



Evaluation of Perceived Depression, Anxiety, Stress Levels, Sleep Quality, and Quality of Life among Adults During the COVID-19 Pandemic

COVID-19 Pandemi Sürecinde Yetişkinlerde Algılanan Depresyon, Anksiyete, Stres Düzeyi, Uyku Kalitesi ve Yaşam Kalitesinin Değerlendirilmesi

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ABSTRACT

Objective: This study aimed to determine sleep quality, depression, anxiety, stress, and quality of life scores among Turkish adults during the pandemic and to examine the correlations among these variables. **Material and Method:** This online cross-sectional study was completed with 962 adults aged ≥ 18 years. The data collection form included questions about demographic and anthropometric characteristics, Pittsburgh Sleep Quality Index (PSQI), The World Health Organization Quality of Life Scale-Short Form (WHOQoL-BREF), and Depression Anxiety Stress Scales (DASS-42). The snowball sampling method was used. **Results:** The median DASS and PSQI scores were higher in participants with poor sleep quality and sleep duration less than 7 hours ($p < 0.05$). All subscales of the WHOQoL were significantly higher in individuals with good sleep quality and the general, physical, and psychological subscales were significantly higher in individuals with sleep duration of 7 hours or more ($p < 0.05$). Age was found to have a weak correlation with the DASS subscales and a very weak correlation with the PSQI. There was a positive and moderately significant correlation between PSQI and the DASS subscales ($p < 0.001$). Body weight and BMI had very weak correlation with DASS-D, DASS-A, and PSQI subscales ($p < 0.05$). All subscales of WHOQoL were found to be negatively correlated with DASS subscales and PSQI ($p < 0.05$). **Conclusion:** Quality of life was significantly correlated with perceived depression, anxiety, and stress, and sleep quality. There was also a correlation between sleep quality and levels of depression, anxiety and stress.

Keywords: Depression, Anxiety, Stress, Sleep quality, Quality of life, COVID-19 pandemic

ÖZ

Amaç: Bu çalışmanın amacı, pandemi sürecinde Türk yetişkinlerin uyku kalitesi, depresyon, anksiyete, stres ve yaşam kalitesi puanlarını belirlemek ve bu değişkenler arasındaki ilişkiyi incelemektir. **Materyal ve Metot:** Bu çevrimiçi kesitsel çalışma yaşları 18 ve üzerinde olan 962 yetişkin ile tamamlanmıştır. Veri toplama formunda demografik ve antropometrik özellikler, Pittsburgh Uyku Kalitesi İndeksi (PUKİ), Dünya Sağlık Örgütü Yaşam Kalitesi Ölçeği-Kısa Formu (WHOQoL-BREF) ve Depresyon Anksiyete Stres Ölçeği (DASÖ-42) yer almıştır. Kartopu örnekleme yöntemi kullanılmıştır. **Bulgular:** Medyan DASÖ ve PUKİ skorları uyku kalitesi kötü olan ve uyku süresi 7 saatten az olan katılımcılarda daha yüksekti ($p < 0,05$). WHOQoL-BREF'in tüm alt ölçekleri iyi uyku kalitesine sahip bireylerde ve genel, fiziksel ve psikolojik alt ölçekler 7 saat ve üzeri uyku süresine sahip bireylerde daha yüksekti ($p < 0,05$). Yaş ile DASÖ alt ölçekleri arasında zayıf, PUKİ arasında ise çok zayıf bir korelasyon bulunmuştur. PUKİ ile DASÖ alt ölçekleri arasında pozitif ve orta derecede bir korelasyon belirlenmiştir ($p < 0,001$). Vücut ağırlığı ve Beden Kütle İndeksi (BKİ) DASÖ-D, DASÖ-A alt ölçekleri ve PUKİ arasında çok zayıf bir korelasyon vardı ($p < 0,05$). WHOQoL-BREF'in tüm alt ölçeklerinin DASÖ alt ölçekleri ve PUKİ ile negatif korelasyon gösterdiği saptanmıştır ($p < 0,05$). **Sonuç:** Yaşam kalitesi, algılanan depresyon, anksiyete, stres ve uyku kalitesi ile ilişkili bulunmuştur. Ayrıca, uyku kalitesi ile algılanan depresyon, anksiyete ve stres düzeyleri arasında da bir ilişki belirlenmiştir.

Anahtar Kelimeler: Depresyon, Anksiyete, Stres, Uyku kalitesi, Yaşam kalitesi, COVID-19 pandemisi

INTRODUCTION

Coronavirus disease (COVID-19) has social and psychological implications that may affect on mental health both directly and indirectly during the pandemic and in the future (1). According to the World Health Organization data from 2023, the number of COVID-19 cases in Türkiye is 17,004,677, with 101,419 deaths (2). These data are worrying for Türkiye, which has a predominantly young and middle-aged population.

