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### Investigating the Relationship Among Coronavirus Anxiety, Smartphone Addiction, and Sleep Quality During Covid-19 Pandemic

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#### ABSTRACT

**Objective:** This research aimed to examine the correlations between coronavirus anxiety, smartphone addiction, and sleep quality during the COVID-19 pandemic. **Material and Methods:** This study had a cross-sectional and correlational design. Snowball sampling was used. Data collection was done online with individuals from different cities around Türkiye between May – June 2021. The study was completed with 684 participants in total. For data collection, a personal information form, the Coronavirus Anxiety Scale, the Smartphone Addiction Scale, and the Richards-Campbell Sleep Questionnaire were used. In the evaluation of the data, number, mean, percentile distributions, standard deviation, Pearson Correlation analysis and Linear Regression analysis were used. **Results:** The participants had mean scores of 2.33±3.34 for the Coronavirus Anxiety Scale, 33.33±11.69 for the Smartphone Addiction Scale, and 61.29±22.75 for the Richards-Campbell Sleep Questionnaire. We found a negative correlation between mean sleep quality scores and mean coronavirus anxiety and smartphone addiction levels and a statistically significant positive correlation between mean coronavirus anxiety and smartphone addiction scores. **Conclusion:** This study revealed some correlations between coronavirus anxiety, smartphone addiction, and sleep quality in the general population during the COVID-19 pandemic. As coronavirus anxiety increased, sleep quality was found to decrease and smartphone addiction to increase. Besides, sleep quality was reduced as smartphone addiction increased. **Keywords:** Anxiety, COVID-19, Smartphone, Sleep.

### Covid-19 Pandemisinde Koronavirüs Anksiyetesi, Akıllı Telefon Bağımlılığı ve Uyku Kalitesi Arasındaki İlişkinin İncelenmesi

#### ÖZ

**Amaç:** Bu araştırmanın amacı, COVID-19 pandemisinde koronavirüs anksiyetesi, akıllı telefon bağımlılığı ve uyku kalitesi arasındaki ilişkinin incelenmesidir. **Gereç ve Yöntem:** Araştırma kesitsel ve ilişki arayıcı türde yapıldı. Araştırmada tesadüfi olmayan örnekleme yöntemi olan kartopu örnekleme yöntemi kullanıldı. Araştırma verileri Türkiye'nin farklı illerinden bireylerle Mayıs- Haziran 2021 tarihleri arasında online olarak toplandı. Araştırma toplam 684 kişiyle tamamlandı. Araştırma verileri "Kişisel Bilgi Formu", "Koronavirüs Anksiyete Ölçeği", "Akıllı Telefon Bağımlılığı Ölçeği" ve "Richards Cambell Uyku Ölçeği" kullanılarak toplandı. Verilerin değerlendirilmesinde; sayı, ortalama, yüzdelik dağılımlar, standart sapma, Pearson Korelasyon analizi ve Linear Regresyon analizi kullanıldı. **Bulgular:** Katılımcıların Koronavirüs Anksiyetesi Ölçeği'nin toplam puan ortalamasının 2.33±3.34 olduğu, Akıllı Telefon Bağımlılığı Ölçeği toplam puan ortalamasının 33.33±11.69 ve Richards Cambell Uyku Ölçeği toplam puan ortalamasının ise 61.29±22.75 olduğu bulundu. Katılımcıların uyku kalitesi düzeyleri ile koronavirüs anksiyetesi ve akıllı telefon bağımlılığı puan ortalamaları arasında negatif yönde; koronavirüs anksiyetesi ve akıllı telefon bağımlılığı puan ortalamaları arasında ise pozitif yönde istatistiksel olarak anlamlı bir ilişki olduğu belirlendi. **Sonuç:** COVID-19 pandemisinde genel nüfusun koronavirüs anksiyetesi, akıllı telefon bağımlılığı ve uyku kalitesi düzeylerinin birbiriyle ilişkili olduğu tespit edildi. Katılımcıların koronavirüs anksiyete düzeyi arttıkça; uyku kalitesinin azaldığı, akıllı telefon bağımlılığı düzeyinin ise arttığı belirlendi. Ayrıca akıllı telefon bağımlılığı arttıkça, uyku kalitesinin azaldığı bulundu.

