

Araştırma makalesi / Research article • DOI: 10.48071/sbuhemsirelik.1385723

## The Relationship between Sleep Quality and Smartphone Addiction among Adolescents<sup>1</sup>

### Ergenlerde Uyku Kalitesi ve Akıllı Telefon Bağımlılığı Arasındaki İlişki

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<sup>1</sup>This research article was presented as an oral presentation at the 2nd International 7th National Pediatric Nursing Congress on 27-30 November 2019.

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**Geliş tarihi / Date of receipt:** 03.11.2023

**Kabul tarihi / Date of acceptance:** 29.04.2024

**Atf / Citation:** Kurudirek, F., Gürarşlan Baş, N., & Arkan, D. (2024). The effects of smartphone addiction on sleep quality in adolescents. *UHS Journal of Nursing*, 6(2), 117-124. doi: 10.48071/sbuhemsirelik.1385723

**ABSTRACT**

**Introduction:** Technological developments have increased the usage of mobile equipment. Using a smartphone became a part of life and accentuated its usage day after day especially in adolescent groups.

**Aim:** The study was aimed to examine the relationship between sleep quality and smartphone addiction of adolescents.

**Method:** This cross-sectional study was carried out with 1192 high school students between March and June 2019. Data were collected with the Personal Information Form, Pittsburg Sleep Quality Index, Smartphone Addiction Scale. The data were evaluated through percentile distributions, means, independent samples t-test, Kruskal-Wallis test, ANOVA, and Pearson correlation analyses.

**Results:** The mean age of adolescents was determined to be 15.79 ± 0.96, with the mean total score of the Pittsburg Sleep Quality Index was 6.05 ± 3.04 and the Smartphone Addiction Scale was 36.01 ± 10.82. Statistically significant differences were observed among adolescents concerning gender, grade, daily smartphone usage duration, internet accessibility, and the use of smartphones before bedtime, impacting both sleep quality and smartphone addiction (p < 0.05). A positive and meaningful correlation was found between sleep quality and smartphone addiction in adolescents (p < 0.05).

**Conclusion:** As the smartphone addiction increases, sleep quality decreases. Adequate sleep is crucial during the growth spurt period. It is evaluated that early diagnosis and prevention of smartphone addiction in adolescents could make a significant contribution to the protection and promotion of adolescent health.

**Keywords:** Addiction; adolescents; nursing; sleep.

**ÖZ**

**Giriş:** Teknolojik gelişmeler mobil cihazların kullanımını artırdı. Akıllı telefon kullanımı hayatın bir parçası haline geldi ve özellikle adolesan yaş gruplarında kullanımı her geçen gün daha da artmaktadır.

**Amaç:** Bu çalışmada, ergenlerde uyku kalitesi ile akıllı telefon bağımlılığının arasındaki ilişkinin incelenmesi amaçlandı.

**Yöntem:** Bu kesitsel araştırma 1192 lise öğrencisinin katılımıyla Mart - Haziran 2019 tarihleri arasında gerçekleştirildi. Veriler, Kişisel Bilgi Formu, Pittsburg Uyku Kalitesi İndeksi, Akıllı Telefon Bağımlılığı Ölçeği kullanılarak toplandı. Veriler, yüzdeler, ortalama, bağımsız gruplarda t testi, Kruskal Wallis test, ANOVA, Pearson korelasyon analizleri ile değerlendirildi.

**Bulgular:** Yaş ortalaması 15,79 ± 0,96 olan ergenlerin Pittsburgh Uyku Kalitesi Ölçeği toplam puan ortalaması 6,05 ± 3,04 ve Akıllı Telefon Bağımlılığı Ölçeği toplam puan ortalaması 36,01 ± 10,82 olarak belirlendi. Ergenlerin; cinsiyet, sınıf, günde akıllı telefona ayırdığı zaman, internet erişim olanağı, uyku öncesinde akıllı telefonu kullanma durumu ile uyku kalitesi ve akıllı telefon bağımlılığı arasındaki fark anlamlı bulundu (p < 0,05). Ergenlerde uyku kalitesi ile akıllı telefon bağımlılığı arasındaki ilişki pozitif ve anlamlı bulundu (p < 0,05).

