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The effect of COVID-19 restrictions on sleep quality of university students and variables predicting sleep quality

Arzu Bulut, Halil Sengul¹, Yeter Demir Uslu², Kazım Bas³, Nurperihan Tosun⁴

Abstract:

BACKGROUND/AIM: The COVID-19 pandemic has created a long period of stress for people worldwide and has significantly affected sleep duration. The pandemic revealed new stress factors that are likely to affect sleep. Uncertainty is a factor that leads to anxiety and depression, which affects sleep. It should also be noted that reductions in sleep quality rather than sleep duration are associated with negative consequences on mental health. This study aims to investigate online that how this situation affected university students.

MATERIALS AND METHODS: This research, with a descriptive study design, was conducted in Turkey between June 01, 2021 and July 30, 2021. The sample included 604 people who accepted voluntary participation, chosen by the random selection method. In the study, sociodemographic information form, Pittsburgh sleep quality index (PSQI), morningness–eveningness questionnaire scale (MEQ Scale), Beck depression inventory (BDI), and Beck anxiety inventory (BAI) were used as data collection tools. Pearson correlation analysis was utilized to examine the relationship between the scales. Multiple regression analysis was performed to investigate the role of morningness–eveningness, anxiety, depression, and insomnia severity on sleep quality.

RESULTS: Sleep quality was negatively correlated with morningness–eveningness scores ($r = -0.32$, $P < 0.01$), and positively and significantly related with anxiety ($r = 0.43$, $P < 0.01$), depression ($r = 0.40$, $P < 0.01$) and insomnia severity ($r = 0.55$, $P < 0.01$). According to regression coefficients, while anxiety ($\beta = 0.041$, $P < 0.001$) and insomnia severity scores ($\beta = 0.226$, $P < 0.001$) positively predicted sleep quality, depression did not predict it significantly ($\beta = 0.009$, $P > 0.05$). A significant difference was found in sleep quality according to morning, evening, and intermediate types ($F = 27.401$, $P < 0.001$).

CONCLUSION: Events related to the COVID-19 pandemic are associated with reduced sleep quality in connection with increasing negative moods. Considering the importance of sleep for a healthy life, efforts should be made to raise awareness about this issue and to provide psychological help to affected individuals.

Keywords:

Anxiety, COVID-19 pandemic, depression, morningness-eveningness, sleep quality, university students

Introduction

The COVID-19 pandemic has led to unprecedented changes in lifestyles in society. The decisions taken to control the pandemic and some sanctions, including the curfew, forced people to adjust their personal and professional lives, work from

home, educate their children at home, and minimize social interactions. In this context, sleep patterns and sleep quality underwent significant changes. Depending on the social restrictions, changes occurred in bedtime and wake-up times.

There is no doubt that the curfew decision helped prevent the further spread of the

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Department of Health Management, Faculty of Health Sciences, Bandirma Onyedi Eylul University, Balıkesir, Turkey, ¹Department of Health Management, Faculty of Health Sciences, Sabahattin Zaim University, Istanbul, Turkey, ²Department of Health Management, Faculty of Health Sciences, Medipol University, Istanbul, Turkey, ³Department of Medical Services and Techniques, Tunceli Vocational School, Munzur University, Tunceli, Turkey, ⁴Department of Health Management, Faculty of Health Sciences, Cumhuriyet University, Sivas, Turkey

Address for correspondence:

Dr. Arzu Bulut,
Department of Health Management, Faculty of Health Sciences/Bandirma Onyedi Eylul University, Kurtulus Street, No: 98, Bandirma/Balıkesir 10200, Turkey.
E-mail: abulut@bandirma.edu.tr

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virus and was an essential measure to reduce the number of hospitalized patients. However, from a psychological point of view, this may cause feelings of uncertainty, fear, anger, and frustration, which can lead to anxiety, boredom, and restlessness in people.^[1-3] The fact that people started working from home with an increased burden of anxiety arising from these health risks and social distancing, which they almost inevitably confronted, or this new circumstance in which they have to manage their work, had a significant impact on daily functioning and night sleep.^[4]

