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Original Article

Sleep parameters and associated health factors among academic staff, students, and other adults during the COVID-19 lockdown in Türkiye

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ABSTRACT

Objectives: This study investigated sleep parameters and their associations with physical activity, musculoskeletal pain, depressive symptoms, and fatigue among academic staff and students, compared with other adults, during the coronavirus disease 2019 (COVID-19) lockdown in Türkiye.

Materials and methods: This web-based cross-sectional study used a one-time online survey administered through Google Forms between May 22, 2020, and July 13, 2020. Sleep quality, physical activity, pain intensity, depressive symptoms, and fatigue were assessed using the Pittsburgh Sleep Quality Index (PSQI), International Physical Activity Questionnaire-Short Form, Numeric Rating Scale, Beck Depression Inventory, and Fatigue Severity Scale, respectively. One-way analysis of variance was used to compare the three groups. Spearman's rank correlation analysis was used to examine associations between PSQI scores and the other study variables.

Results: A total of 1,778 participants from Türkiye (647 males, 1,131 females; mean age: 28.26 ± 10.75 years; range, 18 to 72 years) were included in the study, comprising 278 academic staff members, 880 students, and 620 adults from other occupations who formed the control group. PSQI scores were higher, indicating poorer sleep quality, in students than in academic staff and in academic staff than in controls ($F = 33.99$, $p < 0.001$). Students showed the greatest delays in both bedtime and wake-up time (approximately 138 min; $F = 12.95$, $p < 0.001$ and $F = 15.90$, $p < 0.001$, respectively). Higher PSQI scores were moderately associated with higher depressive symptom scores among academic staff (Spearman's $\rho = 0.516$, $p < 0.001$) and students (Spearman's $\rho = 0.440$, $p < 0.001$). Among academic staff, higher PSQI scores were also moderately associated with greater neck pain ($\rho = 0.406$, $p < 0.001$), back pain ($\rho = 0.425$, $p < 0.001$), and lower-back pain ($\rho = 0.401$, $p < 0.001$).

Conclusion: During the COVID-19 lockdown, academic staff and students showed poorer sleep and less favorable scores for several health outcomes than the comparison group. Higher PSQI scores were associated with greater bedtime delay, screen exposure, musculoskeletal pain, depressive symptoms, and fatigue.

Keywords: COVID-19 pandemic, depression, fatigue, musculoskeletal pain, physical activity, sleep.

The coronavirus disease 2019 (COVID-19) pandemic, declared by the World Health Organization on March 11, 2020, disrupted daily routines and physical, social, economic, and psychological well-being worldwide.[1] Lockdown measures altered work and study arrangements, social activities, mealtimes, exercise, and sleep-wake schedules.[2] During this period, poorer sleep was associated with reduced physical activity and increased fatigue.[3,4] Reduced activity may also be related to musculoskeletal pain,[5,6] while pain and sleep problems can reinforce one another.[7] Depressive symptoms and other mental-health difficulties were also associated with disturbed sleep during the pandemic.[8-16]

Lockdown-related changes in daily routines, sunlight exposure, physical activity, and evening use of digital devices may have contributed to changes in circadian rhythms and sleep.[2,8,17,18] Greater exposure to light-emitting screens near bedtime has been associated with delayed sleep

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and reduced melatonin secretion.[17] Previous research also found later bedtimes and wake-up times, longer time in bed, and poorer sleep quality during lockdown, with particularly pronounced changes among students.[13]

Academic staff and students shifted rapidly to online education and may therefore have experienced distinctive changes in screen exposure, physical activity, pain, depressive symptoms, fatigue, and sleep. Direct comparison with adults in other occupations may help characterize these between-group differences.

The primary aim was to compare sleep parameters among academic staff, students, and other adults during the COVID-19 lockdown in Türkiye. The secondary aim was to examine associations between sleep quality and physical activity, musculoskeletal pain, depressive symptoms, and fatigue within each group. We hypothesized that (1) academic staff and students would have higher PSQI scores than other adults and (2) higher PSQI scores would be associated with lower physical activity and greater pain, depressive symptoms, and fatigue.