Many people have reportedly felt extreme psychological discomfort from persistent anxiety, social isolation, and financial stress as a result of this large-scale infectious health disaster and its severe impact on daily life (3). Another important issue is the change in sleep habits during this time. Sleep quality is an important sign of health, and circadian rhythm is an important component of the sleep-wake cycle. Sleeping for long periods of time due to psychological changes (as a result of isolation), sleeping too much in the morning, and being able to sleep all day disrupt the circadian rhythm of humans and cause insomnia, excessive sleepiness, or both in many people (4). COVID-19 has caused various problems, including depression, anxiety, stress, and sleep disorders, all of which have a significant impact on people's quality of life (5-7). Quality of life (QoL) is a broad indicator of health status that reflects people's subjective perceptions of their overall health (8). The population's QoL is expected to be severely impacted during the pandemic due to widespread panic, anxiety, and stigmatization of patients with the disease (9).

It is a fact that the world has to live with a new type of coronavirus due to the ongoing COVID-19 epidemic. Few studies have examined quality of life, sleep quality and mental health during COVID-19 (5-9). Therefore it is imperative to study sleep quality, QoL, depression, anxiety and stress levels and how the variables interact with each other (10). A better understanding of the structures of sleep quality, depression, anxiety, stress, and QoL is needed to develop appropriate prevention strategies during the COVID-19 pandemic and future pandemics. However, the relationship between sleep quality, depression, stress, anxiety levels, and QoL in Turkish adults is not clear. Therefore, we conducted this study to determine sleep quality, depression, anxiety, stress levels, and QoL scores among Turkish adults during the pandemic and to investigate the relationships among these variables.

MATERIAL and METHOD

Design and Participants

This online cross-sectional study was conducted in Türkiye among individuals aged 18-65 years. This study followed the Declaration of Helsinki guidelines, and all procedures involving research study participants were approved by Izmir Katip Çelebi University Clinical Research Ethics Committee (Decision date/no: 21.10.2021/0443) as well as study permission from the Turkish Ministry of Health Scientific Research Platform. Because the study is web-based, a 'I accept to participate in the study' option was included to online questionnaire to acquire written consent.

The following criteria were used to determine eligibility: (1) use of social media platforms, (2) residence in Türkiye, (3) 18 years or older. Participants who (1) had mental disorders and eating disorders, and (2) did not complete the survey were excluded from the study. To avoid duplicate submissions, participants were asked to provide their email addresses. Duplicate submissions with the same email address were removed from analysis. Figure 1 shows the flowchart of the study.

Data Collection

From October 2021 to May 2022, data were collected via Google Forms web survey software. A snowball sampling method was used. Social media platforms such as WhatsApp, Facebook, and Instagram were used to find respondents. Invitations to participate in the study were routinely sent on Facebook and Instagram at different times of the day and on different days of the week.

Respondents were also encouraged to send others the survey invitation. After feedback from the first 10 responses, the questionnaire was adjusted as needed.

The online questionnaire used for this research consisted of five sections. The first section included questions about general characteristics such as gender, age, marital status, education level, and presence of chronic disease. The other sections included the 'Depression, Anxiety, and Stress Scale (DASS-42)', Pittsburgh Sleep Quality Index (PSQI), and the World Health Organization Quality of Life Scale (WHOQOL-BREF). The final section included self-reported body weight before and during COVID-19, and height.

