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RESEARCH ARTICLE

THE ANALYSES OF THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY, MUSCULOSKELETAL SYSTEM PROBLEMS, SLEEP, AND SCREEN EXPOSURE TIME IN UNİVERSITY STUDENTS DURING THE DISTANCE LEARNING PROCESS

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ABSTRACT

Purpose: To investigate the relationship between physical activity, musculoskeletal system problems, sleep, and screen exposure time in university students during the distance learning process.
Material and Methods: Three hundred and one student (183 female, 118 male) participated in the study via an online survey. The screen exposure time was recorded. The physical activity using Short Form International Physical Activity Questionnaire and pain intensity using Visual Analog Scale were evaluated. Nordic Musculoskeletal System Questionnaire was used to evaluate musculoskeletal symptoms. The Pittsburgh Sleep Quality Index was applied for the details of sleep quality.
Results: The students had a low level of physical activity (58.8%) and poor sleep quality (70.8%). Musculoskeletal pain intensity was reported in the upper back (85%), lower back (85%), neck (79.4%), shoulder (71.4%). The pain was correlated with total sleep quality (r=0.320, p<0.001), daytime dysfunction (r=0.282, p<0.001), sleep quality (r=0.256, p<0.001), and sleep disturbances (r=0.232, p<0.001). Disability within the previous 12 months related to upper back (p=0.031) and the upper back pain within the previous 7 days (p=0.024) was more common for female than male students. The total activity duration (p=0.006) and total activity (p=0.017) were higher in males than females. In the desktop user, neck pain disability was more common than other education tools (p=0.042).
Conclusion: The low-level physical activity, worsened sleep quality, high rate of musculoskeletal problems, and increased amount of screen exposure were reported by students in the distance learning process. While the upper back pain was more common in female students, total activity was found to be higher in male students. We believed that these problems could be the reason for serious health issues later, so approaches targeting to improve physical activity levels, proper posture while studying could be beneficial.

Keywords: Covid-19, screen time, sleep, physical activity

INTRODUCTION

The COVID-19 spread globally was named a pandemic, affected about 128 million people, and caused 2,8 million deaths till April 2021 (1). Besides COVID-19's own mortality and morbidity, precautions taken against the virus caused other health,

economic, and social problems such as physical inactivity, sleep problems, musculoskeletal problems, and social isolation (2).
During the COVID-19 pandemic, strict precautions were taken to control and stop the spreading rate of this contagious virus. In this context, most of the academic institutions switched to the distance learning model instead of the face-to-face model (3). Distance learning is defined as the physical separation of the students from teachers by using online learning methods such as technological tools (communication applications) and devices (computers, cell phones, webcam, etc) (4). Online lectures and examinations, digital conferences, and congresses have become widespread and accessible (5,6). The smartphones, tablets, and computers took place in university halls and classrooms. Along with some advantages, the movement of the teaching-learning process to the distance learning model has important challenges like an excessive increase in the amount of screen exposure and reduced physical activity in the daily routine (3). The increased reliance on digital use is not only resulting from distance learning, it is also related to social distancing and common usage of these devices as socialization tools among the students.
In this period, it was inevitable to spend more time on screen. Thus, the higher amounts of screen exposure may have detrimental effects on physical activity level and poor posture by causing repetitive stress in body parts. Long-term sitting in static posture or improper postures may increase the risk of musculoskeletal pain, which is mostly located in the shoulder, and back (7). In a study, which was conducted between university students in COVID-19 pandemic duration, 68% of participants' physical activity level was found insufficient (8). While in another study, neck and shoulder problems were reported after longer use of mobile phones, and the size of the screen was also stated as an important factor in back pain (9).
In the literature, an increased amount of screen exposure is found related to sleep disturbances (10). It was known that sleep is an important component of the healthy and effective functioning immune system (11). Furthermore, disturbed sleep patterns due to increased screen exposure may affect circadian rhythm and health. There are studies, which suggest that increased screen use related to disturbed sleep quality and decreased physical activity may cause major health problems further (10-13).
There is a need for a holistic approach to evaluating the effects of distance learning in aspects of physical activity, sleep, musculoskeletal pain, and screen exposure among the university students. The aim of this study was to define the physical activity level, sleep, musculoskeletal pain, and screen exposure all together between the university students in the distance learning period. We also investigated possible relationships between these parameters to understand the whole picture better. Our study may have common things with other studies but it differentiates from those studies as evaluating all these parameters together.