MATERIALS AND METHODS

This web-based cross-sectional study used a one-time online survey administered through Google Forms between May 22, 2020, and July 13, 2020. The university rectorate distributed the survey link to universities across Türkiye to reach academic staff, students, and administrative personnel. Before participating, respondents received information about the study purpose and survey duration and provided informed consent. Inclusion criteria were as follows: being aged ≥ 18 years, residing in Türkiye, voluntarily agreeing to participate in the study, and being either a student enrolled at a university in Türkiye, an academic staff member working at a university in Türkiye, or an adult who did not belong to either of these groups. Participants who were neither university students nor academic staff members were included in the control group. Exclusion criteria: being aged < 18 years and not providing informed consent to participate in the study. A written informed consent was obtained from each patient. The study protocol was approved by the Hasan Kalyoncu University Faculty of Health Sciences Non-Interventional Research Ethics Committee (Date: 28.05.2020, No: 2020/037). The study was conducted in accordance with the principles of the Declaration of Helsinki. A non-probability snowball sampling strategy was used: the initial survey invitation was distributed through university networks, and recipients were encouraged to share the survey link with other eligible individuals. No a priori sample-size or power calculation (including G*Power) was conducted; the achieved sample size comprised all eligible responses received during the predefined data-collection period. No restrictions were imposed according to occupational status, and specific occupational categories such as healthcare workers, office workers, homemakers, and unemployed individuals were not collected.

Measures

Participants provided sociodemographic information. The survey included questions about sleep, screen exposure, sunlight exposure, and delays in bedtime and wake-up time. It also included the International Physical Activity Questionnaire-Short Form (IPAQ-SF), Pittsburgh Sleep Quality Index (PSQI), Numeric Rating Scale for pain, Beck Depression Inventory (BDI), and Fatigue Severity Scale (FSS). Screen exposure before bedtime was recorded in the following categories: 0-30 min, 30-60 min, 1-2 h, 2-3 h, and > 3 h.

The PSQI was used to assess sleep quality. The Turkish version is valid and reliable.[19] The instrument contains 24 items and yields seven component scores: subjective sleep quality (PSQI-1), sleep latency (PSQI-2), sleep duration (PSQI-3), habitual sleep efficiency (PSQI-4), sleep disturbances (PSQI-5), use of sleep medication (PSQI-6), and daytime dysfunction (PSQI-7). The global score ranges from 0 to 21; scores > 5 indicate poor sleep quality.[20]

The IPAQ-SF was used to assess physical activity and sedentary behavior. It records vigorous-intensity activity, moderate-intensity activity, walking, and sitting during the previous week. Activity scores were calculated as metabolic equivalent of task (MET)-min/week by multiplying minutes per day by days per week and

the relevant MET coefficient (8.0 for vigorous activity, 4.0 for moderate activity, and 3.3 for walking). Total physical activity was calculated as the sum of vigorous, moderate, and walking MET-min/week. Sitting time, recorded in minutes per day, was analyzed separately as an indicator of sedentary behavior and was not included in the total score. Participants reported activity before and during the pandemic.[21] The Turkish version has demonstrated reliability and validity.[22]

A Numeric Rating Scale was used to assess pain intensity in the head, neck, back, lower back, shoulder, hand, hip, knee, and foot. Scores range from 0 (no pain) to 10 (worst imaginable pain).[23]

The BDI was used to assess depressive symptom severity. This 21-item self-report inventory has a maximum score of 63, with higher scores indicating more severe depressive symptoms.[24] The Turkish version has demonstrated validity and reliability.[25]

The FSS was used to assess fatigue severity.[26] This nine-item self-report scale uses responses from 1 to 7, with higher scores indicating greater fatigue. A mean score of ≥ 4 indicates severe fatigue. The Turkish version was validated by Armutlu et al.[27]

Statistical analysis

Statistical analyses were performed using SPSS version 23.0 software (IBM Corp., Armonk, NY, USA). Continuous data are presented as mean ± standard deviation (SD) and minimum-maximum values. Statistical significance was set at $\alpha = 0.05$. Missing observations were not imputed; each analysis was restricted to participants with complete data for the variables included in that analysis. A global PSQI score was not calculated when information required for any component score was incomplete. One-way analysis of variance was used to compare the three groups, followed by Tukey's post hoc test when an overall difference was detected. Spearman's rank correlation analysis was used to examine associations between sleep quality and other variables. Correlation magnitudes were interpreted as slight (≤ 0.20), fair (0.21-0.40), moderate (0.41-0.60), substantial (0.61-0.80), or almost perfect (0.81-1.00).[28] Age, sex, body mass index (BMI), and chronic-disease status were considered potential confounders; however, they were not included in adjusted models because these covariates were not collected consistently and completely across all groups.

