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Evaluation of sleep quality and physical activity levels of university students during the COVID-19 pandemic

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Abstract

Our study aimed to investigate university students' sleep quality and physical activity levels during the COVID-19 pandemic. We conducted the study on 128 volunteer students studying at Bolu Abant Izzet Baysal University, Vocational School of Health. We collected the data online through the socio-demographic form, the Pittsburgh Sleep Quality Index (PSQI), and the International Physical Activity Questionnaires (IPAQ). The average PSQI score of the students was 8.87±3.47, with 81.3% of the students having poor and 18.8% having good sleep quality. The total physical activity score was 1259.73±2183.33 (MET-Min/week). The percentage of students who had no vigorous physical activity was 80.5%, while 59.4% did not do moderate physical activity, and 5.5% did not have adequate walking activity. About 53.1% of the students were not physically active, 32% had low physical activity, and only 14.8% had adequate physical activity. COVID-19 pandemic had several adverse effects on students' sleep quality and physical activity levels. During the pandemic, we think that students had difficulty forming regular biological rhythms, especially sleep and physical activity, due to various reasons such as concerns about education, quarantine and social isolation. Necessary information should be acquired, and guidance should be given about quality sleep and adequate physical activity to reduce the adverse effects of the disease by keeping the immune system strong.

Keywords: COVID-19, sleep quality, physical activity, quarantine, circadian rhythm

1. Introduction

The COVID-19 pandemic is a global public health problem that threatens all humanity. Individuals are socially isolated to both protect themselves from the disease and prevent it from spreading. Therefore, some measures have been taken through various practices such as distance education and working from home. UNESCO reported that approximately 861.7 million students did not attend school (1). In addition, students switched from face-to-face education to online education and had to follow their education, measurement and evaluation processes from their homes. Such routine-free practices cause individuals to experience various physical, mental, and social problems. In addition to affecting physical health, the pandemic process affects the sleep patterns of the non-sick community.

Sleep is essential for maintaining individuals' physiological and psychological health (2). Çıtak ve Pekdemir (2020) reported that the COVID-19 epidemic causes individuals to experience sleep difficulties, and changes sleep habits (3). Sleep quality and duration might be adversely affected, resulting in various sleep-related diseases, as well as worsening of previous sleep problems (4). There is also a two-way relationship between sleep and the immune system; activation in the immune system changes sleep structure, while sleep helps shape the body's response to infections. We spend a large part of our lives in sleep, and it is of great importance for protecting healthy people and for the comfortable passage of the disease process of infected people (5). Colbay et al. (2007) stated that deterioration in individuals' sleep quality affects their daily activities and decreases energy levels (6).

Physical activity, which protects psychological health and regulates immune system functions, is considered one of our powerful weapons in the pandemic process (7). It can reduce the severity of infections by affecting the immune system and the inflammation process, improve common chronic conditions (cardiovascular disease, diabetes) that increase the risk of severe COVID-19, and is also a great stress management tool by reducing anxiety and depression symptoms (8). Campbell and Turner (2018) reported that a physically active lifestyle reduces the risk of contracting a range of infectious diseases, including viral and bacterial infections (9). During the covid-19 pandemic, our biological clock has difficulties forming regular rhythms because the normal rhythms of daily activities like socialization and working routine are disrupted. Güzel at al. (2020) suggested that creating routine tasks, physical activity, sleep, light

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adjustment, diet and stress control are helpful in adjusting a person's circadian rhythm (10). The importance of the circadian rhythm as another protective resource available to everyone besides social isolation and personal hygiene is mentioned in this process, and it is emphasized that the immune system will weaken if the circadian rhythm is disrupted (11). It is also emphasized that it is helpful to adjust ideally the timing of external stimuli that have a very high effect on the circadian clock, such as sleeping, body temperature, light, diet, physical exercise, to protect against disorders and let the circadian clock run more efficiently (12).

All this information suggests that a pandemic disease, which is not compatible with the natural biological rhythms of individuals, leads to various complications. This study investigated university students' sleep quality and physical activity levels during the COVID-19 pandemic.