Sleep and stress were defined as having a bidirectional relationship throughout a person's lifespan. While stress affects sleep quality, insomnia also triggers stress.^[5] Stress has an inverse relationship with sleep in general, if not always. The impact of stress on sleep quality, timing, and duration is influenced by sleep reactivity.^[6] People with high reactivity have insomnia or sleep problems in stressful situations. The house arrest due to the curfew increased the risks of irregular and poor-quality sleep or insomnia through stress. The need for sleep is a homeostatic factor proportional to the time spent awake. In other words, the longer the waking time, the higher the desire to sleep and the higher the chance of falling asleep. People usually stay awake during the day and accumulate a need for sleep which peaks at night, when circadian factors are also activated to induce sleep.^[7]

Due to the curfew confining people to their homes throughout the day, opportunities to prolong sleep in the morning and take a nap during the day can disrupt the homeostatic process and circadian rhythms. The initiation and maintenance of the sleep-wake cycle are explained by a two-process model in which circadian and homeostatic factors continually interact to induce and maintain sleep. This model suggests that people are more likely to fall asleep at night by nature due to circadian factors.^[7] Quarantine reduced the exposure to daylight needed to synchronize the circadian body clock, thus, affecting many processes, including sleep and mood.^[8,9] Accordingly, recent studies reported that individuals woke up and slept later during quarantine. In addition, this was possibly influenced by increased use of digital media near bedtime.^[10] Furthermore, less exposure to sunlight, limited activity during the day, and changes in mealtimes may cause irregularity in circadian rhythms and ultimately impact sleep.^[11,12]

Sleep is an important process in human physiology in which the body goes into resting mode. Changing or deterioration this process can lead to many disorders in people, both physically and psychologically. Sleep quality is a significant element of psychological health, and sleep disorders are associated with psychopathology.^[13] Also, sleep quality is closely related

to mood, which changed markedly during this time.^[14-16] Huang and Zhao (2020) observed in their study that the prevalence of generalized anxiety disorder, which seems to be associated with COVID-19, was high.^[16] In addition, another study conducted during the initial phase of the COVID-19 pandemic in China determined that 54% of respondents rated the psychological impact as moderate or severe, and about a third reported moderate to severe anxiety.^[17] According to this research, few studies evaluating sleep during the COVID-19 period also examined anxiety, depression, or stress. In their study, Xiao *et al.*^[14] used the Pittsburgh sleep quality index (PSQI) and found a correlation between anxiety and poor sleep quality. Similarly, another study reported that low-quality sleep significantly increased in people with depression, anxiety, and stress.^[13] While current studies have investigated the effect of sleep quality on anxiety and depression, our study examined how anxiety and insomnia severity, which has increased due to the COVID-19 pandemic, affects sleep quality. The present research aimed to analyze how the COVID-19 pandemic impacted the sleep quality of university students and the relationship with depression, anxiety, and morning-evening types.

Materials and Methods

Study design

This research, a descriptive and relationship-seeking design, was conducted from June 01, 2021 to July 30, 2021.

Study participants and sampling

The research universe consists of university students studying at state or foundation universities throughout Turkey. The total number of students in higher education in Turkey in the 2020–2021 academic year was 8.240.997. The sample for this web-based study included 604 associate, undergraduate, and graduate students who accepted participation in the research.

Data collection tools

In this study, the sociodemographic information form, PSQI, morningness–eveningness questionnaire scale (MEQ Scale), Beck depression inventory (BDI), and Beck anxiety inventory (BAI) were used as data collection tools.

Sociodemographic information form

The sociodemographic information form used in the research included questions about the participants' gender, education, university, region of residence, accommodation, and fixed income.

PSQI

The PSQI, which was developed by Buysse *et al.*^[18] was adapted into Turkish by Agargün *et al.*^[19] The scale, which

was designed to quantitatively measure sleep quality with subjective evaluation by the individual, consists of 24 questions. Nineteen of these questions are self-report questions, and the remaining five are questions for the individual's spouse or roommate to answer. If the individual does not share a room with anyone, these five questions are not included in the index score. The initial 19 questions, that contain the subjective evaluation of the individual, aim to determine sleep latency and the frequency and severity of sleep problems in the past month. The 18 scored questions on the scale comprise seven components. These components are "subjective sleep quality", "sleep latency", "sleep duration", "habitual sleep efficiency", "sleep disturbances", "use of sleep medication", and "daytime dysfunction". Each component is evaluated between 0 and 3 points. The total score for the seven components gives the total scale score. The total index score ranges from 0 to 21. A total score greater than 5 indicates "poor sleep quality".