RESULTS

A total of 1,778 participants from Türkiye (647 males, 1,131 females; mean age: 28.26 ± 10.75 years; range, 18 to 72 years) were included in the study, comprising 278 academic staff members, 880 students, and 620 adults from other occupations who formed the control group. The academic staff group comprised research assistants (32.0%), lecturers (21.9%), assistant professors (23.0%), associate professors (7.6%), and professors (15.5%). Their disciplinary affiliations were health sciences (40.6%), social sciences, humanities, and administrative sciences (27.7%), educational sciences (9.7%), and natural sciences (21.9%). The student group comprised, undergraduate students (97.1%), and postgraduate students (2.9%). The comparison group consisted of individuals who were not classified as academic staff or students. Participant characteristics are presented in Table 1. In the comparison group, 17.1% had

Table 1. Descriptive characteristics of the participants

	Academicians			Students			Controls		
	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max
Age (year)	278	37.8 ± 10.3	24-72	880	21.3 ± 4.5	18-55	619	33.5 ± 10.8	16-66
Weight (kg)	278	72.2 ± 14.6	45-126	878	65.2 ± 15.0	39-138	615	71.0 ± 16.4	40-128
Height (cm)	278	168.9 ± 8.8	150-193	879	169.0 ± 9.1	126-194	618	168.8 ± 8.8	148-202
Body mass index (kg/m^2)	278	25.1 ± 3.6	17.1-39.7	878	22.6 ± 4.1	14.5-44.2	613	24.8 ± 4.7	15.0-46.8

The number of participants (n) varies across variables because of missing data. SD, standard deviation.

completed primary school, 59.5% secondary school, 19.8% high school, 1.5% university, and 2.1% postgraduate education.

Table 2 presents the PSQI component and global scores. Students had the highest global PSQI scores, followed by academic staff and the comparison group; higher scores indicate poorer sleep quality. Global PSQI scores were available for 266 academic staff members, 861 students, and 585 comparison participants.

Sleep duration before and during the pandemic is shown in Figure 1, and between-group comparisons are presented in Table 3. Bedtime and wake-up delays differed among the groups, as shown in Table 3 and Figure 2. Bedtime was delayed by approximately 90 min among academic staff, 138 min among students, and 102 min among controls. Wake-up time was delayed by approximately 114, 138, and 90 min, respectively.

Table 2. The scores of the PSQI and their comparison between the groups

	Academicians			Students			Controls				
	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	F	*p*
PSQI-1	278	1.2 ± 0.6	0-3	880	1.5 ± 0.8	0-3	620	1.1 ± 0.7	0-3	43.16	**< 0.001***
PSQI-2	277	1.21 ± 1.0	0-3	880	1.0 ± 0.5	0-2	620	0.8 ± 0.6	0-2	36.81	**< 0.001***
PSQI-3	267	1.0 ± 1.0	0-3	874	0.8 ± 1.1	0-3	618	0.8 ± 1.0	0-3	2.77	0.062
PSQI-4	277	0.2 ± 0.6	0-3	863	0.5 ± 0.9	0-3	587	0.3 ± 0.8	0-3	16.13	**< 0.001***
PSQI-5	278	1.1 ± 0.5	0-3	880	1.3 ± 0.6	0-3	616	1.1 ± 0.5	0-3	20.45	**< 0.001***
PSQI-6	278	0.0 ± 0.4	0-3	880	0.1 ± 0.4	0-3	620	0.0 ± 0.4	0-3	0.64	0.526
PSQI-7	278	0.7 ± 0.8	0-3	880	1.0 ± 0.9	0-3	620	0.7 ± 0.8	0-3	34.73	**< 0.001***
Total PSQI	266	5.7 ± 3.0	1-17	861	6.4 ± 3.1	0-16	585	5.1 ± 2.8	0-16	33.99	**< 0.001***

PSQI, Pittsburgh Sleep Quality Index; SD, standard deviation; Total PSQI: Total score of the Pittsburgh Sleep Quality Index; ANOVA test, PSQI-1-7: *, $p < 0.001$.