MATERIAL AND METHODS

Study Design

This was a cross-sectional study. Ethical approval for the study was obtained from the Hacettepe University, Non-interventional Clinical Ethics Committee (Decision no: 2021/02-09; Date: 19.01.2021; the start date of the study: 15/03/2021; end date of the study: 15/042021). In addition, the scientific research platform of the Ministry of Health was registered, and necessary permissions were obtained. Informed consent online was obtained from all students included in the study, and all procedures were performed in accordance with the Declaration of Helsinki.

Participants

Inclusion criteria were as follows: (1) aged over 18 years; (2) being a university student, (3) willingness to participate in the study; (4) sustaining education with e-learning during the COVID-19 pandemic; (5) using a computer, tablet or phone; (6) presence of adequate proficiency in the Turkish language for providing informed consent and completing the outcome questionnaire. Exclusion criteria included any treatment for concomitant musculoskeletal pain within the preceding three months, having a spinal deformity such as scoliosis or hyperkyphosis, having had spine surgery or any surgery that affects the musculoskeletal system, being diagnosed with lumbar disc herniation, cervical disc herniation, cognitive disorder or systemic inflammatory disorder, and pregnancy or breastfeeding. In addition, the presence of chronic diseases (neurological, cardiac, nephrological, rheumatological, etc.) or currently active diseases (COVID-19, disease attack, etc.) of the students was determined with open-ended questions. The responses of students with active

Table 1. Sociodemographic characteristics, physical activity category, sleep quality, and screen exposure time of the university students

n=301	**Mean ± SD**
Age (years)	21.1 (2.5)
Height (cm)	168.1 (9.0)
Weight (kg)	62.0 (13.5)
BMI (kg/m^2)	21.8 (3.6)
Pain intensity (cm), median (IQR)	4 (3-6)
Pain (Y), n (%)	243 (80.7)
Faculty n (%)	
Health sciences	120 (39.9)
Vocational school of healthcare	68 (22.6)
Law	4 (1.3)
Medicine	6 (2)
Economic and administrative sciences	17 (5.6)
Engineering	13 (4.3)
Science literature	25 (8.3)
Education	12 (4)
Sports sciences	9 (3)
Foreign languages	23 (7.6)
Pharmacy	4 (1.3)
Education tools n(%)	
Laptop	210 (69.8)
Telephone	68 (22.6)
Desktop	19 (6.3)
Tablet	4 (1.3)
Screen time exposure, median (IQR) (min-max)	
Education (hours)	6 (4) (2-17)
Social (hours)	4 (4) (1-16)
Screen exposure- education, n (%)	
0-2 hours	34 (11.3)
2-4 hours	67 (22.3)
4-6 hours	76 (25.2)
6-8 hours	71 (23.6)
8 hours above	53 (17.6)
Screen exposure-social, n (%)	
0-2 hours	123 (40.9)
2-4 hours	76 (25.2)
4-6 hours	52 (17.3)
6-8 hours	33 (11)
8 hours and above	17 (5.6)

BMI, Body Mass Index; IQR, interquartile range; Y, Yes; N, No, IQR: interquartile range.

disease or chronic disease that could affect the outcome of the study were not included in the study.

Sample Size

To determine sample sizes, a power analysis was performed using G Power, version 3.1.9.2. The screen exposure and sleep quality were determined with correlation coefficient (correlation value= 0.21) in agreement with the study by Lane et al. (14). A sample size of at least 194 was identified for detecting moderate effect size (80 % power, alpha= 0.05 (two-tailed)).