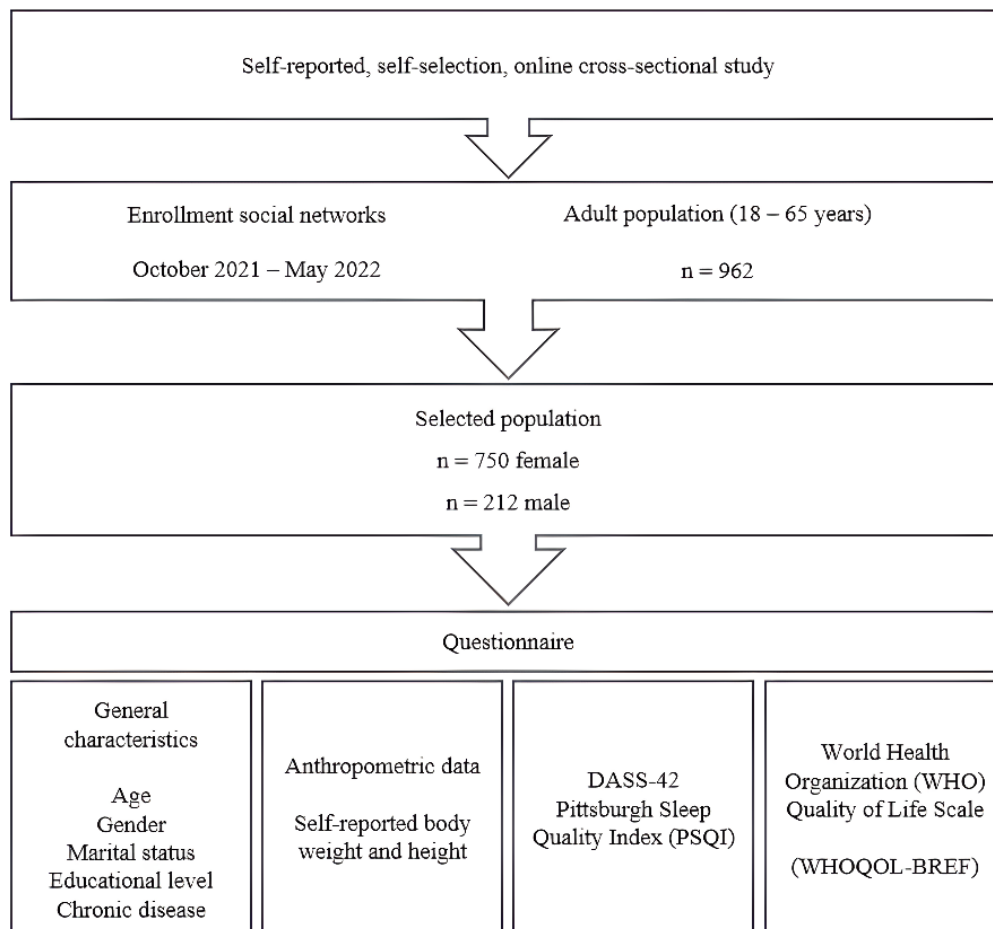


Figure 1: Study Flow Chart

Depression, Anxiety, Stress Scale (DASS-42)

The DASS-42 is a self-administered questionnaire used to assess DAS (Depression, Anxiety, Stress) levels. Lovibond&Lovibond (11) developed the original scale in 1995. The Turkish validity and reliability study of DASS-42 was conducted by Akin and Çetin (12). It is a 42-item instrument consisting of three subscales. There are options ranging from zero (does not apply to me at all) to three (applies to me very much). Total scale scores without reversed items vary from 0 to 42 for each sub-dimension. The standard DAS score ranges are 0-9, 0-7, and 0-14. Total scores above these ranges are classified as mild (10-13 for depression, 8-9 for anxiety, and 15-18 for stress), moderate (14-20 for depression, 10-14 for anxiety, and 19-25 for stress), severe (21-27 for depression, 15-19 for anxiety, and 26-33 for stress), and extremely severe (≥ 28 for depression, ≥ 20 for anxiety, and ≥ 34 for stress). The DASS-42 scale has proven to be a feasible and valid instrument for assessing the perceived DAS in the Turkish population. Cronbach's internal consistency reliability coefficients for the Turkish form were calculated to be 0.95 for depression, 0.92 for anxiety and 0.94 for stress in this study.

Pittsburgh Sleep Quality Index (PSQI)

The 18-item PSQI questionnaire was developed to assess sleep quality (13). Ağargün et al. (14) has demonstrated the reliability and validity of the PSQI in the Turkish patient population. The PSQI contains questions assessing daily dysfunction, sleep disturbance, sleep duration, latency, habitual sleep efficiency, and sleep quality. Each dimension is scored between 0 and 3, with a total score ranging from 0 to 21. A PSQI score above 5 implies poor sleep quality.

The World Health Organization Quality of Life Scale – Short Form (WHOQoL-BREF)

The WHOQOL-BREF was developed by WHO (15) in 1998, and Fidaner et al. (16) conducted a validity and reliability evaluation of the Turkish version in 1999, resulting in the WHOQOL-BREF-TR form. According to the results of the validity and reliability study, the WHOQOL-BREF-TR contains an additional "national" question (27 items in total), which was found to be strongly related to general health and QoL in the Turkish population. General health, physical health, psychological health, social relations and environmental health are the five dimensions of WHOQOL-BREF-TR. Each area is scored separately and the scale has no overall score. Higher scores mean a better QoL. In this study, the internal consistency coefficients were 0.63, 0.82, 0.83, 0.75 and 0.87 for the general, physical, psychological, social and environmental dimensions, respectively.