**Sonuç:** Akıllı telefon bağımlılığı arttıkça uyku kalitesi düşmektedir. Büyüme atağı döneminde yeterli uyku çok önemlidir. Ergenlerde akıllı telefon bağımlılığının erken dönemde belirlenmesi ve önlenmesi ile adolesan sağlığının korunması ve geliştirilmesine önemli katkı sağlanabileceği değerlendirilmektedir.

**Anahtar Kelimeler:** Adolesan; bağımlılık; hemşirelik; uyku.



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## Introduction

Technological developments have increased the usage of mobile equipment (Kuss et al., 2018). Using a smartphone became a part of life and accentuated its usage day after day (Panova & Carbonell, 2018). Multifunctional smartphone initiation and its rapidly growing global popularity raised concerns about smartphone addiction due to the alteration in the communication and information age, reshaping values and desires, and excessive usage worldwide (Kuss et al., 2018; Panova & Carbonell, 2018). The World Health Organization (2015) stated the need for researches related to the current topic by declaring smartphone addiction a public health issue.

With its internet functionalities, the smartphone has a particular appeal that makes it exclusive by helping to send e-mails, chatting, managing personal data, accessing information, navigation, accessing educational materials, using social media, and for fun (Davey & Davey, 2014; Jeong, Kim, Yum & Hwang, 2016; Yayan, Düken, Dağ & Ulutaş, 2018; Gürarlan Baş & Karatay, 2020). It was commonly reported that unrestrained, inappropriate, and extreme smartphones are related to physical, social, behavioral, and emotional problems (Chóliz, 2010; Nowreen & Ahad, 2018). Considering the frequent use of mobile technologies among the youth, it can be inferred that young adults and adolescents are at more risk of smartphone addiction than other age groups (Haug et al., 2015; Jeong et al., 2016; Kuss et al., 2018). Considering that the human mind completes its development until the age of 25, adolescents seem to be the most vulnerable group against technological addictions (Daysal & Yilmazel, 2020; Gürarlan Baş & Karatay, 2020) because of the negative effect of behavioral addiction to cell phones caused on brain developments (Hong et al., 2013). According to the national survey, smartphone addiction is more prevalent among 13 -18 year olds adolescents (Heo, Oh, Subramanian, Kim & Kawachi, 2014).

When effectively used, smartphones provide benefits to their users. However, unconscious and excessive usage of smartphones badly affects physical and mental health (Daysal & Yilmazel, 2020). Increased usage of smartphones causes changes in children's daily routines, family and social relationships, and several other problems. Continuous use of it can especially cause sleeping disturbance as well as physical (Nowreen & Ahad, 2018), and psychological disturbances (Jeong et al., 2016; Panova & Lleras, 2016; Kuss et al., 2018; Daysal & Yilmazel, 2020). The American Academy of Pediatrics stated that sleeping problems are one of the most commonly seen issues in adolescents (Baughcum et al., 2017). These sleeping problems were related to factors such as electronic equipment and long-lasting night-time smartphone usage (Bartel, Gradisar & Williamson, 2014; Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann & Grob, 2014; Randler et al., 2016; Amra et al., 2017; Nowreen & Ahad, 2018; Gürarlan Baş & Karatay, 2020; Sülün, Günay, Sarman & Dertli, 2020). Conducted researches clarify that smart phone usage brings sleeping problems with it (Christensen et al., 2016; Chung et al., 2018; Dewi, Efendi, Has & Gunawan, 2021; Lee & Ogbolu, 2018; Kumar, Chandrasekaran & Brahadeeswari, 2019).

Improving sleep quality could impact growth, emotional stability, and learning abilities. Consequently, addressing smartphone addiction in adolescents might be facilitated by promoting healthy sleep habits (Chung et al., 2018). In this sense, medical professionals who are working with children during their adolescence period are needed.

## Aim

This study was aimed to investigate the relationship between sleep quality and smartphone use in adolescents.

## Research Questions

1. How is the sleep quality of adolescents?
2. How is smartphone addiction level of adolescents?
3. Is there a relationship between sleep quality and smartphone addiction in adolescents?
4. Is there a relationship between demographic variables and sleep quality or smartphone addiction in adolescents?

## Method

### Study Design

The study was designed as a cross-sectional research.