Procedure

Google Forms was used for preparing and designing web-based questionnaires (15). The text of the announcement regarding the study was shared in students' social media groups. The students who volunteered to participate in the study were sent a link via Google Form. An informed consent form was added to the first section of the forms. The students were asked to complete the surveys and the related questions. At the end of the surveys, participants submitted all answers and the students' responses were recorded automatically in a spreadsheet. The students' screen exposure, physical activity level, musculoskeletal pain, musculoskeletal symptoms in different body regions, and sleep quality were evaluated through related questionnaires. All of the questionnaires were administered to the students only once. The time interval in which the questionnaires were administered to the students (from March to April 2021) was not a midterm or final exam week, and it had been about 4 weeks since the beginning of the semester. The government and higher education council decided to continue distance learning in all the universities in Turkey during the stated time. The students were under lockdown on weekends and between 9 pm and 5 am on weekdays.

Instruments

Screen Exposure Time

Sociodemographic characteristics such as age, gender, body mass index, and faculty information were recorded. Then, information such as the time spent with the learning tool (desktop computer, laptop, tablet, phone) during the distance education process and the duration of using the learning tool for social purposes were questioned considering the last 4 weeks. In addition, the screen exposure time was determined in five categories (0-2; 2-4; 4-6; 6-8; 8 hours above). The screen exposure time was assessed once.

Short Form-International Physical Activity Questionnaire (IPAQ-SF)

The IPAQ-SF consists of seven questions that evaluate the physical activity level over the last seven days. The questionnaire provides information about vigorous-intensity activity, moderate-intensity activity, and walking activity levels. The physical activity level was assessed only once. The total score of IPAQ-SF was stated as metabolic equivalent of task (MET) value x minute / week. Also, the MET values were used during the calculation process for the vigorous-intensity activity (8 MET), moderate-intensity activity (4 MET), and walking activity levels (3.3 MET). The levels of physical activity were classified as low physical activity (<600 MET min/wk), moderate physical activity (600–3.000 MET min/wk), and high physical activity (> 3.000 MET min/wk) (16,17).

Visual Analogue Scale (VAS)

The intensity of pain is evaluated with the VAS using a 10-cm-long horizontal line; "no pain" is generally graded as 0 points and "worst pain imaginable" as 10 points. Intensity ranges of pain classified as follows: <3 mild pain, 3-6 moderate pain, >6 severe pain (18). The intensity of pain over the last 4 weeks was questioned and evaluated once.

Nordic Musculoskeletal System Questionnaire (NMQ)

The NMQ is used to evaluate musculoskeletal symptoms in nine different body regions (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, ankles/feet). The questionnaire examines whether there has been pain/discomfort and disability in the regions during the last 12 months and/or the last seven days. The NMQ was completed by giving either yes or no answers (19). The NMQ provides information regarding the musculoskeletal system symptoms, their prevalence, and consequences. The Turkish version of the NMQ was found to have appropriate psychometric properties, including good test–retest reliability, internal consistency, and construct validity (20). The NMQ was answered once by the students according to the last seven days.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI consists of 19 self-rated items that assess the subjective sleep disturbances over a month's time interval. The questionnaire provides a total sleep quality score and the 7 domain scores (sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medications, and daytime dysfunction). Each component is scored between 0 to 3. A total score of PSQI ranges between 0 to 21 points and the higher scores indicate the worse quality of sleep. A total score of over 5 points indicates a poor quality of sleep. The PSQI was answered once by the students. Buysse et. al. found that the questionnaire has a sensitivity of 90% and a specificity of 87% in distinguishing between good and poor sleep quality (21,22).