Table 3. The duration and delay of sleep before and during the pandemic and their comparison between the groups

	Academicians		Students		Controls		Comparison	
ANOVA test (h)	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD	F	*p*
Sleep duration before pandemic	278	6.7 ± 3.0	880	7.2 ± 3.7	620	7.9 ± 3.1	14.29	**< 0.001****
Sleep duration during pandemic	277	7.1 ± 2.6	880	7.2 ± 3.5	620	7.7 ± 2.0	6.42	**0.002***
Bedtime delay during the pandemic	277	1.5 ± 2.1	880	2.3 ± 3.0	620	1.7 ± 2.7	12.95	**< 0.001****
Wake-up time delay during the pandemic	278	1.9 ± 2.8	880	2.3 ± 2.9	620	1.5 ± 2.6	15.90	**< 0.001****

SD, standard deviation; *, $p < 0.05$; **, $p < 0.001$.

Table 4. The percentages of the groups according to the duration of exposure to sunlight during the pandemic

	Academicians		Students		Controls	
Exposure to sunlight	Frequency	Percent	Frequency	Percent	Frequency	Percent
0-30 min	112	40.3	365	41.5	215	34.7
30-60 min	65	23.4	186	21.1	137	22.1
1-2 h	47	16.9	138	15.7	113	18.2
2-3 h	24	8.6	67	7.6	65	10.5
3-4 h	12	4,3	43	4.9	28	4.5
Over 4 h	18	6.5	81	9.2	62	10

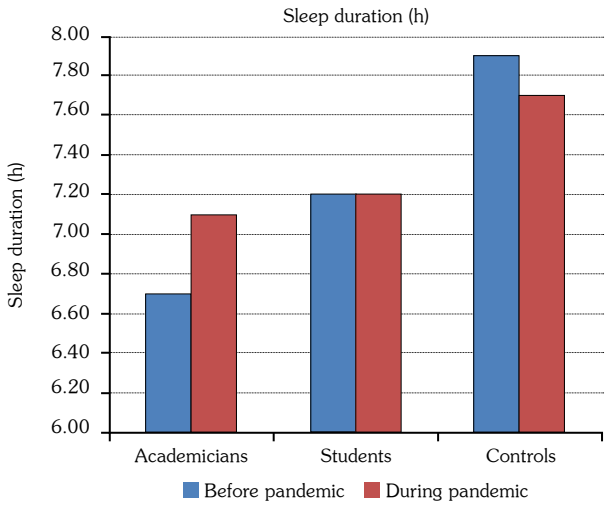

Figure 1. Changes in sleep duration before and during the pandemic in three groups.

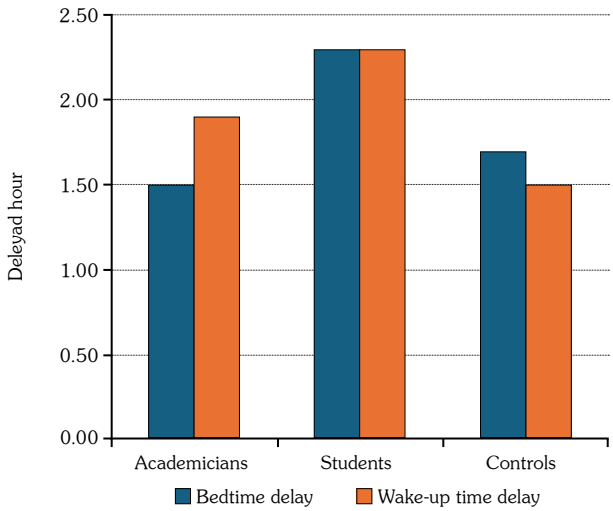

Figure 2. Delay in bedtime and wake-up time (h) during the pandemic in three groups.

Table 4 presents the distribution of sunlight-exposure duration during the pandemic.

As shown in Table 5, vigorous-intensity activity, walking, and daily sitting time differed among the groups. Physical activity values are reported as MET-min/week, whereas sitting time is reported as min/day. The proportions reporting no change, an increase, or a decrease in time allocated to physical activity during the pandemic were 24.1%, 25.5%, and 50.4% among academic staff; 24.1%, 28.2%, and 47.7% among students; and 34.2%, 23.2%, and 42.6% among controls, respectively.