MEQ scale

The Turkish validity and reliability of the scale, developed by Horne and Oztberg,^[20] were determined by Punduk *et al.*^[21] There are 19 questions in the questionnaire, and it is a four-point Likert scale. The time scale is used in the first, second, and 10th questions. If the total score of the questionnaire is between 70 and 86 points, it is definite morning type; if the score is between 59 and 69 points, it is moderate morning type; between 42 and 58 points is intermediate type; between 31 and 41 points is moderate evening type; and scores between 16 and 30 points indicate definite evening type.

BDI

The Turkish validity and reliability of the scale, developed by Beck *et al.*^[22] were completed by Hisli *et al.*^[23] The scale measures physical, emotional, and cognitive symptoms that occur as a result of depression with the subjective evaluation of the individual. The scale contains 21 symptom categories with four options in each. The individual is asked to mark the sentence that best expresses how they felt in the past week, including the day of application. The highest score that can be obtained from the scale is 63. The depression score is calculated by summing the answers given to all questions. A high total score indicates a high level of depression or depression severity.

BAI

The Turkish validity and reliability of the scale, developed by Beck *et al.*^[24] were completed by Ulusoy *et al.*^[25] The scale evaluates the frequency of symptoms related to anxiety experienced by the individual. It is a self-assessment scale consisting of 21 items and scored between 0 and 3. The questions asked to individuals inquire about how much distress has bothered them in

the last week. The highest score that can be obtained from the scale is 63. The anxiety score is calculated by summing the answers given to all questions. A high total score means a high level of anxiety.

Data collection technique

For the data collection method in the study, the computerized test method was applied to 604 students who voluntarily agreed to participate in the research. According to the results of a meta-analysis conducted in Turkey, there is no significant difference between student performances in paper-pencil form and computerized tests.^[26] Therefore, the scale form was sent to participants in the computer environment. After reaching a sufficient sample size in the study, the application was terminated.

Ethical consideration

Ethics committee approval for noninterventional practices was obtained from Istanbul Sabahattin Zaim University with decision numbered 2021/05 and dated 28.05.2021. In addition, permission was granted by the Scientific Research Evaluation Commission of the Ministry of Health of Turkey on 08.05.2021.

Statistical analysis

Normal distribution assumptions were taken into account in the application of the hypothesis tests. Within the scope of the research, first of all, the mean, frequency, standard deviation, and kurtosis-skewness values of the research variables were examined. The kurtosis and skewness values were investigated to see if the variables satisfied the normality assumption, and the normality assumption was met. Parametric test statistics were used for data analysis because the normality assumption was satisfied. Pearson correlation analysis was utilized to examine the relationship between the scales. Multiple regression analysis was performed to investigate the role of morningness-eveningness, anxiety, depression, and insomnia severity on sleep quality. Data were analyzed using the IBM SPSS Statistics Version 22 packet program, and the significance level was determined as $\alpha = 0.05$.

Study model and hypotheses

Figure 1 depicts the research model. The hypotheses created within this framework are given below.

H₁: There is a positive relationship between sleep quality and morningness-eveningness scores in favor of morning type.

H₂: There is a negative relationship between sleep quality and anxiety.

H₃: There is a negative relationship between sleep quality and depression.

H₄: There is a negative relationship between sleep quality and insomnia severity.

Results

In this part of the research, the findings related to the analysis results of the collected data are given.

Demographic findings

Table 1 demonstrates the demographic characteristics of the students in the study. Table 2 illustrates the mean, standard deviation, kurtosis, skewness, and correlation coefficients of the variables in the study. Accordingly, the mean values were between 10.37 and 47.22, the skewness coefficients were between -0.30 and 0.67, and the kurtosis coefficients were between -0.23 and 0.07. Since the kurtosis and skewness coefficients were between -1 and +1, the variables have normal distribution (26). Furthermore, the histogram graphs of the variables also support the kurtosis and skewness coefficients. Sleep quality was significantly and negatively correlated with morningness-eveningness scores ($r = -0.32, P < 0.01$),

