J Surg Med. 2023;7(4):299-303.
DOI: 10.28982/josam.1101380

Research article

Journal of Surgery and Medicine
e-ISSN: 2602-2079
https://jsurgmed.com/

Investigation of sleep quality and musculoskeletal pain of university students during the pandemic period

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Ethics Committee Approval
The study was approved by Ankara Yıldırım Beyazıt University ethics committee (Date/no:08.12.2020/65).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

Financial Disclosure
The authors declared that this study has received no financial support.

Published
2023 April 20

Abstract

Background/Aim: The transition to distance education due to the coronavirus-19 restrictions changed the routines of university students, and physical activity and sleep status were affected due to increased computer screen use. Determining the factors affecting the sleep quality and musculoskeletal pain of university students during the pandemic period will guide the measures that can be taken to address these changes. The aim of this study was to investigate sleep quality and musculoskeletal pain of university students during the pandemic. Our research asked, "What are the factors affecting sleep quality during the pandemic period and does a difference between the musculoskeletal pain of those with good and bad sleep quality exist?"
Methods: University students receiving distance education were included in this cross-sectional study. Students' demographic characteristics, exercise habits, daily use of smart mobile devices were questioned via an online form. The Pittsburgh Sleep Quality Index was used to evaluate sleep quality, and the Cornell Musculoskeletal Discomfort Questionnaire was used to evaluate musculoskeletal pain. Sleep quality status based on regular exercise and daily mobile device usage time were compared. In addition, the musculoskeletal discomforts of the participants with good or bad sleep quality were compared.
Results: Two-hundred twenty-one university students were included in the study (187 female, 34 male). Sleep quality was better in those who exercised regularly (P=0.005). Subjective sleep quality and sleep latency scores were better for those who used smart mobile devices less than 5 h a day (P=0.002 and P=0.018, respectively). Those with good sleep quality had less musculoskeletal discomfort (P<0.001).
Conclusion: The findings of our study showed that increased physical inactivity and smart mobile device use during the distance education period negatively affect sleep quality. Since those with poor sleep quality have more musculoskeletal pain, we think that preventive measures, such as reducing screen time and inactivity, should be taken in distance education students to prevent health problems that may be associated with poor sleep status.

Keywords: sleep, exercise, screen time, pain, distance education

How to cite: Demirdel E, Ceylan A, Koçak H, Güler MA, Türker TC, Demirdel S. Investigation of sleep quality and musculoskeletal pain of university students during the pandemic period. J Surg Med. 2023;7(4):299-303.

Introduction

The coronavirus-19 (COVID-19) pandemic is a respiratory infection that first started in Wuhan, China in December 2019 [1]. It was declared a pandemic by the World Health Organization in March 2020, and many countries have taken precautions, such as social isolation and restriction to prevent the spread of the epidemic [2]. The process of distance education started in universities in Turkey in March 2020 [3]. During the distance education period, the routines of the students changed, and affected many conditions, such as physical activity, screen usage time, and sleep quality [4].

Sleep is a vital physiological event that is necessary for the continuity of body functions [5]. Sleep disorders are associated with many psychological and physical morbidities [6]. Good sleep quality also positively affects students' academic performances [7].

Pandemic restrictions have led to longer use of digital devices and changes in physical activity and sleep patterns [8]. Interrupting face-to-face education increases the risk of sleep disorders in students. This interruption can lead to deterioration of sleep quality and health problems that may be related to sleep [9]. On school days, while most students usually go to bed early and get up at a set time to go to school [10], it has been determined that university students go to bed later and wake up later and their sleep quality has decreased during the pandemic period [11–13].

It is known that physical activity during the day positively affects sleep at night [14]. Mahfouz et al. reported that physical activity was associated with good sleep quality in university students [15]. It has been stated that long-term use of smartphones negatively affects the sleep quality of students [16]. With the start of the distance education process during the pandemic period, the physical activity level of university students decreased while the duration of smart mobile device usage increased [17,18]. However, minimal attention has been given to how these changes affect sleep quality. If the effect of decreased physical activity and increased smart device usage time on sleep quality in the distance education process is understood, it can suggest an idea about what can be done to increase the sleep quality associated with academic success in students.

Sleep and musculoskeletal pain are interactive conditions. Pain can negatively affect sleep, and a sleepless night can cause pain to be felt more intensely the next day [19]. Approaches to improve sleep can also help reduce chronic pain [20]. Knowing the effect of sleep quality on the musculoskeletal system in distance education students is important in terms of showing the effect of sleep management on pain in the distance education process. We hypothesized that those with poor sleep quality might have more musculoskeletal pain. The aim of the study was to determine sleep quality status and musculoskeletal system pain of distance education students during the pandemic period, to examine the effects of long-term use of smart mobile devices and regular exercise habits on sleep quality, and to determine the effect of sleep quality on musculoskeletal pain.