2. Materials and Methods

We obtained ethical approval from Bolu Abant Izzet Baysal University Clinical Research Ethics Committee (decision no: 2020/201) and conducted our study on Bolu Abant Izzet Baysal University Vocational School of Health students. We designed this cross-sectional type study per the principles of the Helsinki Declaration and carried it out in June 2020. We obtained informed consent from all participants. The study included one hundred twenty-eight volunteer students who completed the forms correctly and completely. We excluded students with chronic sleep problems for any reason or illness or disability that would restrict them from doing physical activity in the study. We collected the data online (Google Docs) through "Personal Data Forms", the "Pittsburgh Sleep Quality Index (PSQI)", and "International Physical Activity Questionnaires (IPAQ) (short form)". The study's independent variables were age, gender, height, weight, and body mass index (BMI), while the dependent variables were sleep quality and physical activity levels.

The PSQI is a scale that evaluates sleep quality and sleep impairment in a recent one-month timeframe (13). Ağargün et al. (1996) determined the validity and reliability of the index in Turkey, and its Cronbach Alpha internal consistency coefficient was 0.80. The first 18 items of the scale included in the scoring are rated as poor sleep quality with a score higher than five and good sleep quality with a score lower than five (14).

Craig et al. (2003) developed the IPAQ to determine participants' physical activity levels in the 15-65 age range (15). Öztürk conducted IPAQ's validity and reliability study in Turkey (16). The criteria for each activity to be performed at least 10 minutes at a time are considered in the evaluation of all activities. By multiplying the minutes, days and MET values, a score is obtained as "MET-min/week". Physical activity levels are classified as non-physically active (<600 MET-min/week), low physical activity level (600-3000 MET-min/week) and adequate physical activity level (>3000 MET-min/Week) (15).

2.1. Statistical Analysis

While categorical variations are expressed as percentage and frequency distributions, continuous variables are expressed as mean and standard deviation values. We used the Kolmogorov Smirnov test for the normality distribution of the data and the Mann Whitney U test to compare the two groups. We compared categorical data using the chi-square test. We calculated Spearman's correlation coefficient to determine the relationship between sleep and physical activity. We considered $P<0.05$ values statistically significant and evaluated the data through the SPSS statistical package program.

3. Results

Table 1 shows the descriptive statistics of the participants. The participants were 85.2% (n=109) female and 14.8% (n=19) male. Male students' height, weight and BMI averages were higher than female students. The prevalence of smoking was significantly higher among men than women.

While male students' total physical activity (MET-min/week) scores were significantly higher than female students ($P=0.011$), there was no significant gender difference between the PSQI scores ($p=0.187$) (Table 2).

Regarding students' physical activity levels, 53.1% were physically inactive, 32,0% minimally active and 14.8% sufficiently active (Table 3). Furthermore, the scale results evinced that 80.5% did not do vigorous physical activity, 59.4% did not do moderate physical activity, and 5.5% did not have adequate walking activity.

According to the sleep quality classification of the participants, 81.3% of the students had poor while 18.8% had good sleep quality (Table 4).

Most students (64.84%) think their sleep pattern (sleep-wake cycle) has changed during the COVID-19 pandemic, while 28.13% think it was affected slightly/partially, and 7.03% think it was not affected. The majority of the students (73.44%) think there was a decrease in their level of physical activity during the COVID-19 pandemic, while 19.53% think it decreased slightly/partially and 7.03% think it was not affected (Table 5).

The correlation analysis results evinced a negative correlation between PSQI and total physical activity (MET-min/week) scores ($r=-0.163$). However, this relationship was not statistically significant.