Data Analysis

SPSS, version 23 (SPSS, Inc., Chicago, IL), was used to perform analyses. Data distribution types were analyzed using visual (histogram and probability graphics) and analytical methods (Kolmogorov–Smirnov test). Descriptive statistics were presented as mean (standard deviation) or median (interquartile range) and percentage. For evaluation of categorical variables, Pearson's chi-squared test and Fisher's final test were used. The Pearson correlation coefficient was performed to evaluate the relationship between pain intensity, physical activity, and sleep quality. The Pearson correlation values were considered as follows: excellent for 0.81– 1.0, very good for 0.61– 0.80, good for 0.41– 0.60, fair for 0.21– 0.40, and weak for 0.00– 0.20. The correlation values of 0.4 or greater were considered satisfactory (23,24). p-values <.05 were considered significant.

RESULTS

A total of 301 students (183 female, 118 male; mean age 21.1±2.5; BMI 21.8±3.6 kg/m2) participated in the study. The sociodemographic characteristics of all the students and education tools were listed in Table 1. Screen exposure time of students was 6 (4-8) and 4 (2-6) hours for education and social media, respectively. Screen exposure time of university students during COVID-19 pandemic process was presented in Table 1. The total activity of students was 495 MET-min/week. Musculoskeletal pain regions, pain intensity, physical activity level, and sleep quality parameters regarding gender of the university students were listed in Table 2. Disability within the previous 12 months related to upper back (p=0.031) and upper back pain within the previous 7 days (p=0.024) were more common for female than male students. In addition, total activity duration

Table 2. Musculoskeletal pain regions, pain intensity, physical activity level, and sleep quality parameters regarding gender of the university students

n=301	All participant	Female (n=183)	Male (n=118)	Female vs male P value
NMQ- Symptoms within previous 12 months				
Neck	239 (79.4)	148(80.9)	91(77.1)	0.432
Shoulder	215 (71.4)	134(73.2)	81(68.6)	0.391
Elbow	61 (20.3)	39 (21.3)	22(18.6)	0.574
Wrist	138 (45.8)	90(49.2)	48(40.7)	0.148
Upper Back	256 (85)	161(88.0)	95(80.5)	0.076
Lower Back	256 (85)	157(85.8)	99(83.9)	0.653
Hip-Thigh	155 (51.5)	97(53)	58(49.2)	0.514
Knee	142 (47.2)	86(47)	56(47.5)	0.937
Ankle-feet	108 (35.9)	64(35)	44(37.3)	0.683
NMQ- Disability within previous 12 months				
Neck	115 (38.2)	73(39.9)	42(35.6)	0.454
Shoulder	83 (27.6)	55(30.1)	28(23.7)	0.231
Elbow	14 (4.7)	6(3.3)	8(6.8)	0.159
Wrist	46 (15.3)	31(16.9)	15(12.7)	0.320
Upper Back	138 (45.8)	93(50.8)	45(38.1)	**0.031**
Lower Back	132 (43.9)	86(47)	46(39)	0.171
Hip-Thigh	51 (16.9)	32(17.5)	19(16.1)	0.755
Knee	45 (15)	27(14.8)	18(15.3)	0.905
Ankle-feet	42 (14)	22(12)	20(16.9)	0.228
NMQ-Symptoms within previous 7 days				
Neck	170 (56.5)	103(56.3)	67(56.8)	0.933
Shoulder	133 (44.2)	86(47)	47(39.8)	0.222
Elbow	23 (7.6)	16(8.7)	7(5.9)	0.370
Wrist	63 (20.9)	43(23.5)	20(16.9)	0.173
Upper Back	182 (60.5)	120(65.6)	62(52.5)	**0.024**
Lower Back	177 (58.8)	107(58.5)	70(59.3)	0.883
Hip-Thigh	85 (28.2)	57(31.1)	28(23.7)	0.163
Knee	61 (20.3)	42(23)	19(16.1)	0.149
Ankle-feet	64 (21.3)	41(22.4)	23(19.5)	0.547
Pain intensity (VAS), median (IQR)	5 (3)	5 (4)	4 (3)	0.911
IPAQ, median (IQR)				
Active days (day)	5 (4)	5 (5)	5 (4)	0.077
Total activity duration (min/wk)	40 (85)	30 (60)	60 (12.5)	**0.006**
Total activity (MET-min/wk)	495 (1386)	446 (1040)	660 (1331)	**0.017**
Physical activity category n (%)				
Low	177 (58.8)	112 (61.2)	65 (55.1)	
Moderate	98 (32.6)	60 (32.8)	38 (32.2)	0.123
High	26 (8.6)	11 (6)	15 (12.7)	
PSQI, median (IQR)				
Sleep quality	2 (1)	1(1)	2 (1)	0.780
Sleep latency	2 (2)	2 (1)	2 (1)	0.994
Sleep duration	0 (0)	0 (1)	0 (0)	0.389
Sleep efficiency	0 (0)	0 (0)	0 (0)	0.235
Sleep disturbances	2 (1)	2 (1)	2 (1)	0.953
Use of sleep medication	0 (0)	0 (0)	0 (0)	0.418
Daytime dysfunction	1 (1)	2 (1)	1 (1)	0.170
Total score	7 (5)	7 (2)	7 (4)	0.492
Sleep quality, n (%)				
Poor (PSQI total > 5)	213 (70.8)	130 (71)	83 (70.3)	
Good (PSQI total ≤ 5)	88 (29.2)	53 (29)	35 (29.7)	0.896

