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ORIGINAL ARTICLE

Effects of posture and ergonomics training for students receiving distance education during the covid-19 pandemic on musculoskeletal pain, exercise behavior decision-making balance, and physical activity level

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Purpose: The purpose of our study is to investigate the effects of posture and ergonomics training for students receiving distance education during the Covid-19 pandemic on musculoskeletal pain and activity prevention, exercise behavior decision-making balance and physical activity level.
Methods: The study included a total of 202 undergraduate students including 155 (76.7%) women and 47 (23.3%) men. The students were randomly divided into two groups as the training and control groups. The training group received a specific program regarding posture and ergonomics by a physiotherapist for 60 minutes via distance education. No training was given to the control group. The "Extended Nordic Musculoskeletal Questionnaire" (NMQ-E), "Decisional Balance Scale: Exercise" and "International Physical Activity Questionnaire Short Form" (IPAQ-SF) were used to assess musculoskeletal system disorders, exercise behavior decision-making balance and physical activity level, respectively.
Results: No significant difference was determined between the training and control groups in terms of their physical activity level and exercise behavior decision-making balance cons scores ($p>0.05$). There was a significant difference in favor of the control group in the exercise decision-making pros scores ($p<0.05$). No significant difference was found in terms of musculoskeletal pain and activity prevention ($p<0.05$).
Conclusion: We believe that specific training programs including posture and ergonomics may raise ergonomics awareness in terms of reducing musculoskeletal pain while increasing their physical activity level and contributing their attitude of exercise behavior decision-making balance for students receiving distance education during the Covid-19 pandemic.
Keywords: Covid-19 pandemic, Musculoskeletal system, Physical activity.

Covid-19 salgını sırasında uzaktan eğitim alan öğrenciler için postür ve ergonomi eğitiminin kas-iskelet sistemi ağrısı, egzersiz davranışına karar verme dengesi ve fiziksel aktivite düzeyi üzerine etkileri

Amaç: Çalışmamızın amacı, uzaktan eğitim alan öğrencilere verilen duruş ve ergonomi eğitiminin kas-iskelet sistemi bozuklukları, egzersiz davranışı karar verme dengesi ve fiziksel aktivite düzeyleri üzerindeki etkilerini araştırmak idi.
Yöntem: Çalışmaya 155 (%76,7) kadın ve 47 (%23,3) erkek olmak üzere toplam 202 lisans öğrencisi dahil edildi. Öğrenciler rastgele eğitim ve kontrol grubu olarak iki gruba ayrıldı. Eğitim grubuna, fizyoterapist tarafından 60 dakika boyunca uzaktan eğitim yoluyla postür ve ergonomi ile ilgili özel bir program verildi. Kontrol grubuna herhangi bir eğitim verilmedi. "Genişletilmiş Nordic Kas İskelet Sistemi Anketi (NMQ-E)", "Egzersiz Davranışına Karar Verme Dengesi Anketi" ve "Uluslararası Fiziksel Aktivite Anketi'nin kısa formu sırasıyla kas iskelet sistemi bozukluklarını, egzersiz davranışına karar verme dengesini ve fiziksel aktivite düzeyini değerlendirmek için kullanıldı.
Bulgular: Eğitim ve kontrol grupları arasında fiziksel aktivite ve egzersiz davranışına karar verme dengesi anketinin eksi puanları açısından bir fark bulunmadı ($p> 0,05$). Egzersiz davranışına karar verme dengesi artı puanlarında ise kontrol grubu lehine fark vardı ($p <0,05$). Kas-iskelet sistemi ağrısı ve aktivite önleme açısından anlamlı fark bulunmadı ($p <0,05$).
Sonuç: Covid-19 salgını sırasında uzaktan eğitim alan öğrenciler için duruş ve ergonomi içeren özel eğitim programlarının ergonomik farkındalığı artırarak fiziksel aktivite düzeylerini arttırırken kas iskelet sistem ağrılarını azaltacağını ve egzersiz davranışına karar verme dengesi tutumlarına katkıda bulunacağını inanmaktayız.
Anahtar kelimeler: Covid-19 salgını, Kas-iskelet sistemi, Fiziksel aktivite.