Statistical Analysis

Qualitative variables are denoted as "number (n)" and "percentage (%)". The Shapiro-Wilk test was used to determine if the quantitative variables were distributed normally. Data were given as "mean \pm standard deviation (SD)" for normal distributions and "median (Interquartile range (IQR))" for non-normal distributions. When comparing quantitative variables between two independent groups, the Independent sample t-test was used for those that were normally distributed and the Mann Whitney-U test for those that were not. The Wilcoxon test was used to evaluate quantitative data that did not follow a normal distribution between two assessment times. The relationship between quantitative variables was determined using Spearman correlation analysis. $p < 0.05$ was accepted as significant.

RESULTS

Table 1 presents the DASS, PSQI, and QoL scores of the participants based on their descriptive information. It was determined that 78% of the study participants were female, 71.4% were single, and 73.8% had a university degree or higher. 10.9% of the participants were diagnosed with a chronic disease. According to the PSQI, 62.5% of participants had "poor" sleep quality and individuals with sleep duration of 7 hours or more accounted for 70.6% of the sample. The median scores of the DASS-A (11 (IQR: 17)) and DASS-S (17 (IQR: 14.5)) were higher in females than in males ($p < 0.05$). The median DASS-D (12 (IQR: 17)), DASS-A (13 (IQR: 14)), DASS-S (17 (IQR: 15)), and PSQI scores (6 (IQR: 5)) were higher in single participants than in married individuals ($p < 0.001$).

There were no significant differences in DASS and PSQI scores based on educational status ($p > 0.05$). The median score of DASS-S was higher in participants with chronic diseases (20 (IQR: 14.5)) ($p = 0.012$). In addition, the median DASS and PSQI scores were higher in participants with poor sleep quality and sleep duration less than 7 hours ($p < 0.05$).

The mean score of all subscales of the WHOQoL was significantly higher in married individuals; the general, physical, and psychological subscales in males; and only the general and physical subscales in individuals without chronic disease ($p < 0.05$). In addition, all subscales were significantly higher in individuals with good sleep quality and the general, physical, and psychological subscales were significantly higher in individuals with sleep duration of 7 hours or more ($p < 0.05$) (Table 1).

Table 1. Comparison of DASS, PSQI, and Quality of Life Scores According to Participants' Descriptive Information

	n (%)	DASS ^β (Depression) Median (IQR)	DASS ^β (Anxiety) Median (IQR)	DASS ^β (Stress) Median (IQR)	PSQI ^β Median (IQR)	WHOQoL				
						General ^α (\bar{x} ±SD)	Physical ^α (\bar{x} ±SD)	Psychological ^α (\bar{x} ±SD)	Social ^α (\bar{x} ±SD)	Environmental ^α (\bar{x} ±SD)
Gender										
Male	212 (22.0)	10 (16)	8 (12.75)	14 (16)	6 (5)	6.51±1.54	26.25±4.82	19.74±4.65	9.99±2.64	26.38±6.36
Female	750 (78.0)	11 (17)	11 (13)	17 (14.25)	6 (4)	6.25±1.49	25.07±4.81	18.80±4.78	9.78±2.66	25.43±6.19
Total	962(100.0)	11 (16)	11 (14)	16 (15)	6 (5)	6.30±1.51	25.33±4.84	19.01±4.76	9.83±2.66	25.64±6.23
p value		0.218	<0.001	0.002	0.465	0.022	0.002	0.012	0.314	0.051
Marital Status										
Married	275 (28.6)	6 (12)	7 (10)	13 (14)	5 (4)	6.56±1.45	26.03±4.89	20.87±4.58	10.50±2.56	27.68±6.15
Single	687 (71.4)	12 (17)	13 (14)	17 (15)	6 (5)	6.20±1.52	25.05±4.79	18.26±4.63	9.56±2.65	24.82±6.08
p value		<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	<0.001
Educational Status										
High school and below	252 (26.2)	11 (16.75)	11 (14)	16 (17)	5 (5)	6.25±1.52	25.05±5.10	19.01±4.72	9.59±2.75	25.55±6.38
University and above	710 (73.8)	10 (16)	11 (14)	16 (15)	6 (4)	6.33±1.50	25.43±4.74	19.01±4.78	9.91±2.62	25.67±6.19
p value		0.689	0.785	0.939	0.101	0.465	0.276	0.995	0.105	0.792
Chronic Disease										
Yes	105 (10.9)	10 (16)	11 (12)	20 (14.5)	7 (7)	5.81±1.51	23.82±5.18	19.24±4.77	10.10±2.71	26.58±6.18
No	857 (89.1)	11 (16)	11 (14)	15 (15)	6 (4.5)	6.36±1.50	25.52±4.76	18.98±4.76	9.79±2.65	25.52±6.23
p value		0.818	0.178	0.012	0.123	<0.001	<0.001	0.594	0.267	0.103
Sleep Quality										
Good	361 (37.5)	4 (11)	6 (9)	10 (13)	3 (2)	6.94±1.47	27.45±4.65	20.85±4.77	10.42±2.67	27.52±6.68
Poor	601 (62.5)	14 (16)	14 (14)	19 (14)	8 (3)	5.92±1.40	24.06±4.49	17.90±4.40	9.47±2.58	24.51±5.66
p value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sleep Duration										
<7 hours	283 (29.4)	12 (16)	13 (15)	19 (17)	8 (4)	6.12±1.48	24.73±4.72	18.32±4.76	9.64±2.57	25.14±5.89
≥7 hours	679 (70.6)	9 (16)	10 (13)	15 (15)	5 (4)	6.38±1.51	25.58±4.86	19.30±4.74	9.91±2.69	25.85±6.37
p value		<0.001	0.001	<0.001	<0.001	0.012	0.012	0.004	0.154	0.109