**Anahtar Kelimeler:** Anksiyete, Akıllı telefon, COVID-19, Uyku.

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## INTRODUCTION

The COVID-19 pandemic first began at the end of 2019 in Wuhan, China. The disease was spread all over the globe shortly after, becoming the most challenging disaster the world has seen since World War II (UNDP., 2020). There have been nearly 182 million confirmed COVID-19 cases worldwide to date (July 1<sup>st</sup>, 2021) (WHO, 2021). The leaders of most countries continue working on vaccination to prevent the pandemic ("Coronavirus (COVID-19) Vaccinations, Statistics and Research," 2021). However, with the increase in the more contagious and deadlier delta variant, the threat of the coronavirus continues to maintain its severity (Davies et al., 2021).

It has been more than one year since the onset of the Coronavirus pandemic, and human life has been disrupted on a global scale, significantly threatening people's psychological health (Prati & Mancini, 2021). Closing schools, supporting working from home, imposing curfews, and closing areas of social interaction to prevent the spread of the epidemic, were measures that have been implemented by the Turkish government, similar to many other countries (Güngör, 2020). Psychological problems, such as panic and stress, have been triggered in the general population with this new routine (Prati & Mancini, 2021; Rossi et al., 2020).

In previous research, major outbreaks throughout history have been associated with fear and anxiety (Shultz et al., 2016; Wheaton, Abramowitz, Berman, Fabricant, & Olatunji, 2012). The authors reported fear and anxiety as the first emotional reactions during the COVID-19 pandemic (Kayis et al., 2021; Salari et al., 2020). Individuals may experience anxiety from being sick, dying, losing a relative, or harming others by spreading the disease (Montemurro, 2020). Although individuals may be driven by a functional emotion to action, individuals may be led to maladaptive behaviors when anxiety is experienced excessively (Öz, 2010). According to previous studies, anxiety levels have been increased by the COVID-19 pandemic (Bauerle et al., 2020; Huarcaya-Victoria et al., 2020).

With mental problems, such as anxiety and the changing life routine due to the COVID-19 epidemic, people can be pushed toward inappropriate coping methods (Ogueji et al., 2021; Rettie & Daniels, 2020). This situation may result in various addictions, including increased smartphone use (Caponnetto et al., 2021; Kayis et al., 2021). Smartphone addiction is characterized by a desire to use smartphones for an increased time, deprivation upon not having access to a smartphone, inability to stop using smartphones, and delaying daily tasks (Kwon et al., 2013; Noyan et al., 2021). Using smartphones during the pandemic has had many positive benefits, including granting access to information and communication with others during quarantine. Still, excessive smartphone use may impair one's physical and mental health (Fu,

Chen, & Zheng, 2021; Kwon et al., 2013; Van Deursen, 2020). Smartphone addiction is a gradually increasing risk for the general population, as people spend more time at home and need to cope with stress (Elhai et al., 2021; Kayis et al., 2021). Researchers believe that the effects of this addiction may continue after the epidemic, with a potentially severe threat to public mental health (Caponnetto et al., 2021; Elhai et al., 2020).

Stress, anxiety, changing lifestyles, and smartphone addiction due to the pandemic, are factors that may affect sleep quality (Elhai et al., 2020; Sülün et al., 2021). Increased sleep problems have been reported in the general population during the COVID-19 outbreak (Casagrande et al., 2020). Sleep is a physiological and behavioral process necessary for survival, with a critical role in strengthening the immune system (Besedovsky et al., 2019). Hence, revealing sleep problems and sleep-related elements gained greater importance during the pandemic (Casagrande et al., 2020; Marelli et al., 2021).

So far, there has been no scientific research discussing anxiety components, smartphone addiction, and sleep quality together in the general population during the pandemic. These problems may continue to affect the general population, even after the COVID-19 epidemic. Therefore, this research was designed to determine the rates of mental health problems and their correlations with each other. This research aimed to investigate the correlations between coronavirus anxiety, smartphone addiction, and sleep quality during the COVID-19 pandemic.

## MATERIALS AND METHODS

### Research type

This research was conducted as a cross-sectional, correlational study.