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In Turkey, the Council of Higher Education made a transition to a distance education process at all universities via digital opportunities as a break has been issued on education during the COVID-19 precautions.[1-5] Distance education is an interdisciplinary field that aims to remove the limitations among the learners, educators and learning resources and uses existing technologies with a pragmatic approach to achieve this.[6] Studies on the field of distance education are usually related to technology usage and online learning environments. While most studies mention the advantages brought by technology usage in distance education, some negative effects related to this issue may also be seen in individuals receiving distance education. In individuals continuing their education with computers, staying at a static position by repeated movements such as using a keyboard, clicking on a mouse, usage of the body in incorrect positions and the inadequate ergonomic conditions in the working environment may lead to musculoskeletal system disorders.[7] The study on university students reported that there is a relationship between mobile phone usage and musculoskeletal system problems, after-usage complaints are focused on the neck and shoulder regions, and there is a link between the size of the screen and back pain.[8]

Long time periods spent in front of a touchscreen, tablet computer or a computer with a keyboard also lead to bad posture and repetitive movements in individuals by reducing their levels of physical activity. Several studies in the literature on determining and solving such problems have revealed that posture trainings achieved usage of the body in correct positions and reduction in musculoskeletal system problems by raising ergonomics awareness in individuals.[9,10]

In the COVID-19 pandemic era where daily life has completely changed, immobility, one of the problems of our time, has also started to become increasingly prevalent. In other words, the decrease in the physical activity levels of individuals is highly noticeable in recent years. Physical activity refers to energy production as a result of contraction of skeletal muscles in daily life and bodily movements that require energy consumption higher than the basal level (daily routine activities like household chores, bathing, playing games, shopping).[11] Several recent studies have revealed the prevalence of immobility. For example, a study on university students reported that 64% of students have inadequate levels of physical activity. It was also seen that there is a negative relationship between the physical activity levels of students and their perceived stress.[12]

Especially in this pandemic period where stress is intense, it has become increasingly important to raise the levels of physical activity and exercise as a component of physical activity among students receiving distance education. In this direction, one of the most important steps that may help the individual transform exercising into a behavior is the stage of decision-making. At this stage, it is important to prioritize the benefits of exercise perceived by individuals and hold back the harms.

Several new scientific studies have been conducted, especially in the field of health, regarding the novel coronavirus, which has taken its place in the world's agenda since the moment it emerged. These studies usually contain information on the virus' definition, spreading area and protection methods. In difference to such studies, we believe that, in this pandemic period that has affected the entire world, university students are more in need of training programs regarding physical activity, posture and ergonomics.

Primary hypothesis of the study is to investigate whether there would be a difference between musculoskeletal pain and activity prevention, exercise behavior decision-making balance, and physical activity levels between those who have received and did not receive posture and ergonomics training for students receiving distance education during the Covid-19 pandemic. The purpose of our study is to demonstrate the effects of posture and ergonomics training for students receiving distance education during the Covid-19 pandemic on musculoskeletal pain and activity prevention, exercise behavior decision-making balance and physical activity level.

METHODS

This study was carried out with volunteered 202 students with mean age of 21.02±1.90 years including 155 (76.7%) women and 47 (23.3%) men receiving distance education

at Başkent University. For the questionnaires to be filled out by the participants, permission was received from the Social Sciences, Humanities and Arts Research Committee of Başkent University (15 May 2020, ethic number: 17162298.600-409). Before starting the study, by using a computer program, the students were randomly divided into two groups as the training and control groups.

The data were collected on a voluntary basis by questionnaires that were provided online. Volunteers were informed about the study and approval was received in the questionnaires. The questionnaires were sent to both training and control groups 3 weeks after those who receive and do not the training. Information was collected on the individuals' age, sex, height, weight, previously existing pain complaints, duration and device used for distance education. The following assessments were used in the study:

Extended Nordic Musculoskeletal Questionnaire (NMQ-E):

The Extended Nordic Musculoskeletal Questionnaire was applied to determine the prevalence, severity and impact of musculoskeletal symptoms. The NMQ-E interrogates ache, pain or discomfort experienced in the nine body parts (neck, shoulders, back, elbows, wrists/hands, waist, hips/thighs, knees, ankles/feet) to date, for the last 12 months, for the last four weeks and on the day of the administration, with binary choice questions (yes or no).[3] It has been frequently used in many studies in Turkey.[14-16]