NMQ, Nordic Musculoskeletal Questionnaire; IPAQ, International Physical Activity Questionnaire; PSQI, Pittsburgh Sleep Quality Index; MET, metabolic equivalent of task. * Pearson Chi-Square for NMQ, physical activity category and sleep quality; Kruskal-Wallis Test for pain intensity, IPAQ,and PSQI

(p=0.006) and total activity (p=0.017) were found higher in males than females (Table 2).

The pain intensity was fairly correlated to PSQI total score (r= 0.320, p< 0.001), daytime dysfunction (r=

Table 3. Correlation between the screen expose, pain intensity and sleep quality

	Screen exposure time-education		**Screen exposure time-social**		**VAS**	
	r	**p value**	**r**	**p value**	**r**	**p value**
IPAQ						
Active days	**- 0.119**	**0.040**	-0.069	0.23	-0.09	0.08
MET-vigorous	**- 0.173**	**0.003**	-0.104	0.07	-0.01	0.76
MET-moderate	- 0.026	0.64	**-0.124**	**0.03**	0.04	0.44
MET-walking	- 0.075	0.19	0.09	0.12	-0.06	0.25
Total activity (MET-min/wk.)	**- 0.148**	**0.01**	-0.047	0.42	-0.03	0.56
VAS	**0.213**	**<0.001**	-0.032	0.57	-	-
PSQI						
Sleep quality	0.107	0.06	0.018	0.753	**0.256**	**< 0.001**
Sleep latency	0.095	0.10	-0.107	0.064	**0.195**	**0.001**
Sleep duration	0.006	0.92	0.039	0.501	0.086	0.135
Sleep efficiency	0.039	0.50	0.028	0.63	**0.126**	**0.029**
Sleep disturbances	0.101	0.08	-0.075	0.192	**0.232**	**< 0.001**
Use of sleep medication	0.035	0.54	0.056	0.335	**0.166**	**0.004**
Daytime dysfunction	0.095	0.09	0.024	0.685	**0.282**	**< 0.001**
Total score	**0.118**	**0.04**	-0.019	0.739	**0.320**	**< 0.001**

IPAQ, International Physical Activity Questionnaire; PSQI, Pittsburgh Sleep Quality Index; VAS, Visual Analogue Scale; MET, metabolic equivalent of task.
Bold values indicate statistically significant findings for Pearson correlation analysis ($p < 0.05$).

0.282, p< 0.001), sleep quality (r= 0.256, p< 0.001), and sleep disturbances (r= 0.232, p< 0.001). Correlation results between the screen exposure, pain intensity, and sleep quality were presented in Table 3 in detail. There is no difference observed between the screen exposure time groups in aspects of musculoskeletal pain regions (p>0.05), total score of the PSQI (p= 0.217), and total activity (p= 0.694). The musculoskeletal pain regions, physical activity, and sleep quality regarding screen exposure time were reported in Table 4.