### Study Setting

The research's target population was 24 260 students in the class range 9th, 10th, 11th, and 12th who educate in 43 high schools affiliated with the Provincial Directorate of National Education east of Turkey.

### Study Population and Sample

The sample size was determined as least 950 participants by sample calculation from a known population with a 50% confidence level and a standard deviation of 0.025. The study was administered in 10 schools using the method of simple random sampling. Researchers reached 1225 adolescents (9th, 10th, 11th, and 12th classes) using the technique of stratified sampling. However, 33 of the adolescents were kept aside from the research due to a wrongly-filled datasheet. Eventually, the sample size was out of 1192 adolescents.

### Data Collection Tools

Data collection included the use of Personal Information Form, Pittsburgh Sleep Quality Index, and Smartphone Addiction Scale.

**Personal Information Form:** This form was a descriptive characteristics questionnaire form created by researchers in line with the literature (Chung et al., 2018; Çelebioğlu, Aytekin Özdemir, Küçükoğlu & Ayran, 2020; Dewi et al., 2021) includes 18 questions measuring the age, gender, class, parental education, working status, possession of a smartphone, internet access, and time spent using a smartphone.

**Pittsburg Sleep Quality Index (PSQI):** The scale that measures sleeping disturbance type and magnitude was developed by Buysse, Reynolds, Monk, Berman & Kupfer (1989) and the Turkish version of the scale was performed by Ağargün, Kara & Anlar (1996). The Cronbach's alpha reliability coefficient value was reported as 0.80. PSQI consists of a total of 24 questions and seven components.

However, five of the questions are answered by the spouse or roommate of the participants and are not taken into account in the scoring, and 19 items of the scale are included in the scoring. Each question was scored ranging from 0 to 3. If a symptom did not occur during the last month, the score was 0; if the occurrence was less than one in a week, it was scored as 1. If a disturbance occurred once or twice a week, it was scored as two, and lastly, if disturbances occurred more than three times or more, the score was 3. The obtained value is range 0 to 21. High scores indicate poor sleep quality and a high sleep disturbance level. The Cronbach's alpha value was calculated as 0.95 in this study.

**Smartphone Addiction Scale:** This scale was developed connection with Young's internet addiction and the future smartphone items. Then it was rearranged by Demirci, Orhan, Demirdaş, Akpınar & Sert (2014) into a Turkish version, and the validity and reliability of the scale were assessed by Noyan, Darçın, Nurmedov, Yılmaz & Dilbaz (2015). This scale's internal consistency was based on Cronbach's alpha value, and it was measured at 0.92. The smartphone addiction scale is a unidimensional self-report that consists of 10 items. The total score can vary from 10 to 60 on this scale. In the current study the Cronbach's alpha value was calculated as 0.78.

#### Ethical Considerations

Formal permission was obtained from the Ethics Committee of Ataturk University (Date: 19.04.2019 and No: 2019-2/1), the Nursing Faculty and Provincial Directorate of National Education for conducting the research. Adolescents and their parents who took part in the study provided written and verbal consent and were informed about the research objectives. Adolescents were reassured that personal information would be kept confidential and never be used somewhere else, and if they wanted, they could have the privilege of leaving the study whenever they wanted.

#### Data Collection

Data were collected between March and June of 2019 by researchers when the school management arranged the appropriate day, time, and class. The preferred time limit for completing and returning the paper was 20 - 25 minutes.

#### Data Analysis

The current study was analyzed through the Statistical Package for the Social Sciences Version 23.0 (SPSS, IBM Corp., Armonk, NY, USA) package program. The number, mean, percentage, Kruskal Wallis, ANOVA, independent samples t-test, Pearson correlation analysis and Cronbach's alpha coefficient were used for analyzing obtained data.