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

The physical activity levels of the individuals were assessed by using the Turkish version of the short form of the "International Physical Activity Questionnaire". The questionnaire assesses physical activities in the last 7 days by 7 questions. It provides information on the time spent on sitting, walking, moderate activities, and intense activities. The IPAQ-SF also classifies populations into the following categories: inactive (scores of <599), minimally active (scores between 600 and 2999) or health enhancing physical activity (HEPA) level (scores over 3000) groups. The validity and reliability of the questionnaire in Turkish were tested.[17]

Decisional Balance Scale: Exercise

The Decisional Balance Scale: Exercise was applied in order to determine the gains and losses perceived by the individuals who were included in the study while decision-making for exercise behaviors. The questionnaire consists of 5 positive items where the exercise process is perceived as a gain and 5 negative items where it is perceived as a loss. The items on the questionnaire are answered as a 5-point Likert-type scale (1=not important at all, 5= very important). The validity and reliability of the questionnaire in Turkish were tested.[18-20]

Training Group

The students in the training group received a specific program regarding posture and ergonomics by a physiotherapist for 60 minutes via distance education. The training was carried out interactively via a live broadcast on Adobe Connect. The training was also recorded into the system to allow the students to watch it again, if needed. The training theoretically provided information about posture, poor postures, things to pay attention to while using a computer, ergonomic postures for static positions and suitable working environments. In the presentation, risk situations that may occur and ergonomic recommendations were also included, and protective exercise options were shown in an applied manner.

Control Group

Only the questionnaires were applied in the control group without receiving any specific training.

Statistical analysis

The data obtained were analyzed using statistical software (SPSS) version 21.0 for social sciences (IBM Corp., IBM SPSS Statistics for Windows, Armonk, NY, USA). The mean ± standard deviation, frequencies, and percentages were given, as appropriate. As a result of the Kolmogorov-Smirnov and Shapiro-Wilk tests, it was observed that the data were not normally distributed ($p<0.05$). Mann-Whitney U analysis was used to assess the differences between training and control groups. In addition, Chi-Square analysis was used to test group differences according to physical activity level of participants. Significance level was accepted as $p<0.05$.

RESULTS

The mean weekly distance education time

of the participants was 5.35±1.93 hours/day. The descriptive characteristics of the students who participated in the study are shown in Table 1. No significant difference was determined between the training and control groups in terms of their physical activity level and exercise behavior decision-making balance cons scores ($p>0.05$). There was a significant difference in favor of the control group in the exercise behavior decision-making balance pros scores ($p<0.05$) (Table 2). Pain complaints in the last 7 days were at back region in the Training Group, and at shoulder region in the Control Group. Additionally, other intense pain regions stated by individuals in both groups were the shoulders, neck, back, and waist. No significant difference was found in terms of musculoskeletal pain and activity prevention ($p<0.05$) (Table 3).

DISCUSSION

The purpose of this study was to investigate the effects of posture and ergonomics training for students receiving distance education during the Covid-19 pandemic on musculoskeletal pain and activity prevention, exercise behavior decision-making balance and physical activity level.

In this period that has been declared as a worldwide pandemic, most people have needed to stay at home or apply isolation precautions to prevent the spread of the virus. Staying at home leads to an increase in problems caused by stress, anxiety, and mental restlessness in individuals. In this process, in students receiving distance education, additional immobility for extended durations and listening to classes in anti-ergonomic positions may bring about problems in individuals related to the musculoskeletal system. Student's home-based exercise activities, especially in this period, will have several positive effects such as reducing their musculoskeletal system pains and helping them better concentrate for their classes, have lower fatigue levels and cope with stress.[21] The World Health Organization (WHO) and the American College of Sports Medicine (ACSM) have stated that, for a healthier and better life, a person needs to do at least 150 minutes of moderate-intensity or at least 75 minutes of high-intensity exercise per week.[22,23] It is stated that an increase in sitting times leads to health problems.[24] Many studies reported that most university students do not have sufficient physical activity[25,26] and they spend too much time for screen-based activities.[27] Similarly, considering the physical activity levels of the students in our study, it was seen that the sedentary group constituted a high ratio. The motivation of individuals may decrease depending on different reasons such as the inadequacy of environmental conditions and closed status of gymnasiums in the pandemic era. We believe that these factors may have been effective in the finding of no significant difference between the two groups in our study in terms of their physical activity levels.