Table 5. The scores of the International Physical Activity Questionnaire and its comparison between in the groups

	Academicians			Students			Controls				
	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	F	*p*
Vigorous activity/MET	276	243.0 ± 579.8	0-4800	871	466.1 ± 1240.8	0-9600	603	320.6 ± 830.7	0-8000	6.51	**0.002***
Moderate activity/MET	278	234.0 ± 500.0	0-4000	878	262.0 ± 688.4	0-6000	565	239.0 ± 622.1	0-8400	0.32	0.722
Walking/MET	278	457.0 ± 530.9	0-2772	864	416.4 ± 701.3	0-4950	525	560.9 ± 731.7	0-4851	7.28	0.001*
Sitting (min)	278	484.6 ± 536.9	0-5400	813	451.7 ± 698.8	0-7200	620	712.4 ± 1054.4	0-7276.5	18.61	**< 0.001****
Total MET	276	932.2 ± 1114.1	0-8800	859	1105.8 ± 1904.4	0-17465	496	1188.6 ± 1747.0	0-19572	1.91	**0.147**

SD, standard deviation; MET, metabolic equivalent of task; ANOVA test, *, $p < 0.05$; **, $p < 0.001$.

Pain intensity by body region and between-group comparisons are presented in Table 6. Pain scores differed among groups for all regions except the foot. Head, back, and lower-back pain severity was higher among students and academic staff than among controls ($F = 12.52$, $p < 0.001$; $F = 9.22$, $p < 0.001$; and $F = 6.71$, $p = 0.001$, respectively).

Table 7 presents BDI and FSS scores and the corresponding group comparisons. Students had higher depressive symptom and fatigue scores than academic staff and controls.

Associations between global PSQI scores and the other variables are presented in Table 8 and Figure 3. Higher PSQI scores indicate poorer sleep quality. PSQI scores were not associated with physical activity in any group. Small but statistically significant associations were observed between sunlight exposure and PSQI scores among students and between wake-up-time delay and PSQI scores among controls; the remaining associations with sunlight exposure and wake-up-time delay were not statistically significant. Among academic staff, higher PSQI scores showed fair positive associations with fatigue, shoulder, hand, hip, and foot pain and bedtime delay and moderate positive associations with depressive symptoms and neck, back, and lower-back pain. Among students, PSQI scores showed fair positive associations with fatigue and pain in all assessed regions and a moderate positive association with depressive symptoms. Among controls, PSQI scores showed fair positive associations with depressive symptoms and pain in all assessed regions. Sitting time was not associated with PSQI scores (academic staff: Spearman's $\rho = 0.028$, $p = 0.653$; students: $\rho = 0.069$, $p = 0.052$; controls: $\rho = -0.025$, $p = 0.545$).

The proportions reporting screen exposure before bedtime of 0-30 min, 30-60 min, 1-2 h, 2-3 h, and > 3 h were 54.0%, 21.6%, 7.9%, 2.2%, and 2.2% among academic staff; 27.2%, 21.0%, 22.8%, 11.0%, and 13.5% among students; and 41.1%, 20.5%, 15.3%, 5.6%, and 5.0% among controls, respectively. Among academic staff, screen exposure showed fair positive associations with global PSQI scores and bedtime delay, as shown in Table 9.

Table 6. Musculoskeletal pain and its comparison between the groups

	Academicians			Students			Controls			Comparison	
	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	F	*p*
Head pain	278	2.7 ± 2.7	0-10	880	2.9 ± 2.7	0- 10	620	2.2 ± 2.4	0-10	12.52	< **0.001****
Neck pain	278	2.7 ± 2.7	0-10	880	2.3 ± 2.6	0-10	620	1.8 ± 2.3	0-10	12.36	< **0.001****
Back pain	278	2.8 ± 2.8	0-10	880	2.6 ± 2.7	0-10	620	2.1 ± 2.5	0-10	9.22	< **0.001****
Lower back pain	278	2.6 ± 2.9	0-10	880	2.4 ± 2.7	0-10	620	2.0 ± 2.4	0-10	6.71	**0.001***
Shoulder pain	278	2.3 ± 2.9	0-10	880	1.8 ± 2.5	0-10	620	1.6 ± 2.3	0-10	6.96	**0.001***
Hip pain	278	1.1 ± 2.2	0-9	880	1.0 ± 2.1	0-10	620	0.8 ± 1.7	0-10	3.72	**0.024***
Knee pain	278	1.6 ± 2.5	0-10	880	1.4 ± 2.3	0-10	620	1.0 ± 1.8	0-10	8.33	< **0.001****
Foot pain	278	1.3 ± 2.4	0-9	880	1.3 ± 2.3	0-10	620	1.1 ± 2.1	0-10	1.25	0.287

SD, standard deviation; *, $p < 0.05$, **, $p < 0.001$.