## Results

#### Characteristics of Adolescents

The mean age of participants was  $15.79 \pm 0.96$ . In the study 60.2% of adolescents were female, and 28.3% were in the 10th grade. About 38% of the mothers had at least a primary school degree and 86.8% of adolescents' mothers were housewives. About 34.2% of the fathers graduated from high school and 37.4% had a freelancing business. For the income level, participants had a

**Table 1: Characteristics of Adolescents (n = 1192)**

Characteristics	Mean	SD
<b>Age</b>	15.79	0.96
Characteristics	n	%
<b>Gender</b>		
Female	717	60.2
Male	475	39.8
<b>Class</b>		
9th	333	27.9
10th	337	28.3
11th	291	24.4
12th	231	19.4
<b>Mother's education</b>		
Illiterate	80	6.7
Primary	449	37.7
Secondary	365	30.6
High school	224	18.8
University	74	6.2
<b>Father's education</b>		
Illiterate	29	2.4
Primary	180	15.1
Secondary	317	26.6
High school	408	34.2
University	258	21.6
<b>Mother's job</b>		
Not working, housewife	1035	86.8
Government employee	71	6.0
Laborer	37	3.1
Freelancer	49	4.1
<b>Father's job</b>		
Not working	77	6.5
Government employee	371	31.1
Laborer	298	25.0
Freelancer	446	37.4
<b>Income level</b>		
High	149	12.5
Good	938	78.7
Low	86	7.2
Very low	19	1.6
<b>Family Structure</b>		
Nuclear	927	77.8
Broad	234	19.6
Broken	31	2.6
<b>Total</b>	1192	100.0

SD: Standard Deviation.

**Table 2: Research Outcomes According to Smartphone Usage (n = 1192)**

Characteristics	Mean	SD
<b>Total years spent using smartphone</b>	2.63	1.80
Characteristics	n	%
<b>Time spent using smartphone in a day</b>		
< 1 hour	227	19.0
1 hour	160	13.4
2 hours	211	17.7
3 hours	268	22.5
4 hours and more	326	27.4
<b>Smartphone usage of parents in a day</b>		
< 1 hour	208	17.4
1 hour	231	19.4
2 hours	281	23.6
3 hours	253	21.2
4 hours and more	219	18.4
<b>Purpose of using smartphone<sup>†</sup></b>		
Research and information	690	12.6
Watching (using it like a TV)	645	11.7
Photograph or video	602	11.0
Speaking	627	11.5
Texting	713	13.0
Listening to music	820	15.0
Playing games	496	9.1
Social media	743	13.6
Others	135	2.5
Total	5471	100.0
<b>Internet access</b>		
Permanent connection	522	43.8
Only mobile connection	290	24.3
Only home connection	306	25.7
Connection from friends	28	2.3
Others	46	3.9
<b>Sleep Disturbance<sup>↗</sup></b>		
Yes	298	25.0
No	443	37.2
Sometimes	451	37.8
<b>Smartphone usage at bedtime\day</b>		
Morning and midday (07:00 - 15:00)	45	3.8
Afternoon (15:00 - 18:00)	465	39.0
Evening and night (18:00 - 07:00)	682	57.2
<b>Time spent using smartphone before bedtime</b>		
5 - 10 min	472	39.7
10 - 20 min	272	22.8
20 - 40 min	227	19.0
> 40 min	221	18.5

SD: Standard Deviation; <sup>†</sup>More than one answer; <sup>↗</sup>Self report.

good level of household income (78.7%), and the majority had a nucleus type of family (77.8%) (Table 1).

### Research Outcomes According to Smartphone Usage

The average total years spent using a smartphone by participants was  $2.63 \pm 1.80$  years. Twenty-seven point three of the participants spent their 4 hours in a day using smartphones, and 23.6% of their parents spent two hours a day. Fifteen percent of the adolescents used their smartphones for music purposes. Again, 43.8% were able to continuously access the internet, and 25% of participants suffered from sleep disturbances. Fifty-seven point two percent of the participants were using their phones between certain hours (18:00 - 07:00), and 39.6% were using their smartphones for 5 - 10 minutes before falling asleep (Table 2).

### Pittsburg Sleep Quality Index Components and Smartphone Addiction Scale Outcomes

Out of the PSQI components, subjective sleep quality was rated as  $1.20 \pm 0.876$ ; sleep latency was  $1.26 \pm 0.95$ , sleep duration was  $1.26 \pm 1.14$ , habitual sleep efficiency was  $1.79 \pm 1.28$ , sleep disturbance was  $2.20 \pm 1.01$ , use of sleep medication was  $2.05 \pm 1.34$ , and daytime sleep dysfunction was  $1.33 \pm 0.99$  (Table 3). Not allied within the table, 47.5% of adolescents indicated good sleep quality (0 - 5 points); however, 52.5% showed poor sleep quality (6 - 21 points). Total item scores for adolescents' sleep quality and smartphone addiction were respectively  $6.05 \pm 3.04$  and  $36.01 \pm 10.82$  (Table 3).