No significant difference was found in musculoskeletal symptoms and pain intensity regarding education tools (laptop, telephone, desktop, tablet) was found, except for neck disability within the previous 12 months (p=0.042). In the desktop user, neck pain disability was more common than other education tools although the distribution of the numbers were not similar between the education groups (Table 5).

DISCUSSION

The objectives of this study were to investigate the physical activity, musculoskeletal system problems, sleep, and screen exposure seen in university students during the COVID-19 pandemic and analyze the relationship between physical activity, musculoskeletal system problems, sleep, and screen exposure. The study showed that the university students had a low level of physical activity, poor sleep quality and increased musculoskeletal pain, especially the upper back, lower back, neck. As the pain intensity had increased, quality of sleep had worsened. In addition, the female students suffered from upper back pain more than male students, while male students were more physically active than females. Interestingly, desktop users were found to be more common with neck disability than other education tools (laptop, telephone, tablet), although the distribution of the education tools groups were not similar.

The sedentary lifestyle was known to be associated with cardiovascular problems, obesity, and other chronic health problems related to morbidity and mortality (25). A higher level of physical activity was associated with better health status (11). The study demonstrated that more than half of the students have low levels of activity during the COVID-19 pandemic, which was similar to the literature (3,8,26). Home confinement, social distancing, and change of

Table 4. The musculoskeletal pain regions, physical activity, and sleep quality regarding screen time of the university students

	Screen exposure time					
	0-2 hours	**2-4 hours**	**4-6 hours**	**6-8 hours**	**8 hours above**	**p value***
NMQ	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	
Neck	70.6	76.5	80.3	80.0	86.8	0.435
Shoulder	70.6	67.6	73.7	70.0	75.5	0.883
Elbow	17.6	23.5	22.4	15.7	20.8	0.790
Wrist	38.2	47.1	47.4	47.1	45.3	0.916
Upper Back	82.4	86.8	86.8	84.3	83.0	0.945
Lower Back	82.4	88.2	81.6	81.4	92.5	0.347
Hip-Thigh	52.9	61.8	52.6	44.3	45.3	0.266
Knee	47.1	48.5	50.0	48.6	39.6	0.814
Ankle-feet	29.4	38.2	39.5	38.6	28.3	0.600
PSQI-total scor, Median (IQR), min-max	7.5 (4) (3-15)	8.0 (6) (0-17)	7.0 (4.75) 1-16	7.0 (5) (1-15)	7.0 (5) (2-15)	.217
Total activity (MET-min/wk) Median (IQR) min-max	396 (1399) (0-7324)	648 (1919) (0-14238)	561 (1284) (0-5652)	544 (1223) (0-6132)	396 (742) (0-7998)	.694

NMQ, Nordic Musculoskeletal Questionnaire; PSQI, Pittsburgh Sleep Quality Index; MET, metabolic equivalent of task; IQR, interquartile range.

*Chi Square Test for NMQ vs screen expose time.

*Kruskal Wallis Test for PSQI-total score and total activity vs screen expose time ($p < .05$).

daily habits because of the pandemic are probably the reason for the decline in physical activity levels. According to the results of screen exposure time, most of the students consumed more than 6 hours with an online education device. A high rate of screen exposure time and longer static positions among the students could be the other reason for the decreased activity, which was shown negatively related to the total activity in this study.

The musculoskeletal problems were highly reported among the students in this period in the present study. The pain in the neck, lower and upper back, and shoulder regions were prominent which might be related to improper posture and longer times spent in front of the screen. This decline could be related to longer effects of the biomechanical stresses on body parts caused by the long duration of static or improper postures and longer screen exposure time (7). In a study, Lis et al, stated that especially improper sitting positions significantly increased the risk of lower back pain (27). In addition, the passive flexion stiffness of the spine was found to increase after two hours of sitting and it was found related to a higher risk of back pain in the literature (28). In the present study, it was determined that about 90% of university students were exposed to screens for educational activities and about 60% were exposed to screens for social purposes for more than 2 hours during the distance learning period. It is predicted that this situation may increase the frequency of musculoskeletal pain in university students.