Table 7. The scores of the BDI and FSS and their comparison between the groups

	Academicians			Students			Controls			Comparison	
ANOVA test	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	n	Mean ± SD	Min-Max	F	*p*
BDI	278	9.5 ± 8.7	0-44	880	16.6 ± 11.3	0-56	619	10.6 ± 8.9	0-48	87.79	< **0.001****
FSS	278	4.3 ± 1.3	1.2-7	880	4.7 ± 1.3	1-7	620	4.3 ± 1.3	1-7	15.68	< **0.001****

BDI, Beck Depression Inventory; FSS, Fatigue Severity Scale, SD, standard deviation, **, $p < 0.001$.

Table 8. Relationships between the total score of the PSQI and other parameters in the groups

	Academicians		Students		Controls	
	PSQI-T		PSQI-T		PSQI-T	
Spearman's rho	r	*p*	r	*p*	r	*p*
IPAQ	0.048	0.439	–0.030	0.386	0.019	0.680
BDI	0.516	**< 0.001****	0.440	**< 0.001****	0.398	**< 0.001****
FSS	0.343	**< 0.001****	0.291	**< 0.001****	0.198	**< 0.001****
Neck pain	0.406	**< 0.001****	0.310	**< 0.001****	0.276	**< 0.001****
Back pain	0.425	**< 0.001****	0.363	**< 0.001****	0.297	**< 0.001****
Lower back pain	0.401	**< 0.001****	0.328	**< 0.001****	0.285	**< 0.001****
Shoulder pain	0.322	**< 0.001****	0.340	**< 0.001****	0.239	**< 0.001****
Hand pain	0.264	**< 0.001****	0.244	**< 0.001****	0.208	**< 0.001****
Hip pain	0.353	**< 0.001****	0.307	**< 0.001****	0.240	**< 0.001****
Knee pain	0.198	**0.001***	0.246	**< 0.001****	0.222	**< 0.001****
Foot pain	0.338	**< 0.001****	0.264	**< 0.001****	0.250	**< 0.001****
Bedtime delay	0.230	**< 0.001****	0.068	0.047	0.152	**< 0.001****
Wake-up time delay	–0.012	0.852	0.040	0.237	0.092	0.027
Exposure to sunlight	–0.100	0.103	–0.104	**0.002***	–0.08	0.054

PSQI, Pittsburgh Sleep Quality Index; PSQI-T, Total score of the Pittsburgh Sleep Quality Index; IPAQ, International Physical Activity Questionnaire; BDI, Beck Depression Inventory; FSS, Fatigue Severity Scale; *, $p < 0.05$; **, $p < 0.001$.