**Table 3: Average Scores for Pittsburg Sleep Quality Index Components and Smartphone Addiction Scale (n = 1192)**

PSQI components	Mean $\pm$ SD	Min	Max
Component 1: Subjective Sleep Quality	$1.20 \pm 0.876$	0	3.00
Component 2: Sleep Latency	$1.26 \pm 0.95$	0	3.00
Component 3: Sleep Duration	$1.26 \pm 1.14$	0	3.00
Component 4: Habitual Sleep Efficiency	$1.79 \pm 1.28$	0	3.00
Component 5: Sleep Disturbance	$2.20 \pm 1.01$	0	3.00
Component 6: Use of Sleep Medication	$2.05 \pm 1.34$	0	3.00
Component 7: Daytime Sleep Dysfunction	$1.33 \pm 0.99$	0	3.00
<b>Total PSQI score</b>	$6.05 \pm 3.04$	0	21.00
<b>Smartphone Addiction Scale</b>	$36.01 \pm 10.82$	10	60

SD: Standard Deviation; Min: Minimum value; Max: Maximum value; PSQI: Pittsburg Sleep Quality Index.

**Table 4: Comparison of Demographic Features of Adolescents with Pittsburg Sleep Quality Index and Smartphone Addiction Scores (n = 1192)**

Characteristics	PSQI Total Mean ± SD	Test Statistics p	Smartphone Addiction Mean ± SD	Test Statistics p
<b>Gender</b>				
Female	6.27 ± 3.05	3.007 <sup>†</sup>	36.39 ± 10.78	1.508 <sup>†</sup>
Male	5.73 ± 2.99	0.003 <sup>*</sup>	35.42 ± 10.87	0.032 <sup>*</sup>
<b>Class</b>				
9 <sup>1</sup>	5.59 ± 2.82	8.268 <sup>§</sup>	36.35 ± 10.83	
10 <sup>2</sup>	6.23 ± 3.38	0.001 <sup>**</sup>	36.84 ± 11.02	3.013 <sup>§</sup>
11 <sup>3</sup>	6.68 ± 2.98	1 < 2, 3 <sup>††</sup>	34.39 ± 11.01	0.029 <sup>*</sup>
12 <sup>4</sup>	5.69 ± 2.71	3 > 4	36.32 ± 10.12	2 > 3 <sup>††</sup>
<b>Time spent using smartphone in a day</b>				
< 1 hour <sup>1</sup>	5.32 ± 2.61		34.37 ± 12.61	
1 hour <sup>2</sup>	5.74 ± 2.89		34.40 ± 10.75	
2 hours <sup>3</sup>	5.68 ± 2.91	14.494 <sup>§</sup>	33.69 ± 9.89	18.463 <sup>§</sup>
3 hours <sup>4</sup>	5.91 ± 2.63	0.001 <sup>**</sup>	35.05 ± 9.49	0.001 <sup>**</sup>
4 hours and more <sup>5</sup>	7.08 ± 3.50	5 > 1, 2, 3, 4 <sup>††</sup>	40.22 ± 9.98	5 > 1, 2, 3, 4 <sup>††</sup>
<b>Smartphone usage of parents in a day</b>				
< 1 hour <sup>1</sup>	5.49 ± 2.72		36.23 ± 11.05	
1 hour <sup>2</sup>	5.77 ± 3.20		36.64 ± 10.95	
2 hours <sup>3</sup>	6.00 ± 2.89	6.143 <sup>§</sup>	34.99 ± 10.57	2.705 <sup>§</sup>
3 hours <sup>4</sup>	6.15 ± 2.95	0.001 <sup>**</sup>	34.95 ± 10.57	0.029 <sup>*</sup>
4 hours and more <sup>5</sup>	6.84 ± 3.29	5 > 1, 2, 3 <sup>††</sup>	37.64 ± 10.90	5 > 3, 4 <sup>††</sup>
<b>Internet access</b>				
Permanent connection <sup>1</sup>	6.31 ± 3.33		36.92 ± 10.34	
Only mobile connection <sup>2</sup>	6.09 ± 2.81		36.11 ± 11.28	
Only home connection <sup>3</sup>	5.40 ± 2.55	19.546 <sup>  </sup>	35.10 ± 10.92	14.745 <sup>  </sup>
Connection from friends <sup>4</sup>	7.28 ± 3.17	0.001 <sup>*</sup>	36.39 ± 11.26	0.005 <sup>*</sup>
Others <sup>5</sup>	6.56 ± 3.15	3 < 1, 2, 4	30.76 ± 10.88	5 < 1, 2 <sup>††</sup>
<b>Sleep Disturbance</b>				
Yes <sup>1</sup>	8.33 ± 3.22	193.786 <sup>§</sup>	38.49 ± 11.06	13.795 <sup>§</sup>
No <sup>2</sup>	4.43 ± 2.19	0.001 <sup>**</sup>	34.28 ± 10.93	0.001 <sup>**</sup>
Sometimes <sup>3</sup>	6.14 ± 2.61	1 > 2, 3 <sup>††</sup>	36.06 ± 10.24	1 > 2, 3 <sup>††</sup>
<b>Smartphone usage at bedtime\day</b>				
Morning and midday (07:00 - 15:00) <sup>1</sup>	6.00 ± 3.47	7.399 <sup>  </sup>	35.37 ± 12.93	33.130 <sup>  </sup>
Afternoon (15:00 - 18:00) <sup>2</sup>	5.40 ± 2.67	0.025 <sup>*</sup>	35.03 ± 10.50	0.001 <sup>**</sup>
Evening and night (18:00 - 07:00) <sup>3</sup>	6.50 ± 3.16	2 < 3 <sup>††</sup>	36.71 ± 10.85	2 < 3 <sup>††</sup>
<b>Time spent using smartphone before bedtime</b>				
5 - 10 min <sup>1</sup>	5.16 ± 2.61		34.68 ± 11.24	
10 - 20 min <sup>2</sup>	5.73 ± 2.78	41.692 <sup>§</sup>	35.12 ± 10.13	14.503 <sup>§</sup>
20 - 40 min <sup>3</sup>	6.80 ± 3.06	0.001 <sup>**</sup>	35.76 ± 9.69	0.001 <sup>**</sup>
> 40 min <sup>4</sup>	7.59 ± 3.38	4 > 1, 2, 3 <sup>††</sup>	40.19 ± 10.89	4 > 1, 2, 3 <sup>††</sup>