Table 1. Descriptive statistics of variables

	Female		Male		Total		
	n=109	85.2%	n=19	14.8%	n=128	100%	
	Mean±Sd		Mean±Sd		Mean±Sd		P
Age	20.42±2.02		20.32±1.77		20.41±1.98		0.640
Height(cm)	163.66±5.74		175.16±7.37		165.37±7.25		**<0.001***
Weight(kg)	59.54±10.83		74.32±15.14		61.73±12.65		**<0.001***
BMI	20.22±3.87		24.14±4.22		22.50±3.96		**<0.044***
Smoking	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	
	17 15.6%	92 84.4%	10 52.6%	9 47.4%	27 21.1%	101 78.9%	**<0.001****

* Mann Whitney U test. ** $\chi 2$ test

Table 2. Comparison of PSQI and total physical activity scores by gender

	PSQI	Total physical activity (MET-min/week)
	Mean±Sd	Mean±Sd
Female n=109 85.2%	9.09±3.56	1259.73±2183.33
Male n=19 14.8%	7.58±2.67	3164.24±3733.05
Total n=128 100%	8.87±3.47	1542.43±2547.74
P	0.055*	0.011*

* Mann Whitney U test

Table 3. Participants' physical activity levels

Physical Activity Levels	Physically inactive		Minimally active		Sufficiently active		Total	
	n	%	n	%	n	%	n	%
Female	60	88.2	39	95.1	10	52.6	109	85.2
Male	8	11.8	2	4.9	9	47.4	19	14.8
Total	68	53.1	41	32.0	19	14.8	128	100

Table 4. Participants' PSQI levels

PSQI	Quality Sleep (PSQI score =< 5)		Poor Quality Sleep (PSQI score >5)		Total	
	n	%	n	%	n	%
Female	20	83.3	89	85.6	109	85.2
Male	4	16.7	15	16.4	19	14.8
Total	24	18.8	104	81.3	128	100

Table 5. Distribution of participants' responses on sleep and physical activity during COVID-19

	Yes		Slightly/Partially		No	
	n	%	n	%	n	%
Do you think your sleep pattern (sleep-wake cycle) has changed during the COVID-19 pandemic?	83	64.84	36	28.13	9	7.03
Do you think there was a decrease in your level of physical activity during the COVID-19 pandemic?	94	73.44	25	19.53	9	7.03

4. Discussion

Our study aimed to investigate university students' sleep quality and physical activity levels during the COVID-19 pandemic. Several measures were taken, such as quarantine and social isolation, to prevent the spread of COVID-19, which is considered a pandemic by the World Health Organization. Students had to follow lessons while others had to work from home in this process. Such measures limited the spread of the virus but brought along various difficulties. Quarantine exposes individuals to a highly stressful condition. Quarantine measures not only increase stress, anxiety and depression levels but also impair sleep quality. On the other hand, Altena et al. (2020) reported that carrying out work from home due to quarantine and social isolation, and lack of access to places where physical activities take place (e.g., gyms, parks, etc.) resulted in a significant decrease in physical activity levels (17). COVID-19 affected individuals altered daily routines, sleep and physical activity patterns (18).

Our findings showed that while there was no difference between male and female students in terms of PSQI scores, the vast majority of participants had low sleep quality. In their study, Casagrande et al. revealed that 57.1% of participants reported poor sleep quality, which indicates a link between

low sleep quality and post-traumatic stress disorder associated with COVID-19 (19). An online survey performed by Kaparounaki at al. (2020) on college students in COVID-19 quarantine showed that students' sleep amount increased by 66.3%, but sleep quality worsened by 43.0% (20). In line with the literature, the vast majority of students in our study had low sleep quality. These results suggested that routine disruptive practices, such as COVID-19 quarantine and social isolation, which expose individuals to high stress, negatively affected students forming regular biological rhythms. Two-thirds of the students thought their sleep pattern (sleep-wake cycle) changed during the COVID-19 outbreak. These results were consistent with participants' PSQI scores, which indicated that students experienced decreased sleep quality during the pandemic compared to previous times. Home quarantine significantly changed the timing of sleep. Individuals spent more time in bed before sleep and got up late, but paradoxically, they had lower sleep quality. Studies showed that the relationship between sleep difficulty and high levels of depression, anxiety and stress was strong (21, 22).