^aIndependent samples t-test; ^βMann Whitney U test

Participants' mean age and QoL scores by depression, anxiety, stress status, and sleep quality are shown in Table 2. 47.3% of participants by DASS-D, 35.8% by DASS-A, and 45.6% by DASS-S were classified as “normal”. Participants rated as having good sleep quality accounted for 37.5% of the sample. Mean age and QoL scores were higher in those with normal (by DASS) and good sleep quality (by PSQI) ($p<0.001$).

Table 2: Participants' Age and QoL Scores by Depression, Anxiety, Stress Status, and Sleep Quality

	n (%)	Age ($\bar{x}\pm SD$)	WHOQoL				
			General ($\bar{x}\pm SD$)	Physical ($\bar{x}\pm SD$)	Psychological ($\bar{x}\pm SD$)	Social ($\bar{x}\pm SD$)	Environmental ($\bar{x}\pm SD$)
Depression							
Normal	455(47.3)	29.59±11.87	6.95±1.31	27.46±3.99	21.72±3.97	10.85±2.34	27.95±5.96
Depressed	507(52.7)	25.30±4.39	5.73±1.44	23.42±4.73	16.58±4.06	8.91±2.59	23.57±5.73
p value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Anxiety							
Normal	344(35.8)	30.79±12.01	7.06±1.28	27.76±4.06	21.73±4.12	10.70±2.46	28.13±6.08
Anxious	618(64.2)	25.41±9.51	5.89±1.46	23.98±4.71	17.50±4.41	9.34±2.64	24.26±5.89
p value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Stress							
Normal	439(45.6)	29.61±11.93	6.90±1.41	26.92±4.34	21.17±4.42	10.42±2.55	27.17±6.36
Stressed	523(54.4)	25.42±9.31	5.80±1.40	24.00±4.83	17.19±4.26	9.33±2.64	24.36±5.83
p value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sleep Quality							
Good	361(37.5)	29.89±11.77	6.94±1.47	27.45±4.65	20.85±4.77	10.42±2.67	27.52±6.68
Poor	601(62.5)	25.79±9.84	5.92±1.40	24.06±4.49	17.90±4.40	9.47±2.58	24.51±5.66
p value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Independent samples t-test

Participants' mean BMI increased significantly over the course of COVID, from 22.91 \pm 4.22 kg/m² in the period before COVID to 23.22 \pm 4.34 kg/m² ($p<0.001$) (Figure 2). When participants were compared based on depression, anxiety, stress, sleep quality, and sleep duration, the increase in mean BMI remained significant during the pandemic ($p<0.05$). Furthermore, participants with anxiety and poor sleep quality had lower mean BMI values both before and during COVID ($p<0.05$) (Table 3).