Table 1: Distribution of demographic characteristics of the participants

| | n | % |
|--------------------|-----|------|
| Gender | | |
| Woman | 493 | 81.6 |
| Male | 111 | 18.4 |
| Education | | |
| Associate Degree | 199 | 32.9 |
| License | 381 | 63.1 |
| Graduate | 24 | 4.0 |
| University | | |
| State University | 452 | 74.8 |
| Private University | 152 | 25.2 |
| Living Area | | |
| Urban Area | 497 | 82.3 |
| Rural Area | 107 | 17.7 |
| Accommodation | | |
| Family | 562 | 93.0 |
| Student House | 13 | 2.2 |
| Alone | 9 | 1.5 |
| Student Dormitory | 14 | 2.3 |
| Other | 6 | 1.0 |
| Fixed Income | | |
| Yes | 387 | 64.1 |
| No | 217 | 35.9 |

while it was significantly and positively related with anxiety ($r = 0.43, P < 0.01$), depression ($r = 0.40, P < 0.01$), and insomnia severity ($r = 0.55, P < 0.01$).

Findings regarding the effects of COVID-19

Table 3 shows the distributions of COVID-19 impacts in the study. Accordingly, 23.7% of the participants experienced loss in their families or friends. However, the social life of participants was most negatively affected by COVID-19 for 96.2%, followed by daily routines for 94%, education for 90.2%, and economic conditions for 80.3%.

Table 4 demonstrates t-test results for independent samples made to compare the variables according to experiencing loss, changes in daily routines, and economic, educational, and social effects in the study.

For the results of the study, there were significant differences in anxiety ($t = 2.076, P < 0.05$), depression ($t = 3.144, P < 0.01$), and insomnia severity ($t = 4.58, P < 0.001$) scores according to experience of loss. The mean scores for anxiety, depression, and insomnia severity of individuals who experienced loss were higher than the mean for those who have not experienced it.

There was a significant difference in depression ($t = 2.461, P < 0.05$) scores according to the changes in daily routines. Depression mean scores of individuals whose daily routines were affected were greater than those whose daily routines were not affected.

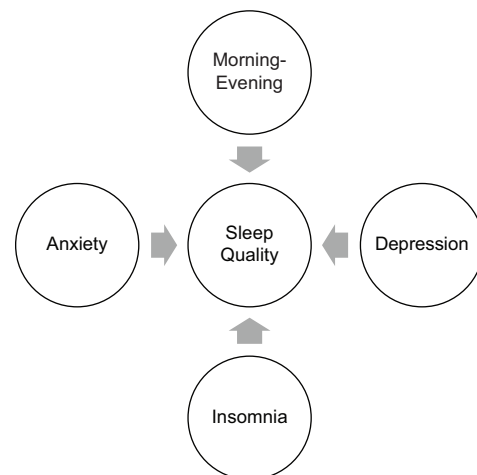


Figure 1: Research model

Table 2: Mean, standard deviation, kurtosis, skewness, and correlation coefficients of the variables

| | \bar{X} | SD | Skewness | Kurtosis | 1 | 2 | 3 | 4 |
|-------------------|-----------|-------|----------|----------|--------|-------|-------|-------|
| Morning-Evening | 47.22 | 9.70 | -0.30 | -0.15 | - | | | |
| Anxiety | 21.45 | 14.39 | 0.67 | -0.12 | -0.16* | - | | |
| Depression | 19.86 | 10.59 | 0.55 | 0.07 | -0.29* | 0.63* | - | |
| Insomnia Severity | 10.37 | 5.96 | 0.58 | 0.02 | -0.32* | 0.51* | 0.59* | - |
| Sleep Quality | 13.64 | 3.12 | 0.37 | -0.23 | -0.32* | 0.43* | 0.40* | 0.55* |

* $P < 0.01$, \bar{X} Mean, SD: Standard deviation

According to the economic effects, there were significant differences in anxiety ($t = 3.287, P < 0.01$), depression ($t = 3.524, P < 0.001$), insomnia severity ($t = 5.344, P < 0.001$) and PSQI ($t = 3.626, P < 0.001$) scores. Anxiety, depression, insomnia severity, and PSQI mean scores of economically affected individuals were higher than economically unaffected individuals.

According to the educational effects, there were significant differences in anxiety ($t = 1.992, P < 0.05$),

depression ($t = 2.796, P < 0.01$) and insomnia severity ($t = 3.47, P < 0.001$) scores. The anxiety, depression, and insomnia severity mean scores of individuals whose education was affected were greater than individuals whose educationally was unaffected.

According to the social effects, there was a significant difference in depression ($t = 2.395, P < 0.05$) scores. Depression mean scores of socially affected individuals were higher than socially unaffected individuals.