University students switched from face-to-face to online education and followed all educational processes from their homes, such as courses, measurement and evaluation. In addition to concerns about COVID-19, this process has caused students to experience stress on various topics such as participation in online courses, evaluation and graduation (23). Considering the strong relationship between stress and sleep, we believe all these stressors could be considered causes that decrease the quality of students' sleep. Pelin (2020) reported the importance of a strong immune system to combat COVID-19 (5). The deterioration in sleep quality during the COVID-19 pandemic made healthy individuals susceptible to infection while also complicating epidemic control (5). Alschuler et al (2020) emphasized that enough sleep was essential to reduce the risk of COVID-19 infection and also provided the secretion of melatonin, a molecule that may play a role in reducing coronavirus virulence (24). Regular sleep is directly associated with melatonin. Melatonin, a natural antioxidant, activates immune system cells either directly through melatonin receptors or indirectly due to changes in steroid hormones (25). Natural disasters are major sources of stress, and sleep disorders develop in response to these events. A worldwide crisis, such as COVID-19, is also likely to lead to sleep and circadian rhythm disorder (26). During the COVID -19 quarantine periods, students are subject to high stress due to concerns related to education and illness. Due to such stress, students have difficulty forming a regular biological rhythm. The rhythms affected are preceded by the sleep-wake cycle. Thus, students' circadian rhythms are negatively affected, and their sleep quality decreases accordingly.

Participants' classification according to the total physical activity score obtained from IPAQ revealed that the activity level of the majority was insufficient to maintain and improve health; only a small proportion performed adequate physical activity. During the COVID-19 pandemic, quarantine and social isolation practices for fear of being infected created an environment that caused decreased physical activity (27). Public health recommendations made to prevent the spread of COVID-19 (the stay-at-home proposal, closure of parks, gyms and fitness centers) can reduce the level of daily physical activity. Simpson and Katsanis (2020) suggested that daily exercise and physical activity could help fight diseases such as obesity, diabetes, hypertension and severe heart disease, making the immune system more susceptible to COVID-19 (28). Our results evidenced that the majority of participants did not have vigorous physical activity, approximately one third did not have moderate physical activity, and a few did not have adequate walking activity. The COVID-19 pandemic decreased physical activity levels in three-quarters of the students, showing that during COVID-19, there was a severe level of physical activity deficiency among university students. Kaya Ciddi (2019) reported that 67.85% (n=95) of the participants stated that their physical activity was negatively affected during the isolation process, while 32.6% (n=46) stated that they were not affected (29). In Kaya Ciddi's study (2019), among the participants, the highest proportion was inactive individuals with the lowest physical activity at 69.28% (N=97), followed by minimally active individuals with 20% (N=28) and sufficiently active individuals with 10.71% (n=15). Kaya Ciddi's study also revealed that most participants were inactive during this process and did not engage in regular physical activity compared to pre-isolation. Kaya Ciddi (2019) stated that the closure of gyms and parks during the quarantine process is reported to potentially contribute to the decline in physical activity (29). Ercan and Keklicek (2020) also reprted that due to the COVID-19 pandemic, students' regular physical activity rate decreased, and the overall rate of physical inactivation increased (30). In Maugeri et al.'s study, before and during the COVID-19 pandemic, the total physical activity was reported as MET-minute/week, and the scores of individuals for strenuous physical activity, moderate activity, and walking activity decreased significantly compared to the pre-quarantine period (31). Maugeri et al (2020) also noted that the proportion of students with high physical and moderate physical activity prior to COVID-19 decreased considerably during the COVID-19 pandemic (31). Gallo et al (2020) compared nutrient uptake, and physical activity levels of earlier periods (2018 and 2019) and in the early phase of the COVID-19 outbreak (March/April). The same study discovered higher nutrient consumption for women and lower physical exercise in both men and women. The findings of Gallo et al. (2020) suggested that the procedures to isolate people may negatively affect physical and psychological health with the possible long-lasting influence on food intake and physical exercise patterns (32). Due to social isolation and the long decaying of education, Chen et al. (2020) reported that the routine physical activities of tens of millions