Materials and methods

Participants

Volunteer students from 6 different universities in Turkey participated in this cross-sectional study. Ethics committee approval of the study was obtained from Ankara Yıldırım Beyazıt University ethics committee (Date/no: 08.12.2020/65), and the study was carried out in accordance with the rules of the Declaration of Helsinki. Inclusion criteria for the study were voluntary participation, participating in distance education, and being a university student. The exclusion criteria were non-volunteer and having had an illness/surgery that may have affected pain and sleep during the last six months. The study was carried out between February and April 2021. An online survey was prepared to evaluate sleep quality and musculoskeletal pain of the university students during distance education period. The online survey link was sent to students via e-mail or message. At the beginning of the online survey, an information about the purpose of the study was provided. All students marked an option stating that they voluntarily participated in the study before starting the survey.

Descriptive characteristics of students such as age and gender were recorded. Daily smart mobile device usage time and regular exercise habits were questioned. In previous studies, it has been reported that screen use time over 5 h has negative effects on health [21,22]. Therefore, to determine the effect of mobile device use on sleep quality, students were grouped as those with equal or less than 5 h of use and those with more than 5 h of use. Students were also asked whether they exercised at least 30 min per session, twice a week or more, and were considered to have regular exercise habits if answering "yes" [23]. The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) was used to assess musculoskeletal pain, and the Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality.

Instruments

The Turkish version of the CMDQ was used to evaluate musculoskeletal pain. CMDQ is a questionnaire that questions pain or discomfort felt in different body parts over the last week. It examines the frequency and severity of pain felt in twenty different body parts in the last week and its effect on work performance. Scoring for each body part is calculated by multiplying the frequency, severity, and work performance scores of the discomfort. The score for each body part ranges from 0 to 90. The total score is calculated by sum of the scores of all body parts. Higher scores indicate greater frequency and severity of pain and a greater negative impact on work performance [24].

PSQI Turkish version was used to evaluate sleep quality. This scale includes 24 items and seven subscales that evaluate sleep quality in the last four weeks. The last five items are answered by the person's roommate and these items are not included in the scoring. Subscales are subjective sleep quality (PSQI-1), sleep latency (PSQI-2), sleep duration (PSQI-3), sleep efficiency (PSQI-4), sleep disturbance (PSQI-5), sleep medication use (PSQI-6), and daytime dysfunction (PSQI-7). Each component is scored between 0 and 3 points. The total score of the scale is obtained by summing the scores of all subscales. The total score of the scale ranges from 0 to 21. If the

total score is below 5, it indicates good sleep quality, and equal or above 5 indicates poor sleep quality [25].

Statistical analysis

IBM SPSS software (Version 22.0 for Windows, SPSS Inc. NY, USA) was used for statistical analysis. Categorical variables were presented as frequency (N) and percentage (%), and continuous variables were expressed as median (M) and interquartile range (IQR). Normal distribution of the obtained data was assessed using visual and analytical methods. Non-parametric statistical methods were chosen as the data did not show normal distribution. A Mann–Whitney U test was used for comparison of independent variables. Statistical significance level was accepted as $P<0.05$.

The effect size (ES) was calculated to determine the clinical significance of the statistical results. The effect size was calculated using the formula "$r=z/\sqrt{N}$". The z score of the Mann Whitney *U* test was used for the calculation. The ES value was accepted as 0.1 to 0.3 "small", 0.3 to 0.5 "medium", and > 0.5 "large" [26].

G*Power 3.1.9.4 software (Heinrich-Heine-Universität Düsseldorf) was used for the power analysis. When the difference between the musculoskeletal pain of the participants with good and bad sleep quality was considered, the power of the study with 221 participants at 0.495 effect size was found to be 0.97 (power alpha=0.05). Evaluation results of individuals with missing data were not included in the analysis.

Results

Two-hundred thirty-three students filled out the online form, and 12 of these were excluded due to missing answers; thus, analyses of the answers of 221 students were done. Descriptive characteristics, daily smart mobile device usage times, and sleep quality scores of the students are shown in Table 1. Ninety-seven (43.89%) of the students participating in the study reported that they exercised regularly during the pandemic period, and they generally performed stretching and strengthening exercises and walking. Daily smart mobile device use time of 72 (32.6%) of the students was over 5 h. The sleep quality of 127 (57.5%) of the students was found to be poor. It was determined that no differences in terms of age, height, weight averages and gender distributions were found between the students with and without regular exercise habits, using mobile devices for more than 5 h and for 5 h or less, and with poor and good sleep quality ($P>0.05$).