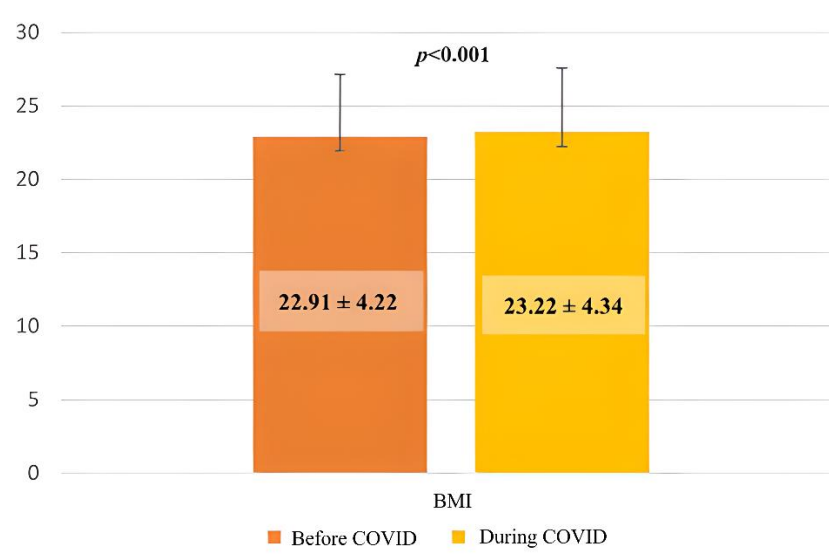


Figure 2: Comparison of participants' BMI values before and during COVID

Table 3: Comparison of Participants' BMI Score Before and During COVID by Depression, Anxiety, Stress Status, Sleep Quality, and Sleep Duration

BMI Score	Before COVID ($\bar{x} \pm SD$)	During COVID ($\bar{x} \pm SD$)	p value
Depression			
Normal	23.05 \pm 4.18	23.38 \pm 4.29	<0.001 ^β
Depressed	22.78 \pm 4.26	23.09 \pm 4.39	<0.001 ^β
p value	0.238 ^α	0.163 ^α	
Anxiety			
Normal	23.35 \pm 4.12	23.80 \pm 4.26	<0.001 ^β
Anxious	22.66 \pm 4.26	22.90 \pm 4.36	<0.001 ^β
p value	0.002 ^α	<0.001 ^α	
Stress			
Normal	23.12 \pm 4.23	23.43 \pm 4.24	<0.001 ^β
Stressed	22.73 \pm 4.21	23.05 \pm 4.42	<0.001 ^β
p value	0.094 ^α	0.065 ^α	
Sleep Quality			
Good	23.33 \pm 4.12	23.60 \pm 4.16	<0.001 ^β
Poor	22.66 \pm 4.26	23.00 \pm 4.44	<0.001 ^β
p value	0.004 ^α	0.006 ^α	
Sleep Duration			
<7 hours	22.94 \pm 4.38	23.23 \pm 4.46	0.003 ^β
≥7 hours	22.89 \pm 4.16	23.22 \pm 4.29	<0.001 ^β
p value	0.904 ^α	0.912 ^α	

^αMann Whitney U test, ^βWilcoxon test

The correlation of participants' DASS and PSQI scores with some selected variables is shown in Table 4. Age was found to have a weak correlation with the DASS subscales and a very weak correlation with the PSQI. There was also a positive and moderately significant correlation between PSQI and the DASS subscales ($p < 0.001$). It was determined that body weight and BMI had very weak correlation with DASS-D, DASS-A, and PSQI subscales ($p < 0.05$). All subscales of WHOQoL were negatively correlated with DASS subscales and PSQI ($p < 0.05$).

Table 4: The Correlation of DASS and PSQI Scores with Some Selected Variables

	DASS Depression		DASS Anxiety		DASS Stress		PSQI	
	r	p	r	p	r	p	r	p
Age	-0.220	<0.001	-0.263	<0.001	-0.201	<0.001	-0.172	<0.001
Sleep duration	-0.043	0.185	-0.026	0.418	-0.043	0.180	-0.343	<0.001
PSQI score	0.489	<0.001	0.505	<0.001	0.477	<0.001	1.000	-
Weight before COVID	-0.080	0.013	-0.137	<0.001	-0.089	0.006	-0.077	0.018
Weight during COVID	-0.092	0.004	-0.155	<0.001	-0.104	0.001	-0.072	0.025
BMI before COVID	-0.076	0.018	-0.109	0.001	-0.059	0.068	-0.088	0.006
BMI during COVID	-0.097	0.003	-0.137	<0.001	-0.084	0.009	-0.086	0.008
WHOQoL								
General	-0.486	<0.001	-0.452	<0.001	-0.435	<0.001	-0.396	<0.001
Physical	-0.472	<0.001	-0.462	<0.001	-0.370	<0.001	-0.428	<0.001
Psychological	-0.629	<0.001	-0.524	<0.001	-0.495	<0.001	-0.368	<0.001
Social	-0.379	<0.001	-0.288	<0.001	-0.263	<0.001	-0.231	<0.001
Environmental	-0.403	<0.001	-0.354	<0.001	-0.288	<0.001	-0.288	<0.001