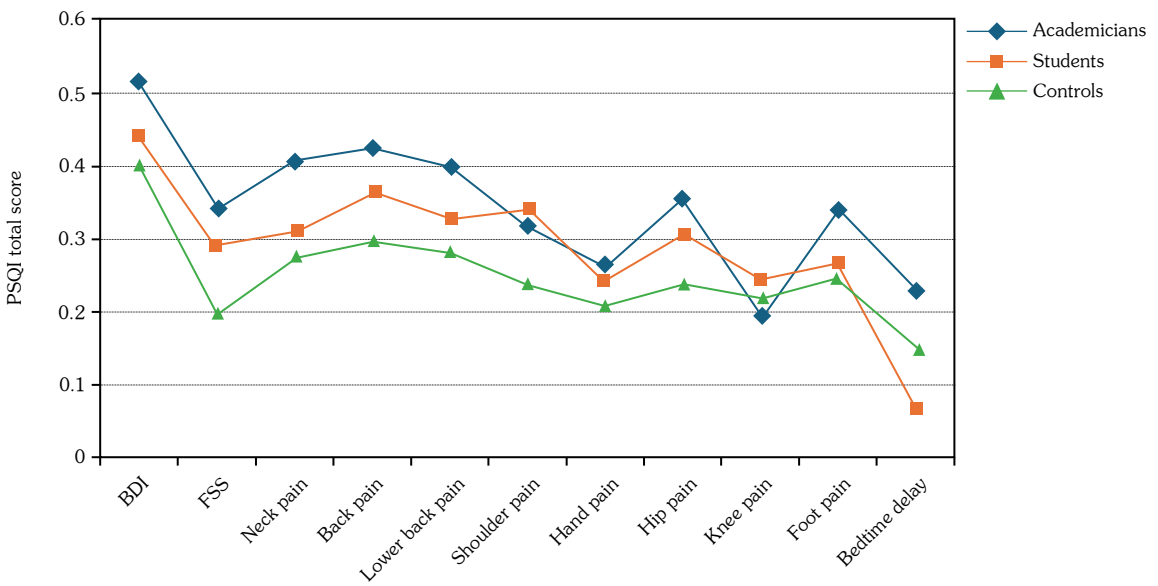

Figure 3. The correlation of total score of the PSQI and other parameters in three groups.
PSQI, Pittsburgh Sleep Quality Index; BDI, Beck Depression Inventory; FSS, Fatigue Severity Scale.

DISCUSSION

This study found higher PSQI scores among students and academic staff than among controls during the COVID-19 lockdown. Bedtime and wake-up time were delayed by approximately 90-138 min across the three groups. Higher PSQI scores were associated with greater screen exposure, bedtime delay, musculoskeletal pain, depressive symptoms, and fatigue.

Table 9. Relationships of screen time and total score of the PSQI, delay of bedtime, and wake-up time in the groups

	Academicians		Students		Controls	
Spearman's rho	Screen time		Screen time		Screen time	
PSQI-T	0.223	**< 0.001****	0.188	**< 0.001****	0.140	**0.001***
Bedtime delay	0.237	**< 0.001****	0.153	**< 0.001****	0.195	**< 0.001****
Wake-up time delay	0.163	**0.006***	0.183	**< 0.001****	0.131	**0.001***

PSQI, Pittsburgh Sleep Quality Index; PSQI-T, Total score of the Pittsburgh Sleep Quality Index; *, $p < 0.05$; **, $p < 0.001$.

All three groups had mean PSQI scores consistent with poor sleep during lockdown. The European Cognitive Behavioral Therapy for Insomnia (CBT-I) Academy task force noted that reduced sunlight exposure, lower physical activity, and loss of regular time cues may disrupt sleep during home confinement.[18] In the present study, students had higher PSQI scores than academic staff, who in turn had higher scores than controls. Associations of PSQI scores with depressive symptoms, fatigue, and pain were generally stronger among academic staff and students than among controls. Greater educational screen exposure and uncertainty about teaching and learning arrangements may partly explain this pattern; however, these mechanisms were not measured directly and should be interpreted cautiously.

Students reported poorer subjective sleep quality, sleep efficiency, sleep disturbance, and daytime functioning than academic staff and controls. Similar changes have been reported elsewhere: Saadeh et al.[29] found that 94.9% of students perceived a change in sleep behavior and 74.0% described the change as negative. Gupta et al.[30] reported later sleep and wake times, longer time in bed, and poorer sleep quality during lockdown. In the present study, bedtime was delayed by approximately 90 min among academic staff, 138 min among students, and 102 min among other adults; corresponding wake-up delays were approximately 114, 138, and 90 min. Marelli et al.[13] likewise reported larger delays among students than workers. Disrupted routines, online education, reduced outdoor and social activity, and relocation to family homes may partly explain the larger changes observed among students, although these factors were not directly tested.

Among academic staff, bedtime delay and screen exposure were associated with higher PSQI scores, and sleep latency was poorer than among students. Age differences between groups may have contributed to these findings because academic staff were older on average. Academic staff may also have combined online teaching with parenting, household responsibilities, and other work demands. Screen light can suppress melatonin and has been associated with sleep inefficiency,[31-34] but the present study did not directly measure blue-light exposure or melatonin. Additional studies should identify factors associated with student sleep while accounting for demographic and occupational differences.

