the study. Adıyaman University Non-Interventional Ethical Committee approved the method of the study (IRB Number:2021/08-21).

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