### Population and sample

The research was performed from May to June 2021. Snowball sampling was used, with data collection forms prepared using the Google Docs software and then sent online (via email or WhatsApp) to individuals in different cities around Türkiye. These individuals were asked to fill in the forms and share them with other people around them. The research was completed by 684 people. A post hoc power analysis was performed using the G\*Power 3.1.9.4 software to determine whether the sample size was sufficient. The study had an effect size of 0.1368 and a power level of 0.95 at a 95% confidence interval and 0.05 significance level, indicating that the sample size was at the desired level (Çapık, 2014).

### Data collection tools

*Personal information form:* The personal information form was prepared by the researcher according to the literature. The form includes 10 questions, which ask about age, sex, marital status, educational status, chronic diseases, COVID-19 infection status, and smartphone use during the pandemic, including the main purpose of smartphone use, average daily

amount of time of smartphone use, and average amount of sleep per day.

**Coronavirus Anxiety Scale (CAS):** This scale was developed by Lee (2020) to evaluate anxiety levels in relation to the coronavirus. The scale was tested for Turkish validity and reliability by Biçer et al., (2020). The CAS uses a 5-point Likert-type scale consisting of 5 questions and 1 dimension. The questions are scored from “never” to “almost every day during the last two weeks.” Total scores range from 0 to 20, with increased scores indicating higher anxiety levels. The Cronbach-alpha internal consistency coefficient of the original scale was 0.83 (Biçer et al, 2020). In this study, the Cronbach-alpha internal consistency coefficient of the scale was found to be 0.84.

**Smartphone Addiction Scale – Short Version (SAS-SV):** This scale was developed by Kwon et al. (2013) to evaluate smartphone addiction levels. The scale was tested for Turkish validity and reliability by Noyan, et al., (2015). It uses a 6-point Likert-type scale consisting of 10 items, with no subscales. Total scores range from 10 to 60, with increased scores indicating higher risk of addiction. The Cronbach-alpha internal consistency coefficient of the original scale was 0.86. (Noyan et al., 2015) In this study, the Cronbach-alpha internal consistency coefficient of the scale was found to be 0.90.

**Richards-Campbell Sleep Questionnaire (RCSQ):** The RCSQ was developed by Richards (1987) to evaluate perceived sleep quality. This questionnaire was tested for Turkish validity and reliability by Özlü and Özer (2015). The RCSQ contains six items that inquire about perceived sleep depth, amount of time required to fall asleep, number of times of waking, percentage of time awake, sleep quality, and noise level. Each item is assessed over a scale from 0 to 1,000 using the visual analog scale technique. The scale scoring is 0-100. A total score between 0 and 25 indicates very poor sleep, while a total score between 76 and 100 indicates very good sleep. Thus, increased scores show greater sleep quality. The Cronbach-alpha internal consistency coefficient of the original scale was 0.91 (Özlü and Özer, 2015). In this study, the Cronbach-alpha internal consistency coefficient of the scale was found to be 0.80.

#### Statistical analysis

Research data were evaluated using the SPSS 24 statistical package software. The normal distribution of the study was evaluated according to the Skewness and Kurtosis values (between -2 and +2). It was determined

that the study showed a normal distribution. Number, mean, percentile distribution, standard deviation, Cronbach’s alpha coefficient, Pearson’s correlation analysis, and regression analysis were used. The level of significance was set at  $p < .05$ .

#### Ethical considerations

Before the research was conducted, approval was obtained from the ethics committee of a university (dated 08.04.2021 and numbered 2021/05-30). The research was conducted according to the ethical standards of the Declaration of Helsinki. The participants were informed about the purpose and methods of the research, the amounts of time they would require, and the fact that participation would cause them no harm and was completely voluntary. Each participant gave his or her consent. Participation was on a voluntary basis, and personal information was kept confidential.