Moreover, computer usage that has been more prevalent by distance education may also pose a potential obstacle to people's regular physical activity and exercise. However, we think increasing the awareness of individuals on this issue and emphasizing the gains to be created by exercise on individuals may help overcoming obstacles in this issue. In this context, based on the transtheoretical model, to transform a thing into action, one firstly needs to make a decision. Afterwards, stages of transformation and the transformation itself follow. Stages of transformation take place in time. The person passes through different development stages until they are ready to be motivated, and at the end, behavioral change occurs.[28] In the Exercise Decisional Balance Questionnaire that was used in our study, it was seen that the perception of loss regarding decision-making for exercise was higher than the perception of gain in the training group. On the other hand, a significant difference in favor of the control group was found in terms of the gain perceived in exercise behavior. In other words, it was observed that, although training was not provided to the control group, the individuals in the control group had a higher tendency to exercise, and they have a more positive thinking style on this topic.

Perception of the exercise process as a gain may be related to individuals' personality characteristics, psychological statuses, support received from their families and social environment and their perspective towards life. A more positive thinking structure of the individuals in the control group and their comprehension of the importance of exercise in

Table 1. Descriptive characteristics of the participants.

	Training Group (N=96)	Control Group (N=106)	Total (N=202)	
	X±SD	X±SD	X±SD	p
Age	20.94±2.17	21.10±1.63	21.02±1.90	0.07
Body weight (kg)	64.14±17.02	64.64±13.82	64.40±15.44	0.52
Height (cm)	168.76±9.48	167.82±13.45	168.29±11.62	0.85
Distance education time				
Diary, hour	1.62±0.75	1.65±0.75	1.63±0.75	0.80
Weekly, hour	6.10±1.70	4.67±1.89	5.35±1.93	
	n (%)	n (%)	n (%)	
Gender				
Female	73 (76)	82 (77.4)	155 (76.7)	0.82
Male	23 (24)	24 (22.6)	47 (23.3)	
Distance education device				
Smart phone	21 (21.9)	24 (22.6)	45 (22.3)	
Desktop Computer	19 (19.8)	19 (17.9)	38 (18.8)	0.88
Laptop	56 (58.3)	62 (58.5)	118 (58.4)	

Table 2. Comparison of physical activity levels and exercise decisional balance questionnaire scores of the groups.

	Training Group (N=96)	Control Group (N=106)	p
Decisional Balance Scale: Exercise (X±SD)			
Pros Score	21.37±3.55	22.32±3.18	0.04¥*
Cons Score	11.30±3.26	11.10±3.30	0.32¥
Physical activity levels (Mean score / n (%))			
Inactive	455 / 58 (60.4)	445 / 54 (50.9)	0.157β
Minimally active	1170 / 25 (26)	980 / 41 (38.7)	
Health enhancing physical activity	3430 / 13 (13.5)	3400 / 11 (10.4)	

*p<0.05. ¥: Mann-Whitney U Test. β: Chi-Square Test.

Table 3. Comparison of musculoskeletal pain (Extended Nordic Musculoskeletal Questionnaire) between the Training Group (N=96) and the Control Group (N=106).

	Past 12 months		Past 1 months		Past 7 days	
	Training Group	Control Group	Training Group	Control Group	Training Group	Control Group
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Neck	42 (43.75)	47 (44.33)	32 (33.33)	39 (37.44)	22 (22.91)	24 (22.64)
Shoulder	23 (23.95)	28 (26.41)	20 (20.83)	25 (23.58)	16 (16.66)	29 (27.35)
Back	37 (38.54)	43(40.56)	32 (33.33)	32 (30.18)	24 (25.00)	19 (17.92)
Elbows	3 (3.12)	8 (7.54)	4 (4.16)	7 (6.60)	2 (2.08)	6 (5.66)
Wrists/Hands	7 (7.29)	6 (5.66)	7 (7.29)	4 (3.77)	7 (7.29)	2 (1.88)
Waist	25 (26.04)	26 (24.52)	22 (22.91)	18 (16.98)	13 (13.54)	15 (14.15)
Hips/Thighs	4 (4.16)	5 (4.71)	6 (6.25)	4 (3.77)	4 (4.16)	2 (1.88)
Knees	5 (5.20)	10 (9.43)	7 (6.72)	12 (11.32)	4 (4.16)	9 (8.49)
Ankles/Feet	1 (1.04)	2 (1.88)	3 (3.12)	4 (3.77)	1 (1.04)	2 (1.88)
p β	0.209		0.850		0.488	

β: Chi-Square Test.

this pandemic period without needing training may have led to these results in the study. However, not having used questionnaires that could assess these issues in our study limits our interpretations on these issues.