Subjective sleep quality, sleep latency, and total PSQI scores of those who exercised regularly were significantly lower than those who did not exercise regularly ($P<0.001$, $P=0.005$, and $P=0.005$, respectively). Subjective sleep quality and sleep latency scores of those who used smart mobile devices more than 5 h a day were significantly higher than those who used less than 5 h a day ($P=0.002$ and $P=0.018$, respectively). However, the effect sizes were small (Table 2).

It was found that those with good and bad sleep quality had a significant difference in neck, right shoulder, upper back, waist and right wrist pain ($P=0.001$, $P=0.043$, $P=0.002$, $P<0.001$, and $P=0.014$, respectively). In addition, a significant difference was found between total CMDQ scores ($P<0.001$). However, the effect sizes were small (Table 3).

Table 1: Demographic features, exercise habits, mobile device use time, and sleep quality of the students (n=221)

	Mean (SD)
Age (years)	20.11 (1.64)
Height (cm)	164.48 (17.7)
Weight (kg)	61.16 (12.44)
	n (%)
Gender	
Female	187 (84.6)
Male	34 (15.4)
Exercise habit	
Exercising regularly	97 (43.9)
No exercising regularly	124 (56.1)
Daily smart mobile device use time	
≤5 hours	149 (67.4)
>5 hours	72 (32.6)
Sleep quality	
Good (PSQI total score <5)	94 (42.5)
Bad (PSQI total score ≥5)	127 (57.5)

SD: standard deviation, PSQI: Pittsburgh Sleep Quality Index

Table 2: Sleep quality based on regular exercise and daily mobile device usage time

	Exercising regularly (n=97) Median (IQR)	No exercising regularly (n=124) Median (IQR)	*P*-value	ES	Daily mobile device usage ≤5 hours (n=149) Median (IQR)	Daily mobile device usage >5 hours (n=72) Median (IQR)	*P*-value	ES
PSQI 1	1 (1)	1 (1)	<0.001*	0.24	1 (1)	2 (1)	0.002*	0.2
PSQI 2	1 (2)	2 (1)	0.005*	0.18	1 (2)	2 (1.75)	0.018*	0.15
PSQI 3	0 (0)	0 (0)	0.543	0.04	0 (0)	0 (0)	0.850	0.01
PSQI 4	0 (0)	0 (0)			0 (0)	0 (0)		
PSQI 5	1 (0)	1 (0)	0.650	0.03	1 (0)	1 (0)	0.763	0.02
PSQI 6	0 (0)	0 (0)	0.207	0.08	0 (0)	0 (0)	0.160	0.09
PSQI 7	1 (1)	1 (2)	0.414	0.05	1 (2)	1 (2)	0.961	0
PSQI total	4 (3.5)	6 (4)	0.005*	0.18	5 (4)	6 (4)	0.832	0.01

* *P*-value<0.05, PSQI: Pittsburgh Sleep Quality Index, ES: effect size, M: median, IQR: interquartile range

Table 3: Musculoskeletal discomforts of students with good or bad sleep quality

	PSQI score <5 (n=94)	PSQI score ≥5 (n=127)	*P*-value	ES
	Median (IQR)	Median (IQR)		
Neck	1.5 (3)	3 (14)	0.001*	0.22
Right shoulder	0 (1.5)	0 (6)	0.043*	0.13
Left shoulder	0 (1.5)	0 (3)	0.054	0.12
Upper back	1.5 (3.5)	3.5 (31.5)	0.002*	0.21
Right upper arm	0 (0)	0 (0)	0.681	0.02
Left upper arm	0 (0)	0 (0)	0.315	0.06
Waist	1.5 (3.5)	3 (20)	<0.001*	0.27
Right forearm	0 (0)	0 (0)	0.694	0.02
Left forearm	0 (0)	0 (0)	0.287	0.07
Right wrist	0 (0)	0 (1.5)	0.014*	0.16
Left wrist	0 (0)	0 (0)	0.736	0.02
Hip	0 (1.5)	0 (3)	0.067	0.12
Right thigh	0 (1.5)	0 (1.5)	0.763	0.02
Left thigh	0 (1.5)	0 (1.5)	0.730	0.02
Right knee	0 (0)	0 (0)	0.972	0
Left knee	0 (0.38)	0 (0)	0.985	0
Right lower leg	0 (0)	0 (0)	0.264	0.07
Left lower leg	0 (0)	0 (0)	0.505	0.04
Right foot	0 (0)	0 (0)	0.198	0.08
Left foot	0 (0)	0 (0)	0.238	0.07
CMDQ total score	11.75 (27.75)	42 (115.5)	<0.001*	0.28

* *P*-value<0.05, PSQI: Pittsburgh Sleep Quality Index, CMDQ: Cornell Musculoskeletal Discomfort Questionnaires, ES: effect size, M: median, IQR: interquartile range

Discussion

In the study, we planned to examine the sleep quality and musculoskeletal system pain in distance education students during the pandemic period. We determined that the sleep quality of most of the students was bad, and those who were physically inactive and had more screen time had worse sleep quality. In addition, we found that those with poor sleep quality had more musculoskeletal discomfort.