#### RESULTS

Examination of the distribution of the sociodemographic characteristics of the participants (Table 1), revealed the following: the mean age of the participants was  $30.23 \pm 9.11$ , 50.6% were male, 58.3% were single, 54.2% were university graduates, 93.6% had no chronic disease, 86.8% had been using smartphones more during the pandemic, and 61% used smartphones for social media purposes. Also, the mean daily amount of time that they used their smartphones was  $5.32 \pm 3.26$  hours, and the mean daily amount of time they slept was  $7.44 \pm 1.68$  hours. With regard to the scales, the participants had mean scores of  $2.33 \pm 3.34$  for the CAS,  $33.33 \pm 11.69$  for the SAS-SV, and  $61.29 \pm 22.75$  for the RCSQ (Table 2). When the correlations between the mean scores for the three scales were considered (Table 3), we found a statistically significant negative correlation between the sleep quality levels and the coronavirus anxiety and smartphone addiction levels ( $p=0.000$ ). However, there was a statistically significant positive correlation between coronavirus anxiety and smartphone addiction levels ( $p=0.000$ ). The regression analysis (Table 4) revealed that coronavirus anxiety had a significant positive effect on smartphone addiction ( $\beta=0.190$ ,  $p=0.000$ ) and a significant negative effect on sleep quality ( $\beta=-0.177$ ,  $p=0.000$ ). In addition, the regression analysis in Model 3 revealed that smartphone addiction had a significant negative effect on sleep quality ( $F=12.409$ ,  $p=0.000$ ,  $\beta=-0.134$ ).

**Table 1. Comparison of demographic characteristics of participants (n=684).**

Demographic variables	n	%
<b>Sex</b>		
Female	338	49.4
Male	346	50.6
<b>Marital status</b>		
Single	399	58.3
Married	285	41.7

Table 1 (Continued). Comparison of demographic characteristics of participants (n=684).

Demographic variables	n	%	
<b>Educational status</b>			
Primary education	30	4.5	
High school	150	21.9	
Undergraduate education	371	54.2	
postgraduate education	133	19.4	
<b>Chronic illness</b>			
Yes	44	6.4	
No	640	93.6	
<b>The state of being infected with COVID-19</b>			
Yes	161	23.5	
No	523	76.5	
<b>Has your smartphone usage time increased during the pandemic?</b>			
Yes	594	86.8	
No	90	13.2	
<b>Your main purpose of using the smartphone</b>			
Information	129	18.8	
Social media	417	61.0	
Entertainment	46	6.7	
Game	39	5.7	
Business	41	6.0	
Other	12	1.8	
<b>Demographic variables</b>	<b>Min-Max</b>	<b>Mean</b>	<b>SD</b>
Age	18-65	30.23	9.11
Average daily smartphone usage time	20 minutes-19 hours	5.32	3.26
Average sleep time per day	4 hours-14 hours	7.44	1.68

Table 2. Distribution of participants' CAS, SAS-SV and RCSQ scores.

	Min-Max	Mean±SD
CAS	0-20	2.33±3.34
SAS-SV	10-60	33.33±11.69
RCSQ	0-100	61.29±22.75

SD=Standard deviation, Min=Minimum, Max=Maximum.

Table 3. Relationship between CAS, SAS-SV, and RCSQ mean scores.

Scales		CAS	SAS-SV	RCSQ
CAS	r	1	0.190**	-0.177**
	p		0.000	0.000
SAS-SV	r	0.190**	1	-0.134**
	p	0.000		0.000
RCSQ	r	-0.177**	-0.134**	1
	p	0.000	0.000	

\*\*p<0.01. RCSQ=Richards-Campbell Sleep Questionnaire CAS=Coronavirus Anxiety Scale, SAS-SV=Smartphone Addiction Scale.

**Table 4. Regression analysis results.**

Dependent Variables	Model	Variables	B	Standard Error	$\beta$	t	p	95% Confidence interval	
								Lower	Upper
SAS-SV	1	Constant	31.781	0.536		59.341	<b>0.000*</b>	30.730	32.833
		CAS	0.666	0.131	0.190	5.062	<b>0.000*</b>	0.407	0.924
		R=0.190	R <sup>2</sup> =0.036						
		F=25.626	p=0.000*						
RCSQ	2	Constant	64.098	1.045		61.343	<b>0.000*</b>	62.046	66.150
		CAS	-1.206	0.257	-0.177	-4.699	<b>0.000*</b>	-1.709	-0.702
		R=0.177	R <sup>2</sup> =0.031						
		F=22.084	p=0.000*						
RCSQ	3	Constant	69.958	2.609		26.819	<b>0.000*</b>	64.837	75.080
		SAS-SV	-0.260	0.074	-0.134	-3.523	<b>0.000*</b>	-0.405	-0.115
		R=0.134,	R <sup>2</sup> =0.018						
		F=12.409	p=0.000*						

\*p<0.001. RCSQ=Richards-Campbell Sleep Questionnaire CAS=Coronavirus Anxiety Scale, SAS-SV=Smartphone Addiction Scale – Short Version.