Gerr et al. (2004) stated that an increase in the computer usage times of students poses a risk factor for musculoskeletal system disorders associated with computer usage, and 20 hours of computer usage per week needs to be considered as the limit value in university students and viewed as a risk.[29] Although the weekly distance education durations of the students who participated in our study (mean: 5.35±1.93) were lower than the stated limit value, musculoskeletal system complaints were encountered in both groups. We may explain this by the multifactorial nature of the factors that may lead to musculoskeletal system pains.

The vast majority of studies in the literature have focused on the disorders induced by computer usage on the upper extremities. Yağcı et al. showed that computer usage led to more complaints of neck pain in female students than male students.[30] Similarly, in our study, it was seen that pain was more prevalent in the female students. This may have been caused by that the sex distribution in the study was not homogenous, 76% of the participants were women, and the prevalence of musculoskeletal system diseases in men is lower.[30]

While Todd et al. (2007) stated that long-term sitting and long durations of static posture may increase the risk of lower and upper back pain,[31] Myrtveit et al. (2014) reported that spending excessive time for screen-based activities may increase the risk of neck and shoulder pain.[32] In another study, Ariens et al. (2000) reported that the flexion posture of the neck and sitting posture are associated with neck pain, and spending 95% of working hours by sitting and working for more than 70% of one hour with at least a 20° neck flexion increase the risk of neck pain.[33]

Noack-Cooper et al. (2009) reported that students use computers in unsuitable postures, and they felt disturbance in one or more areas of their bodies by adapting to these poor postures.[34] In our study, in similarity to the literature, pain was determined most frequently in the shoulder, neck, back and waist regions, and no difference was found between the groups in terms of pain. We think long-term static positions and anti-ergonomic conditions lead to this result by stressing especially the upper trapezius, scalene and back muscles.

In a study, 94 computer users who were using computers for at least 3 hours a day were divided into two groups as control and training. The training group received a comprehensive ergonomics training, an ergonomics training brochure, and workplace arrangements were made. As a result of 6 months of follow up, in the training group, there was an improvement in the working posture in comparison to the control group, a reduction in the severity, duration and incidence of disorders, an increase in productivity and an improvement in functional status. In another study, an e-learning method was formed for office ergonomics training, and the short and long-term effects of the training were assessed. As a result of the study, it was observed that the individuals transformed the knowledge they had gained by the web-based ergonomics training into behavioral change, and they reflected this into their working positions and workplace environments.[35] In a different study on 50 individuals at the ages of 25-50 using computers for more than 6 hours per day, while one group was given a 1-time training, the other group received training for 2 months and had exercises. After two months, significant changes were observed in the pain, functionality, fatigue and depression levels of the group where the training and exercise were applied together.[36] Although training was provided in our study in a similar way to what is found in the literature, the short duration of the training in our study and not having compared the assessments before and after training may have led to the similar results between the two groups.

In distance education, which has become more prevalent especially with the pandemic period, provision of flexibility in terms of time and working spaces may provide suitable conditions for exercising and turn exercise into an advantage.[37] In addition to this, in order to obtain positive outcomes in students receiving distance education, more comprehensive and longer-term trainings should be conducted, and awareness should be raised on this issue.

Limitations

Our study had some limitations. First of all, considering the time of exposure to electromagnetic effects, not only the class hours

of distance education but also the times spent in front of a computer or screen (e.g. playing games, following social media) could have been questioned. Additionally, the dominant extremity could have been assessed for pain and posture effects that could occur in relation to mouse usage. Furthermore, we believe following up on individuals in such training studies with methods such as e-mail, telephone and diary-keeping may affect the results more positively.

It is important to determine musculoskeletal system pains in students and ensure that individuals can cope with these. In terms of reducing pain that could develop in relation to musculoskeletal system disorders in young adults, increasing their physical activity levels and contributing to their transformation of exercise into a behavior, we believe that our study may be guiding by creating awareness.

Conclusion

As a result of this study there was no difference found between musculoskeletal pain and activity prevention, exercise behavior, decision-making balance cons scores and physical activity levels among those who have received and have not received posture and ergonomics training. Our results showed that there is a need for further studies to be conducted with longer training durations.

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