Spearman correlation

DISCUSSION and CONCLUSION

The COVID-19 pandemic has led to serious changes in mental health, sleep quality and quality of life. The current study examined participants' depression, anxiety, stress, sleep quality and quality of life scores during COVID-19. Anxiety and stress scales were lower in women than in men. In addition, the scores for general health, physical quality of life and psychological quality of life, which are subgroups of quality of life, were lower in women. However, there was no difference in sleep quality between the genders. In the study on the fear of COVID-19, it was reported that women, especially married women with children, had higher levels of anxiety (17). This situation did not change during the quarantine period. During the pandemic, married women who were engaged in both domestic and professional activities worried about their families, which may have increased their levels of anxiety and stress. In a global survey of 53,524 participants from 26 countries, high stress levels were associated with being younger, female, having a lower level of education, being single, and living with more children (18). The questionnaire given to participants during the COVID-19 quarantine showed that 50.9% of participants suffered from anxiety, 57.4% from stress and 58.6% from depression (19).

Stress, anxiety and depression were observed in individuals aged of 18-24 years and in women; anxiety and stress were observed in separated individuals, and anxiety occurred more frequently in married individuals. Depression was more common among single and divorced persons (19). In this study, the individuals with depression, stress, anxiety and poor sleep quality were younger. No association was found between educational status and mental health, sleep quality and quality of life. Being single is significantly associated with higher levels of depression, anxiety, and stress. They also have poorer sleep quality and quality of life. Feelings of loneliness, which are more prevalent among single people than married couples due to social isolation, have a negative impact on mental health. A limited social life and limited interpersonal interaction also have a poor impact on mental health and sleep quality (20, 21). In a similar study conducted with university students, there was a positive correlation between sleep quality and mental health (22).

In a study that examined the mental health of students during the pandemic period in China, the depression, anxiety and stress scores were significantly higher in students with chronic illnesses than in students without chronic illnesses (23). Higher mental health problems, lower sleep quality and quality of life were found in participants with chronic illnesses during the pandemic (24). In our study, stress levels were higher in individuals with chronic diseases; general health and physical quality of life scores were lower. It is known that the risk of death due to COVID-19 is increased in people with chronic diseases such as diabetes, cardiovascular disease, and chronic lung diseases. Therefore, people with chronic diseases may experience more stress, anxiety and depression symptoms.

When the present study examined the relationship between sleep quality and mental health, depression, anxiety and stress were higher in individuals who slept less than 7 hours and had poor sleep quality. High levels of stress, anxiety, depression and insomnia were observed worldwide during COVID-19. In the study conducted with 1653 participants, 77% of individuals suffered from stress, 59% from anxiety and 34.9% from depression, and 73% of individuals had poor sleep quality (25). In the study, which examined the effects of sleep quality on mental health, poor sleep quality was associated with high levels of depression, anxiety, and stress (26). After the onset of the COVID-19 pandemic, it also had a negative impact on mental health and sleep during the quarantine period. In addition, this condition was associated with sleep disturbances, depressive symptoms, and anxiety. In older people during the pandemic, there was a link between a sleep duration of less than 4 hours and a high level of depressive symptoms (27). In addition to depression, sleep quality also worsened in the elderly during the pandemic. It has been reported that people who suffer from insomnia and sleep less than 7 hours are at higher risk for chronic mental health symptoms (27, 28).

The COVID-19 pandemic has had a negative impact on quality of life. According to the ATHIS 2014 study in Austria, depression increased and quality of life decreased during COVID-19 compared with before COVID-19 (29). In our study, quality of life scores were lower in individuals with poor sleep quality and in individuals who slept less than 7 hours. In addition, individuals with depression, anxiety and stress had lower quality of life scores (general health, physical health, psychological health, social relations, environmental health). A study conducted in Brazil during the pandemic found high levels of depression and anxiety symptoms. Depressive symptoms were associated with a lower quality of life. Specifically, lower religious belief status among individuals was positively associated with depression and anxiety symptoms and was associated with poorer social and environmental quality of life (30). Sleep quality worsened and the incidence of depression and anxiety increased among Turkish adults during the COVID-19 pandemic. In particular, female gender and the age group of young adults under 40 years are associated with poor sleep quality (31).