## DISCUSSION

The findings obtained in this research were discussed in light of the relevant literature. The participants had a low level of anxiety regarding the coronavirus. Casagrande et al. (2020) investigated the effects of quarantine on sleep quality, anxiety, and psychology during the pandemic in Italy and found relatively high anxiety levels. Huang and Zhao, (2020) conducted a web-based survey with 7,236 volunteers during the pandemic in China and showed a high prevalence of anxiety among the participants. Salari et al. (2020) conducted a meta-analysis of 17 studies with a sample size of 63,439 individuals and found a 31.9% prevalence of anxiety among the general population during the COVID-19 pandemic. In another study, Elhai, et al., (2020) reported moderate anxiety levels during the pandemic. The measures taken to prevent the virus from spreading have profound effects on social and economic life, along with fear of infection, uncertainties regarding the epidemic, and epidemic control difficulties, all of which increase anxiety levels (Gao et al., 2020; Wang et al., 2020). Nonetheless, the participants in this research had relatively low anxiety levels, which may be associated with the relatively lower mean age of the sampled individuals, indicating a lower risk of infection. Also, the COVID-19 vaccine was already developed and administered at the research time, reducing the uncertainties regarding the pandemic.

A major consequence of the COVID-19 crisis is its effect on the sleep-wake cycle through lifestyle changes due to the pandemic. We found that the participants had moderate sleep quality levels. Casagrande et al. (2020) reported that more than 50% of their participants had poor sleep quality during the pandemic in Italy. Sleep problems were highlighted in one out of every five people in another research in China (Huang & Zhao, 2020). Marreli et al. (2021) examined the effect of social isolation measures on sleep quality in Italy and determined the adverse

impact of quarantine on sleep quality. A recent review and meta-analysis of published studies showed that the

prevalence rate of sleep problems among the general population in the pandemic was 35.7% (Jahrami et al., 2021). It was noted in studies during the epidemic that individuals spent more time in bed, went to bed later, stayed in bed longer, and had deteriorated sleep quality (Altena et al., 2020; Cellini, Canale, Mioni, & Costa, 2020; Li et al., 2020). The measures for controlling the epidemic lead to some changes in the social rhythm of the individuals, resulting in decreased physical activity and less exposure to sunlight, consequently changing sleep habits and hindering sleep quality (Altena et al., 2020; Cellini et al., 2020). In this research, participants had moderate levels of smartphone addiction. Gao et al. (2020) conducted a cross-sectional study of 4,872 people during the COVID-19 pandemic in China, where 80% of the participants reported frequent exposure to social media. Sülün et al. (2020) found that 40% of adolescents used smartphones all day during the pandemic. In a study investigating telephone addiction among adolescents in Brazil during the Covid pandemic, it was found that half of the participants had a phone addiction (de Freitas et al., 2022). In a study conducted with university students during the covid pandemic period, it was determined that the prevalence of phone addiction was high among the participants (Citó et al., 2022). The social isolation measures taken to manage COVID-19 infection have increased the free time that individuals spend at home and their distancing from school and leisure routines. This has led to more opportunities for leisure activities, such as surfing on social media, watching movies and series, and listening to music, which is believed to have affected smartphone use. It is also believed that individuals use smartphones more as an ineffective coping strategy to avoid or alleviate the mental distress of the pandemic. Here, we found a significant negative correlation between coronavirus anxiety and sleep quality, similar to

previous findings in the literature (Casagrande et al., 2020; Huang & Zhao, 2020; Voitsidis et al., 2020; Xiao et al., 2020). Baglioni et al., (2010) investigated the correlations between sleep and emotions and suggested a bidirectional relationship between insomnia and anxiety. The authors reported that sleep has a significant effect on neurobehavioral functions and emotion regulation, high sleep quality improves many psychological problems, such as depression and anxiety, and poor sleep quality increases the risks of these disorders. They also highlighted that sleep disruption could be caused by excessive emotional stimulation due to stressful life events and anxiety during the transition to sleep, indicating an association between high anxiety levels and poor sleep quality. Also, cortisol levels tend to be increased, and the synthesis of melatonin tends to be decreased by psychological problems, such as fear and anxiety, negatively affecting sleep quality (Cardinali et al., 2012).