SD: Standard Deviation; PSQI: Pittsburg Sleep Quality Index; †: Independent samples t-test; §F: ANOVA; ||: Kruskal Wallis test; \* p < 0.05; \*\* p < 0.001; ††: Dunn-Bonferroni.

### Comparison of Demographic Features of Adolescents with Pittsburg Sleep Quality Index Scores and Smartphone Addiction Scores

The differences between genders, class, and time spent using smartphone separately from adolescents and parents, internet access, sleep disturbance, the time interval for smartphone usage, smartphone use at bedtime and smartphone addiction or sleep quality were statistically significant ( $p < 0.05$ ) (Table 4). A positively low level and statistically significant correlation between PSQI score and Smartphone Addiction Scale scores was observed ( $r = 0.197$ ,  $p < 0.05$ ).

### Discussion

Adequate sleep is a crucial requirement for adolescent health, and the assessment of sleep quality has become increasingly important. Adolescents admitted that the research had an average score of  $6.05 \pm 3.04$  for total sleep quality as, and more than half had poor sleep quality. There was a significant relationship between gender and class; time spent using a smartphone for participants and parents, internet access, time interval using smartphones, and smartphone usage before bedtime and sleep quality. Similar to this research, sleep quality was observed to be 6.12 (Nowreen & Ahad, 2018),  $5.11 \pm 3.02$  (Çelebioğlu et al., 2020). In agreement with the study results, some studies (Randler et al., 2016; Nowreen & Ahad, 2018; Kumar et al., 2019; Çelebioğlu et al., 2020) show that more than half of the adolescents display poor sleep quality. Again, Kumar et al. (2019) reported that males have worse sleep quality than females. Chung et al. (2018) reported that females falling asleep in the afternoon, long duration of falling asleep, night sleep durations lower than six hours were asleep and negatively associated with sleep quality. Similarly, some studies have shown that people who spend long hours staring at a screen and use social media often have poor sleep quality (Woods & Scott, 2016). Masthi, Pruthvi & Mallekavu (2017) stated in their research with participants aged 12-16 with or without social media addiction that participants with addiction statistically had more sleeping problems.