When the present study examines the BMI of individuals before and after COVID-19, the mean BMI value, which was $22.91 \pm 4.22 \text{ kg/m}^2$ in the period before COVID-19, increases significantly to $23.22 \pm 4.34 \text{ kg/m}^2$ during the period COVID-19. There is also an increase in BMI in individuals whose mental health and sleep quality deteriorate during COVID-19. In the study conducted in Italy during the first month of lockdown, individuals gained an average of approximately 1.5 kg of weight. Weight gain is associated with less exercise, feelings of boredom/loneliness, anxiety/depression, eating more meals, grains and sweets, and eating unhealthy snacks. A direct effect of anxiety and depression on weight gain was reported as 2.07 kg (32). In another study, the prevalence of overweight was 30.5% before the pandemic and increased to 34.9% during the pandemic (33). According to the Korean National Health and Nutrition Examination Survey, obesity increased during the pandemic, especially in men compared with before the pandemic, while there was no significant increase in women (34). In a study conducted with university students, men's BMI increased by 0.5 kg/m^2 during the pandemic, while women's BMI decreased by an average of 0.45 kg/m^2 . The percentage of overweight and obese men increased from 14% to 30.4% (35). As a result of the systematic review and meta-analysis published on the impact of the COVID-19 pandemic on body weight during the first lockdown period, younger people gain weight and older adults over 60 years of age are at risk of weight loss, malnutrition, and sarcopenia (36). In the study, the majority of whom were women, it was reported that 30% of individuals gained more than 5% weight during the pandemic and 19% lost more than 5% weight. The average weight gain was 4.3%. Anxiety, stress, and depression scores were higher in the weight gain group and sleep scores were lower in the weight loss group (37). In university students, there was a negative correlation between anxiety, stress, and depression scores and BMI in male students, and in female students, this correlation is associated with depression and stress scores (38). Micheletti Cremasco et al. (39) found an association between weight gain and poor sleep quality during the pandemic in his study. A study conducted in Malaysia found an association between poor sleep quality and high BMI in adults (40). Positive association was reported between poor sleep quality and depression, stress, and anxiety scores in young adults before and after COVID (41). In the study conducted by Targa et al. (42), lower sleep quality was reported during the pandemic period compared with before. In addition, the decrease in sleep quality was associated with an increase in negative mood. When the relationship between sleep duration and weight change during the pandemic period was examined, individuals who slept less than 7 hours gained more weight than individuals who slept more than 7 hours. Poor sleep quality can affect weight gain by affecting hormones that influence appetite and energy metabolism (43). In the study conducted by Husain et al. (44) the average daily sleep duration was 7.1 hours before the pandemic and 8 hours during the pandemic. Another study found similar results and showed an increase in sleep duration during lockdown (45). In the study that examined the relationship between sleep duration and BMI before and after the pandemic, no significant relationship was found (46).

Since 2019, the COVID-19 pandemic has impacted lifestyles and health around the world. With the changing lifestyle during the pandemic period, there were differences in people's depression, stress,

and anxiety levels, as well as their sleep quality and quality of life. In our study, sleep quality, quality of life, and mental health status were assessed together. There are few studies in the literature that assess QoL, sleep quality, and mental health status together during COVID-19. The large number of participants in the study also makes it more original.

This study has several limitations. The cross-sectional design of the study is the most significant limitation. Although a more balanced gender distribution was targeted throughout the study's design phase, it was not achieved. Anthropometric measurements (height and body weight) were obtained from self-reports. Another limitation is that DAS levels, sleep quality, and quality of life of the participants could not be evaluated before the pandemic.

In conclusion, the results of this study showed that more than half of the individuals participating in the study had poor sleep quality. The median DASS and PSQI scores were higher in participants with poor sleep quality and sleep duration less than 7 hours. At the same time, all subscales of WHOQoL were negatively correlated with DASS subscales and PSQI. We hope that this present study will help in the development of strategies through understanding the predictors related to DASS levels, sleep quality, and quality of life during the pandemic period.

Declaration of Ethical Code: In this study, we undertake that all the rules required to be followed within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with, and that none of the actions stated under the heading "Actions Against Scientific Research and Publication Ethics" are not carried out.

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving research study participants were approved by Izmir Katip Celebi University Clinical Research Ethics Committee (Decision date/no: 21.10.2021/0443) and study permission from the T.R. Ministry of Health Scientific Research Platform. As the study is web-based, in order to obtain written consent, 'I agree to participate in the study' tab was added per online questionnaire.

Conflict of Interest: The authors declare that there are no conflicts of interest.

Author Contribution: Concept – GK, EA ; Supervision – GK, BB, GGY ; Materials –; Data Collection – GK , EA ; Analysis and Interpretation – BB ; Writing – GK, BB, GGY. All authors approved the final version of the manuscript.

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