It has been reported that sleep quality decreased in the general population [27–29] and university students [11,12,30] during the pandemic period. In the current study, the sleep quality of most of the participants was found to be poor. We think that the change in daily routines during the pandemic period and the increase in screen usage time and physical inactivity that occurred because of the transition to distance education may be effective in negatively affecting sleep quality.

Marelli et al. [12] stated that sleep latency also increased in university students during the pandemic period. According to the findings of our study, a reduction in increased screen usage time and low physical activity level during the pandemic period may be effective in increasing sleep latency.

It has been recommended to establish a sleep routine, maintain a certain level of physical activity, and be exposed to more daylight in order to reduce negative effects on sleep during the pandemic period [31]. Diniz et al. [32] also reported that decreased physical activity during the pandemic period adversely affected sleep pattern. Nixon et al. [33] stated that physical activity shortens sleep latency. Our study findings also show that those who exercise regularly fall asleep in a shorter time. Subjective sleep quality and total PSQI scores were also higher in those who did not exercise regularly. The lack of difference in other sleep scores such as sleep duration, sleep efficiency, sleep disturbance, sleep medication use, and daytime dysfunction suggests that sleep effects were limited during the pandemic period due to the fact that the participants of the study were young and healthy students. The fact that sleep quality was found to be higher in those who have regular exercise habits in our study shows that distance education students can be protected from negative effects related to sleep by exercising.

It has been reported that screen use time increased in university students during the pandemic period and this situation is associated with poor sleep [34]. In the current study, 32.6% of the students were using smart mobile devices for more than 5 h. Although smart mobile devices make life easier in terms of access to information, communication and ensuring the continuity of education during the pandemic, it has been reported that the types of mobile devices and excessive use were risk factors for musculoskeletal injuries [35]. Cellini et al. [11] found that use of digital media before going to bed negatively affected sleep latency. Huang et al. [36] reported that inappropriate content on websites that some phone users browse before going to bed may cause users to experience tension and excitement thus causing them to have difficulty falling asleep in some physiological and psychological ways and that more than one variable may be effective on sleep. In the current study, long-term use of mobile devices led to an increase in subjective sleep quality score and sleep latency but did not affect other sleep-related components. The fact that our study participants were young adults and did not have any co-morbid disease may be a reason why other sleep-related components were not affected. The fact that sleep quality is worse in those who use smart mobile devices for more than 5 h suggests that correct adjustment of the screen time during the distance education period is necessary for sleep quality.

Many studies suggesting that increasing sleep problems and psychological problems during the pandemic period may be related to each other are available [12,13]. However, less attention has been paid to the relationship between sleep problems and physical health during the pandemic period. It has been reported that poor sleep quality is associated with low back and neck pain in adolescents [37]. Karatel et al. [38] reported that musculoskeletal pain and sleep quality were associated in Turkey during the pandemic period. In our study, the fact that those with poor sleep quality had more discomfort in the whole spine, especially in the neck, upper back, and waist regions, may be due to their long periods in inappropriate postures during the day due to distance education. However, greater discomfort, especially in the right wrist and shoulder, may be associated with increased use of the right extremities. The fact that the musculoskeletal pain of those with poor sleep quality was a more common finding in our study and suggests that the measures taken to increase the sleep quality of the distance education students would be beneficial for preventing the development of chronic musculoskeletal pain.

Limitations

Our study is important in terms of revealing the effect of sleep quality on musculoskeletal pain in university students receiving distance education during the pandemic period. However, not evaluating physical activity in detail and not questioning students' physical activity, sleep quality, and pain status before the start of the pandemic can be counted as limitations. In future studies, it will be useful to examine the effects of practices that lead to an increase in physical activity and improvement in sleep quality in distance education students.

Conclusion

In conclusion, the results of our study show that not doing regular exercise and using smart mobile devices for a long time during the pandemic process in which university students continue their distance education negatively affect sleep quality. Students with poor sleep quality also had more musculoskeletal pain, especially in the neck, back and waist. We think that it will be beneficial for students to reduce their screen time and participate in regular physical activity so that they do not encounter health problems related to sleep problems and do not become individuals with chronic pain in the future.

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