Table 3: Distributions of Covid-19 effects

| | <i>n</i> | % |
|-----------------------------------|----------|------|
| Losing family or friends | | |
| Yes | 143 | 23.7 |
| No | 461 | 76.3 |
| Negative impact on daily routines | | |
| Yes | 568 | 94.0 |
| No | 36 | 6.0 |
| Economically negative impact | | |
| Yes | 485 | 80.3 |
| No | 119 | 19.7 |
| Negative impact on education | | |
| Yes | 545 | 90.2 |
| No | 59 | 9.8 |
| Negative impact on social life | | |
| Yes | 581 | 96.2 |
| No | 23 | 3.8 |

Regression analysis

Table 5 illustrates the multiple linear regression findings to examine morning–evening types, anxiety, depression, and insomnia severity scores as predictors of sleep quality in the study. In the regression analysis, there was no multicollinearity problem between the independent variables since the tolerance values were higher than 0.10 and the VIF values were less than 10.^[27] For this reason, the results of the regression analysis were interpreted. This model was statistically significant ($F_{(3,600)} = 98.041, P < 0.001$), and 33% of the observed variability in sleep quality ($R = 0.57, R^2 = 0.33$) was explained by anxiety, depression, and insomnia severity.

According to the regression coefficients, anxiety ($\beta = 0.041, P < 0.001$) and insomnia severity ($\beta = 0.226, P < 0.001$) scores

Table 4: Independent sample t-test results according to Covid-19 effects

| | <i>n</i> (%) | Morning-Evening $\bar{X} \pm SD$ | Anxiety $\bar{X} \pm SD$ | Depression $\bar{X} \pm SD$ | Insomnia Severity $\bar{X} \pm SD$ | PUKI $\bar{X} \pm SD$ |
|----------------------------|--------------|-------------------------------------|-----------------------------|--------------------------------|---------------------------------------|-----------------------|
| Living Lost | | | | | | |
| Yes | 143 (23.7) | 46.55±9.67 | 23.63±15.96 | 22.27±11.38 | 12.33±5.88 | 14±3.36 |
| No | 461 (76.3) | 47.43±9.7 | 20.78±13.82 | 19.11±10.22 | 9.76±5.86 | 13.53±3.03 |
| <i>t</i> | | -0.95 | 2.076 | 3.144 | 4.58 | 1.576 |
| <i>P</i> | | 0.342 | 0.038** | 0.002* | <0.001 | 0.115 |
| Influencing Daily Routines | | | | | | |
| Yes | 568 (94.0) | 47.16±9.7 | 21.62±14.35 | 20.13±10.57 | 10.48±6.01 | 13.65±3.15 |
| No | 36 (6.0) | 48.11±9.68 | 18.81±15.09 | 15.67±10.11 | 8.61±4.88 | 13.51±2.58 |
| <i>t</i> | | -0.569 | 1.138 | 2.461 | 1.825 | 0.253 |
| <i>P</i> | | 0.569 | 0.256 | 0.014** | 0.069 | 0.8 |
| Economic Impact | | | | | | |
| Yes | 485 (80.3) | 47.26±9.69 | 22.4±14.53 | 20.6±10.49 | 10.99±5.92 | 13.87±3.17 |
| No | 119 (19.7) | 47.04±9.76 | 17.6±13.2 | 16.82±10.45 | 7.81±5.43 | 12.72±2.72 |
| <i>t</i> | | 0.221 | 3.287 | 3.524 | 5.344 | 3.626 |
| <i>P</i> | | 0.825 | 0.001* | <0.001 | <0.001 | <0.001 |
| Educational Influence | | | | | | |
| Yes | 545 (90.2) | 47.26±9.77 | 21.84±14.49 | 20.25±10.65 | 10.64±6.04 | 13.71±3.14 |
| No | 59 (9.8) | 46.88±9.1 | 17.92±13.1 | 16.22±9.27 | 7.83±4.54 | 12.99±2.85 |
| <i>t</i> | | 0.281 | 1.992 | 2.796 | 3.47 | 1.689 |
| <i>P</i> | | 0.779 | 0.047** | 0.005* | <0.001 | 0.092 |
| Social Influence | | | | | | |
| Yes | 581 (96.2) | 47.21±9.7 | 21.49±14.4 | 20.06±10.58 | 10.4±5.93 | 13.64±3.1 |
| No | 23 (3.8) | 47.48±9.83 | 20.48±14.51 | 14.7±9.42 | 9.48±6.76 | 13.78±3.59 |
| <i>t</i> | | -0.131 | 0.331 | 2.395 | 0.728 | -0.221 |
| <i>P</i> | | 0.896 | 0.741 | 0.017** | 0.467 | 0.825 |