Students reported more vigorous-intensity activity but less walking than controls. Current recommendations advise adults to perform 150-300 min/week of moderate-intensity activity or 75-150 min/week of vigorous-intensity activity.[35] Moore et al.[36] found that a greater proportion of Canadian youth than adults met age-specific activity recommendations during the pandemic. In the present study, none of the groups met recommended activity levels, and physical activity was not associated with PSQI scores. Park and Suh[37] described a U-shaped relationship between physical activity and sleep quality, suggesting that associations may depend on the activity range. The uniformly low activity levels in our sample may partly account for the absence of a detectable association.

Recent evidence has continued to link physical activity with sleep among university students. Garcia et al.[38] reported that physical activity was associated with better sleep quality among Brazilian college students during the pandemic, although screen time was not associated with sleep outcomes. In a large 2025 study of

Chinese university students using the IPAQ-SF and PSQI, moderate- and vigorous-intensity physical activity were associated with better sleep quality and lower anxiety and depressive symptom scores.[39] Differences in sampling, activity distributions, covariate adjustment, and sociocultural context may partly explain why physical activity was not associated with PSQI scores in the present study.

Other studies have reported reductions in moderate and vigorous activity, walking, and sport among university students during lockdown, together with increases in sedentary leisure and screen-based activities. Some students nevertheless increased vigorous activities such as high-intensity interval training and strength exercise,[40] possibly to compensate for prolonged sedentary time.

Most previous studies reported reduced physical activity during COVID-19 lockdowns. University populations may be important targets for interventions designed to increase physical activity because university employees can spend approximately 75% of the working day seated.[41] Universities could support both academic staff and students by integrating practical recommendations for achieving appropriate activity levels into online education.

Pain severity across most body regions was higher among academic staff and students than among controls. Prolonged uninterrupted screen-based work may partly explain these differences, although device use and sitting patterns were not measured in sufficient detail to establish this mechanism. Mustafa[42] reported an association between smartphone use for distance learning and neck pain. Majumdar et al.[17] described pain in the neck, shoulders, elbows, wrists/hands, and upper back among office workers during lockdown, whereas Toprak Celenay et al.[6] reported differing patterns according to whether participants stayed at home or continued working. In the present study, higher neck, back, and lower-back pain scores were associated with higher PSQI scores, particularly among academic staff and students. Age and occupational differences may have contributed to these patterns.

Students had higher depressive symptom and fatigue scores than the other groups. Previous studies have also reported associations between sleep, depressive symptoms, and mental health during lockdown.[8,9] Academic uncertainty and prolonged disruption may be related to poorer mental and physical health among students.[43]

This study has several limitations. Its cross-sectional design precludes causal inference, and pre-pandemic information was collected retrospectively. Screen exposure was recorded in broad categories, and laptop use was not assessed separately. COVID-19 infection history was not collected, although infection may be associated with pain and fatigue. Occupations in the comparison group could not be categorized because of their heterogeneity; therefore, home-based and on-site work arrangements could not be distinguished. Furthermore, the snowball sampling strategy may have introduced selection bias and limited the representativeness of the sample. The absence of detailed occupational categories in the comparison group prevented occupation-specific analyses.

Outcome-specific missing observations reduced the analytic samples; available-case analysis may introduce bias if the probability of missingness was related to the outcomes. These limitations should be considered when interpreting the unadjusted group comparisons and correlations. The broad age range (18-72 years), including adolescents in the student and comparison groups, introduced developmental heterogeneity that could not be addressed through age-stratified or adjusted analyses. An a priori power analysis was not performed, so the study's statistical power was not prospectively established. Multiple linear regression could not be performed because age, sex, BMI, and chronic-disease data were not consistently available as complete participant-level covariates across all groups; consequently, residual confounding cannot be excluded.

A strength of the study was its large sample, which enabled comparisons among academic staff, students, and adults from other occupations during the lockdown.

In conclusion, during the COVID-19 lockdown, students and academic staff had higher PSQI scores and less favorable scores for several

health outcomes than adults in the comparison group. Higher PSQI scores were associated with greater bedtime delay, screen exposure, musculoskeletal pain, depressive symptoms, and fatigue. These findings describe between-group differences and cross-sectional associations and do not demonstrate causation or prospective risk. Future studies should use longitudinal designs and multivariable analyses to account for age, sex, BMI, chronic disease, and occupational conditions, and should test interventions intended to support sleep and physical activity among academic staff and students.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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