Smartphones are cell phones that offer advanced functionality such as internet browsing, gaming, and social media usage, extending beyond basic calling and texting capabilities (Kumar et al., 2019). The excessive use of smartphones can be linked to smartphone addiction in adolescents. In this study, the mean total score of the Smartphone Addiction subscale score was similar to Kumar et al. (2019) reported the mean total score of the same subscale as  $30.2 \pm 9.7$ . According to Nowreen and Ahad (2019), the mean total score was 27.16. Other researchers conducted by Soni, Upadhyay & Jain (2017) and Haug et al. (2015) respectively reported the mean total scores as  $85.66 \pm 23.46$  and 23.45. Smartphone addiction rates seem to be at 12% (Lee & Ogbolu, 2018), 16.9% (Haug et al., 2015), 19.9% (Chung et al., 2018), 34.4% (Nowreen & Ahad, 2018) and 33.3% (Soni et al., 2017). Based on these findings, it is evident that adolescents exhibit levels of smartphone addiction that surpass the norm.

In this study, more than, 1/4th of the participants spent four hours or more in a day using smartphones, and nearly half of the participants have permanent access to the internet. A prospective

association was observed between time spent using a smartphone, permanent internet access, sleep disturbance, time interval for using a smartphone, smartphone usage before bedtime, gender, class and smartphone addiction. Jeong et al. (2016), Gürarlan and Karatay (2020) reported that 72% and Soni et al. (2017) reported 87% of adolescents use smartphones actively and frequent usage was related to smartphone addiction. In similar researches to this study (Aljomaa, AlQudah, Albursan, Bakhiet & Abduljabbar, 2016; Kumar et al., 2019) smartphone addiction seems to occur more often in males than in females. On the other hand in some studies (Haug et al., 2015; Randler et al., 2016; Chung et al., 2018) females perform more smartphone addiction than males. In some studies, it has been revealed that gender has no meaningful association with smartphone addiction. Research related to this topic reported that students with low performance (Chung et al., 2018; Sülün et al., 2020), students with long-term smartphone use (Haug et al., 2015; Chung et al., 2018; Gürarlan Baş & Karatay, 2020), students who sleeps less than six hours in a day (Chung et al., 2018), younger adolescents (Haug et al., 2015; Randler et al., 2016; Chung et al., 2018), students who wakes up without a rest (Sülün et al., 2020) have higher smartphone addiction levels.

This study identified a relationship between the smartphone addiction and sleep quality in adolescents, suggesting that potential smartphone addiction may reduce the quality of sleep. Likewise, other studies have suggested a connection between smartphone addiction and poor sleep quality (Demirci, Akgönül & Akpınar, 2015; Chung et al., 2018; Nowreen & Ahad, 2018; Yayan et al., 2018; Kumar et al., 2019; Sülün et al., 2020).

### Conclusion

This cross-sectional study discovered a statistically significant and very low positive link between smartphone addiction and sleep quality in adolescents. Smartphone addiction decreases the sleep quality. Moreover, gender, time spent using smartphones, and smartphone use before bedtime were associated with smartphone addiction and sleep quality.

**Ethical Considerations:** Ethical approval was obtained from the Ethics Committee of Atatürk University for this study (Date: 19.04.2019 and No: 2019-2/1).

**Author Contribution:** Study Idea (Concept) and Design – FK, NGB, DA; Data Collection / Literature Review – FK; Analysis and Interpretation of Data – FK, NGB; Preparation of the Article – FK, NGB, DA; Approval of the Final Version to be Published – FK, NGB.

**Peer Review:** External independent.

**Conflicts of Interest:** The author reports no conflicts of interest.

**Sources of Funding:** This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

**Acknowledgments:** The authors thank all the adolescents who participated in the study.

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