* $P < 0.01$, ** $P < 0.05$

Table 5: Variables predicting sleep quality

| | Unstandardized coefficients | | Standardized Beta | t | P | Tolerance | VIF |
|-------------------|-----------------------------|-------|-------------------|--------|--------|-----------|-------|
| | \bar{X} | S.E. | | | | | |
| Fix | 10.240 | 0.238 | | 43.108 | <0.001 | | |
| Anxiety | 0.041 | 0.010 | 0.187 | 4.246 | <0.001 | 0.575 | 1.739 |
| Depression | 0.009 | 0.014 | 0.032 | 0.682 | 0.495 | 0.507 | 1.972 |
| Insomnia Severity | 0.226 | 0.022 | 0.433 | 10.240 | <0.001 | 0.626 | 1.596 |

Dependent variable: Sleep quality

positively predicted sleep quality, while depression did not predict sleep quality significantly ($\beta = 0.009, P > 0.05$).

Variance analysis

Table 6 shows the results of one-way variance analysis, which was performed to compare sleep quality according to morningness–eveningness scores. As a result of the analysis, a significant difference was found in sleep quality according to morning, evening, and intermediate type groups ($F = 27.401, P < 0.001$). The Scheffe test, one of the post hoc tests, was used to detect which groups caused the difference. As a result of the analysis, a significant difference was determined between all groups. In other words, it was found that evening type (14.99) had the highest sleep quality, followed by the intermediate type (13.37) and the morning type (12.09).

Discussion

This study aimed to examine the perceived impact of COVID-19 on daily life and its resulting psychological consequences (for example, depression, anxiety, financial difficulties, educational problems, social life), as well as how this situation affected the sleep quality of university students and to analyze its relationship with depression, anxiety, and morning-evening types. The obtained findings partially supported the research hypotheses.

The World Health Organization reported that as of November, there were 7.249 million cases and more than 5 million deaths occurred due to COVID-19.^[27] Despite the fight continuing with the vaccine, COVID-19 continues to impact lives from health systems to psycho-social areas.^[28] Cielo *et al.* (2021)^[29] reported that pandemic and COVID-19 measures not only cause mental problems in young people but also lead to anxiety, depression, and sleep problems by disrupting psychological well-being. They noted that these problems are related to economic issues, the reduction of academic perspectives, mass learning adoption, and social restrictions. The results of the present research are in line with this study. According to the findings of the current research, 94% of the participants reported that the COVID-19 pandemic negatively affected their daily routines, 80.3% stated it negatively influenced them economically, 90.2% said that it had a negative impact on their education, and 96.2% reported that it negatively affected their social life.

Table 6: Comparison of sleep quality according to morningness-eveningness scores

| | n | \bar{X} | SD | F | P | Post hoc |
|-----------------------|-----|-----------|------|--------|--------|----------|
| Evening type (1) | 159 | 14.99 | 3.20 | 27.401 | <0.001 | 1-2 |
| Intermediate type (2) | 373 | 13.37 | 2.88 | | | 1-3 |
| Morning type (3) | 72 | 12.09 | 3.07 | | | 2-3 |

In the research by Savarese *et al.*^[30] participants stated that distance education was tiring as they face many problems such as internet connection problems, not being physically close to their teachers and friends, and being forced to stay in a closed environment. Moreover, there are many studies detecting the negative effects of COVID-19 on education.^[31,32] There are also several studies that found the economic impacts of COVID-19, its detrimental effects on social life, and resulting psychological symptoms (depression, anxiety, and so on), and these studies support the findings of the present research.^[1,33,34]

According to the research findings, the groups who indicated that they were influenced educationally, economically, and socially during COVID-19 were also affected by anxiety, depression, insomnia severity, and sleep quality, and this impact was statistically significant. Several studies found that depression, anxiety, and sleep problems were observed at various rates in young individuals during the COVID-19 period.^[35-40] Research conducted in China reported that during COVID-19, general anxiety disorder (5.1%), depression symptoms (20.1%), and low sleep quality (18.2%) were all seen in society, with depression and anxiety rates being higher in young individuals.^[16] A study performed in the United Kingdom stated that the COVID-19 pandemic, especially the quarantine process, deteriorated the welfare of students, and the clinical depression level of 15% in students increased during the quarantine. The findings of this study are consistent with those of the current study.^[41,42]