A negative correlation was found between smartphone addiction and sleep quality in the current study. Poor sleep quality is one of the most critical adverse consequences of smartphone addiction (Demirci et al., 2015). A series of cross-sectional studies have revealed that sleep quality deteriorates with increased addictive smartphone use (Demirci et al., 2015; Liu et al., 2017; Sülün et al., 2021). The main reasons for this include sleeping at later times, mainly since smartphone use has shifted to late at night (Cellini et al., 2020; Gao et al., 2014), negative emotional stimulation due to social media use (Baglioni et al., 2010; Gao et al., 2020), and the melatonin-suppressing effects of the blue monochromatic light emissions from mobile phones (Heo et al., 2017). A positive correlation between coronavirus anxiety and smartphone addiction was marked by this research. Elhai et al. (2020) analyzed 908 Chinese adults and found a positive correlation between COVID anxiety and problematic smartphone use. Other studies on the correlations between smartphone use and anxiety levels have reached similar results (Elhai et al., 2020; Wolniewicz et al., 2020; Yang et al., 2020). One meta-analysis on the correlations between smartphone use, stress, and anxiety revealed that some studies associated elevated anxiety levels with increased smartphone use, while others suggested that high anxiety levels caused increased smartphone use (Vahedi & Saiphoo, 2018). Excessive smartphone or Internet use is considered an avoidant coping strategy that some people use to avoid or alleviate negative feelings and emotions (Wolniewicz et al., 2020). The quarantine, social distancing, fear of infection, and uncertainties regarding COVID-19 have all increased anxiety and negative emotions among the public (Gao et al., 2020; Wang et al., 2020). It is observed that using smartphones as an ineffective coping method to avoid stress and anxiety and to provide emotional relief has increased during the pandemic (Arpaci et al., 2021;

Elhai et al., 2020). Moreover, some studies have demonstrated higher levels of anxiety with increased exposure to news regarding COVID-19 (Gao et al., 2020; Garcia-Priego et al., 2020; Huang & Zhao, 2020). In other words, as people try to manage their anxiety through excessive smartphone use, learning more about COVID-19 over the news, they unintentionally get trapped within a vicious feedback cycle, which further fuels their anxiety and increases their smartphone use.

## CONCLUSION

In the present research, it was found that individuals had a relatively low level of coronavirus anxiety and moderate levels of smartphone addiction and sleep quality during the COVID-19 pandemic. We also determined some correlations between coronavirus anxiety, smartphone addiction, and sleep quality levels. As coronavirus anxiety increased, sleep quality decreased, and smartphone addiction increased. Besides, smartphone addiction levels were found to increase as sleep quality decreased. In conclusion, we recommend providing individuals with online or face-to-face training on proper methods of coping with stress, conscious smartphone use, and sleep hygiene during the COVID-19 epidemic. We also recommend launching prevention campaigns on phone addiction and its effects on mental and physical health. Further studies, particularly longitudinal studies to determine trajectories of sleep problems over time in these various COVID-19-impacted populations are warranted.

## Limitation of study

This research has suffered from certain limitations. First, data collection was based on self-report scales, so the possibility of common method bias should be considered. Second, relying on online data has limited our reach regarding individuals who used technology less. Finally, due to the cross-sectional design targeting cause-effect relationships, we recommend that further research be focused on experimental and longitudinal analysis to investigate the correlations between these variables.

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## Conflict of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

## Author Contributions

**Plan, design:** ZÖ; **Material, methods and data collection:** ZÖ, GBT; **Data analysis and comments:** GBT, ZÖ, MA; **Writing and corrections:** GBT, ZÖ, MA.

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