Most of the students reported their sleep quality as low. A study evaluating exposure to screens of digital media devices, sleep, and concentration abilities in adults found that increased exposure to the digital media devices at nighttime was related to longer sleep latency and decreased sleep hours. Moreover, the authors noted that exposure to digital screens in the evening and night time was positively associated with subjective sleepiness (29). In another study, Christensen et al. showed that screen-time was associated with poor sleep, and exposure to screens particularly around bedtime may negatively impact sleep (12). In the present study, we found that only the total score of PSQI was weakly correlated with screen exposure time. We think that this may be related to daytime screen exposure for educational purposes, unlike nighttime or bedtime screen exposure. Even though there is only a weak correlation between total sleep quality score and screen exposure time, it was known that increased screen usage time and musculoskeletal problems

Table 5. Comparison of musculoskeletal symptoms and pain intensity regarding education tools (laptop, telephone, desktop, tablet)

n=301	Laptop (n=210)	Telephone (n=68)	Desktop (n=19)	Tablet (n=4)	P value*
NMQ					
Symptoms within previous 12 months, n(%)					
Neck	168 (80)	52 (76.5)	16 (84.2)	3 (75)	0.869
Shoulder	147 (70)	52 (76.5)	12 (63.2)	4 (100)	0.348
Elbow	46 (21.9)	13 (19.1)	1 (5.3)	1 (25)	0.375
Wrist	102 (48.6)	28 (41.2)	6 (31.6)	2 (50)	0.422
Upper Back	179 (85.2)	59 (86.8)	16 (84.2)	2 (50)	0.257
Lower Back	181 (86.2)	53 (77.9)	19 (100)	3 (75)	0.087
Hip-Thigh	110 (52.4)	32 (47.1)	11 (57.9)	2 (50)	0.821
Knee	105 (50)	27 (39.7)	9 (47.4)	1 (25)	0.394
Ankle-feet	82 (39)	20 (29.4)	5 (26.3)	1 (25)	0.374
Disability within previous 12 months, n(%)					
Neck	73 (34.8)	31 (45.6)	11 (57.9)	0 (0)	**0.042**
Shoulder	56 (26.7)	19 (27.9)	8 (42.1)	0 (0)	0.305
Elbow	10 (4.8)	4 (5.9)	0 (0)	0 (0)	0.715
Wrist	33 (15.7)	9 (13.2)	4 (21.1)	0 (0)	0.691
Upper Back	94 (44.8)	35 (51.5)	9 (47.4)	0 (0)	0.224
Lower Back	90 (42.9)	34 (50)	7 (36.8)	1 (25)	0.555
Hip-Thigh	39 (18.6)	8 (11.8)	4 (21.1)	0 (0)	0.434
Knee	36 (17.1)	7 (10.3)	2 (10.5)	0 (0)	0.400
Ankle-feet	33 (15.7)	8 (11.8)	1 (5.3)	0 (0)	0.448
Symptoms within previous 7 days, n(%)					
Neck	116 (55.2)	42 (61.8)	12 (63.2)	0 (0)	0.092
Shoulder	95 (45.2)	25 (36.8)	11 (57.9)	2 (50)	0.374
Elbow	18 (8.6)	5 (7.4)	0 (0)	0 (0)	0.538
Wrist	47 (22.4)	11 (16.2)	5 (26.3)	0 (0)	0.460
Upper Back	126 (60)	41 (60.3)	14 (73.7)	1 (25)	0.319
Lower Back	121 (57.6)	40 (58.8)	15 (78.9)	1 (25)	0.158
Hip-Thigh	62 (29.5)	16 (23.5)	6 (31.6)	1 (25)	0.791
Knee	47 (22.4)	9 (13.2)	4 (21.1)	1 (25)	0.436
Ankle-feet	48 (22.9)	12 (17.6)	3 (15.8)	1 (25)	0.747
Pain intensity (VAS), median (IQR)	5 (3)	4.5 (3.5)	4 (4)	3.5 (2)	0.802