According to the research results, the anxiety and insomnia severity mean scores of the participants who experienced loss due to COVID-19 in their close circle and those who were influenced economically and educationally by COVID-19 were higher. In addition, those who were economically affected had higher PSQI scores. In a study of students, the mean PSQI score

was 6.2 ± 2.4 . It was realized that participants (75.4%) were poor sleepers.^[43] In another study on students, the mean PSQI score was 6.356 ± 1.88 . About 84.6% of the students had poor global sleep quality scores.^[44] Many studies in the literature show that sleep quality is related to some factors such as depression, fear, and anxiety. For example, a study found that insomnia affected 24% of university students before the COVID-19 pandemic and increased to 42% after the pandemic. Also, this was accompanied by depression symptoms at rates of 27.8% and anxiety symptoms at rates of 34.3%.^[45] Lu *et al.*^[46] examined the sleep, anxiety, and depression levels of students during and after the quarantine. They found that the anxiety level, which was higher during the quarantine period, reduced after quarantine and increased sleep quality, but the depression level remained unchanged with a rate of 70%.^[46] Another study discovered that sleep quality remained unchanged before and after the COVID-19 quarantine period, but depressed students had poor sleep quality.^[47] Another research conducted on university students reported that the rates of low sleep quality, anxiety, depression, and fear of COVID-19 were 27.1%, 51.0%, 45.9%, and 86.0%, respectively. Accordingly, anxiety, depression, and fear of COVID-19 were related to the type of university, department, and university studied and these conditions affected sleep quality. The study also found that anxiety decreased the students' sleep quality while increasing their depression levels.^[13] According to the findings of the present research, 33% of the observed variability in sleep quality was explained by anxiety, depression, and insomnia severity. Also, in terms of regression coefficients, while anxiety and insomnia severity scores positively predicted sleep quality, depression did not significantly predict it.

A study determined that having to stay at home during COVID-19 caused young people to go to bed and wake up later, which led to a decrease in sleep quality with the change in sleep rhythms. Also, it detected that depression, anxiety, and stress symptoms decreased sleep quality.^[13] Saadeh *et al.*^[37] noted that the prolonged quarantine period during COVID-19 reduced sleep quality, and 50% of students participating in the research had poor sleep quality. Also, they found that poor sleep quality was associated with depression and anxiety. According to the distinction of the morning–evening types, several studies revealed that the anxiety scores of evening type adolescents were statistically significant and higher than the intermediate and morning type adolescents; the depression scores of the evening type students were higher than the intermediate and morning type students; and the sleep quality of evening type students was worse than intermediate and morning type students.^[48,49] According to the present research results, sleep quality was negatively correlated with

morningness–eveningness scores, and positively related with anxiety, depression, and insomnia severity. Furthermore, sleep quality was the highest for the evening type (14.99), followed by the intermediate type (13.37), and the lowest in the morning type (12.09). This result is inconsistent with previous studies.

Limitation and recommendation

Although this study attempted to evaluate how sleep quality in college students affected the severity of anxiety and insomnia, it had its own limitations as it was a descriptive study. We have conducted the study on population that was chosen based on convenient sampling and hence the results should be carefully interpreted. Future studies should focus on investigating the effect of sleep quality on anxiety and insomnia severity after the COVID-19 pandemic.

Conclusion

In line with the findings obtained in this study, approximately 90% of university students were affected by the COVID-19 pandemic in different ways, and this caused anxiety, depression, and deterioration in sleep quality. Stress factors related to COVID-19, including losing a person from their close circle due to COVID-19, economic stressors, effects on daily life, and educational difficulties, were found to be related to anxiety symptoms and sleep quality of university students in Turkey. Increasing anxiety levels and decreasing sleep quality significantly impact the mental health of university students. Society, families, and educational institutions should pay attention to this issue. University students need help and support during this period. Providing high-quality, crisis-focused psychological services to university students can contribute to dealing with this problem. It is recommended that policymakers, families, and educational institutions cooperate in this regard.

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Conflicts of interest

There are no conflicts of interest.

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