of students in China were inevitably disrupted. Therefore, Chen et al. stressed that as schools begin to re-enter the service, all school administrators, teachers, and parents should be encouraged to ensure that all students effectively pass mandatory restrictions limiting exercise by participating in recommended physical activity levels. Continuing regular physical activities in this way is considered to help students recover from the stress and anxiety they experienced while in quarantine during the COVID-19 crisis (33). Our findings revealed that male students' total physical activity scores were higher than female students. Savcı et al. (2005) found that male students' total physical activity scores were higher than female students (34). Our results were in line with Savcı et al.'s study and indicated that female students were more exposed to the harmful effects of the pandemic process on physical activity than male students.

Circadian rhythm refers to behavioral and physiological changes involved in important biological processes such as the sleep-wake cycle that lasts approximately 24 hours (35). Body temperature, the sleep-wake cycle, melatonin and cortisol are important indicators of the circadian rhythm. Light is the most important rhythm regulator, also involved in social and physical activities (36). It is common knowledge that there is a strong link between the circadian rhythm and the immune system. During the COVID-19 pandemic, our biological clock had difficulty establishing regular biological rhythms for various reasons such as lack of social rhytms like socialization, child care and work life (10). The hormone melatonin, the best-known natural antioxidant and a major biorhythm regulator, effectively reduces inflammation and fibrosis in COVID-19 disease. In addition, melatonin reduces oxidative stress-inducing infections such as SARS-CoV. Shneider et al. (2020) emphasized that melatonin stimulates immunity impaired by anxiety and sleep deprivation (37). Sleep, a circadian behavioral reflection of the critical regulatory homeostatic mechanisms associated with immunity, has been shown to interact with host defences at the molecular and cellular levels (37). Shneider et al. also reported clear interdependencies between sleep duration and quality and immune responses to viral, bacterial and parasitic pathogens, with the latter altering sleep patterns. Therefore, improved sleep quality and duration in the population is likely to alleviate the spread and severity of the disease caused by SARS-CoV-2 infection (38). Hower et al. (2018) reported an association between circadian rhythm and exercise; exercise positively affected circadian rhythmicity (39). Hower et al. (2020) also noted that physical activity might regulate irregular circadian rhythm, possibly due to changes in skeletal muscle (39). The COVID-19 pandemic process highlights the need to do enough physical activity to increase immunity and reduce the harmful effects of inactivity and social isolation-induced stress on our immune system.

Kaya Ciddi (2019) stated that exercise would not prevent our likelihood of contracting COVID-19, but physical activity would help maintain the adverse effects of isolation and quarantine-induced stress on the immune system (29). Furthermore, evidence from other viral infections revealed that physically active people would have less severe symptoms, shorter recovery times, and a lower risk of transmission (28). According to Tunç et al. (2020) individuals who exercised during the COVID-19 pandemic had a higher quality of life. Physical activity increases the quality of life in normal times as well as during the epidemic period.

Moreover, Tunç et al. (2020) emphasized the importance of physical activity to maintain physical and mental health in extraordinary situations such as the pandemic and reported that physical exercise increases resistance to living conditions and disease (40). Alschuler et al (2020) showed that as schools improved their distance education practices, physical education should be given priority (24). According to Alschuler et al. (2020), besides sending homework plans for courses such as maths and English, it would be appropriate to send homework plans for physical activity (24).

In conclusion, the COVID-19 pandemic decreased students' sleep quality and physical activity levels. Keeping the immune system strong is important for protection from the disease in this process. The creation of regular biological rhythms is essential for a strong immune system. In this context, students should be informed about the importance of quality sleep and physical activity during the COVID-19 process. Training, seminars, etc., on the importance of sleep and physical activity, should be given through distance education and various activities. Encouraging directions can be made in terms of exercise practices that can be performed at home. Besides, the participation of the students can be ensured by adding physical education courses to the distance education curriculum.

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Conflict of interest

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