NMQ, Nordic Musculoskeletal Questionnaire; VAS, VAS, Visual Analogue Scale
* Pearson Chi-Square for NMQ, Kruskal-Wallis Test for pain intensity.

cause sleep disturbances (10,12,30). Decreased quality of sleep is also shown in students with more pain. The students in this study presented widely distributed musculoskeletal problems related to pain. Previous studies showed a higher prevalence of back pain in females compared to males (31,32). In another recent study, both pain duration and pain intensity were found higher in females due to desktop/laptop or tablets usage in females compared to males (33). In addition, the study reported that the duration of these devices use correlated with duration and degree of pain and most of the students used the sitting position with supine bent forward during the device usage. Several studies reported a correlation between a sedentary lifestyle and low back pain (34,35). In this study, we found that neck pain disability was more common in desktop users. This result may be related to possible supine bent forward posture in a prolonged sitting position, especially since desktop computers are not portable. Previous studies could explain the results of this study as the students' life before the COVİD-19 pandemic has shifted to a more sedentary life during the COVID-19 pandemic, and students have received most of their education from distance learning online. Students who remained inactive for long periods experienced an increase in back pain, especially with the decreasing physical activity level. Also, females showed higher percentage of back pain compared to males possibly owing to psychological factors, female hormone fluctuation, and menstruation (36).

Upper back pain in the last 7 days and in the last 12 months was more common in females than males. The activity duration and total activity were higher in males than females might cause lesser sedentary position duration in males. Higher physical activity in males could be also related to the higher activity motivation which was stated in Kilpatrick et al. Motivatinal factors could be investigated in detail (37). In another study showed that males participated in sport activities with a higher intensity and spent more time on these activities than females in the university students. Also, females spent much more time on housework activities and sitting in the house than males (38). The gender variations in physical activity levels can be explained by males having greater opportunities for athletic competition to enhance their physical skills and abilities, as well as males and females having different patterns of sports or physical activity participation (39). The lower activity duration and long-duration of sedentary positions could have more detrimental effects on females than males. It could be also related to the presence of large breast tissue in females. In the literature, it was stated that especially larger breast tissue in females is related to the upper torso musculoskeletal pain with increasing kyphotic posture (40). Also, Dunk et al. showed that males and females may be exposed to different loading patterns during prolonged sitting and may experience different pain generating pathways. In this study suggested that females could be encouraged to use the back support more to reduce muscle activity, and males may need greater lumbar support to increase lordosis (41).

The main difference of the present study from the other studies was to evaluate musculoskeletal pain related to the last 1 year, which is switched to the distance education model. Also, the study presented important data regarding screen exposure time, sleep quality, musculoskeletal pain, and physical activity with relatively large sample size. Further studies should investigate the relationship between screen exposure time in nighttime or daytime, sleep quality, and musculoskeletal pain. The present study was limited to a few points. The physical environment of the students, pain duration and sitting position could be investigated to determine other factors related to posture and musculoskeletal problems. The frequency of post-COVID cases and night shifts were not investigated, it could give another perspective to the study. Also, it is hard to make the generalization of the results because of the cross-sectional collection of the data.

CONCLUSION

In conclusion, musculoskeletal problems were found widespread among the students in the COVID-19 pandemic. Most of the students had decreased quality of sleep and more than half of them had low levels of activity with a high amount of screen exposure. These problems could be the reason for serious health issues later, so approaches targeting to improve physical activity levels, better posture while studying could be beneficial. Distance learning or hybrid education model seems to be one of the indispensable models of the education system in the future. So far distance learning has proved as a useful and applicable way of education, dependency on-screen and increased screen exposure in static or improper postures could have negative effects on the human body. The activity reminders, tele-exercises between the lectures could be beneficial to reduce the negative effects of distance learning.

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