



Evaluation of Musculoskeletal Disorders and the Effect of Ergonomic Conditions in Karadeniz Technical University Students Receiving Distance Education Due to COVID-19

COVID-19 Nedeniyle Uzaktan Eğitim Alan Karadeniz Teknik Üniversitesi Öğrencilerinde Kas İskelet Sistemi Rahatsızlıkları ve Ergonomik Koşulların Etkisinin Değerlendirilmesi

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ABSTRACT

Objective: The aim of the study was to evaluate the effects of musculoskeletal disorders (MSDs) and ergonomic conditions in Karadeniz Technical University students who received distance education due to coronavirus disease-2019 (COVID-19).

Methods: The population of this descriptive study consisted of 33,219 students at Karadeniz Technical University. Three hundred two university students selected using the convenience sampling method were included in the study by completing the questionnaire completely. Participation in the research was based on volunteering. The questionnaire consisted of sociodemographic and personal characteristics, online education and work environment characteristics, Cornell Musculoskeletal Disorders Questionnaire and International Physical Activity Questionnaire Short Form.

Results: The mean of participants' Total Cornell Score was 76.6 ± 97.3 (0-624). The chairs used by 205 (67.9%) of the participants during the lesson did not have wheels and 360° rotation feature. Total Cornell Score of the participants without head-neck and lumbar support was statistically significantly higher than those with head-neck and lumbar support (p values were 0.009 and 0.006, respectively). The Total Cornell Score was statistically significantly higher in the participants who could not put their feet on the ground completely while sitting on the chair compared to the participants who could keep their feet on the ground completely (p=0.018). The Total Cornell Score was statistically significantly lower in those who

ÖZ

Amaç: Çalışmanın amacı, koronavirüs hastalığı-2019 (COVID-19) nedeniyle uzaktan eğitim alan Karadeniz Teknik Üniversitesi öğrencilerinde kas-iskelet sistemi rahatsızlıklarının ve ergonomik koşulların etkilerini değerlendirmektir.

Yöntemler: Tanımlayıcı tipteki bu araştırmanın evrenini Karadeniz Teknik Üniversitesi'nde eğitimine devam eden 33.219 öğrenci oluşturmaktadır. Kolayda örnekleme yöntemiyle seçilen 302 üniversite öğrencisi anketi eksiksiz doldurarak çalışmaya dahil edilmiştir. Araştırmaya katılım gönüllülük esasına dayanmaktadır. Anket, sosyodemografik ve kişisel özellikler, çevrimiçi eğitim ve çalışma ortamı özellikleri, Cornell Kas-iskelet Sistemi Rahatsızlıkları Anketi ve Uluslararası Fiziksel Aktivite Anketi Kısa Formu'ndan oluşmaktadır.

Bulgular: Katılımcıların Toplam Cornell Puanı ortalaması $76,6 \pm 97,3$ (0-624) idi. Katılımcıların 205'inin (%67,9) ders sırasında kullandığı sandalyenin tekerlek ve 360° dönebilme özelliği yoktu. Baş-boyun ve bel desteği olmayan katılımcıların Toplam Cornell Skoru, baş-boyun ve bel desteği olanlara göre daha yüksek ve istatistiksel olarak anlamlı idi (p değerleri sırasıyla 0,009 ve 0,006). Sandalyede otururken ayağını tam olarak yere basamayan katılımcıların Toplam Cornell Skoru, ayaklarını tamamen yere basabilen katılımcılara göre daha yüksek ve istatistiksel olarak anlamlı idi (p=0,018). Ders sırasında kullanılan odanın aydınlatması yeterli olanlarda olmayanlara göre Toplam Cornell Skoru daha düşük ve

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had adequate lighting in the room used during the lesson than those who did not have ($p=0.028$).

Conclusion: This study showed the importance of providing ergonomically appropriate conditions in the working environment in order to prevent musculoskeletal disorders.

Keywords: Ergonomics, musculoskeletal disorders, COVID-19, distance education, online learning

istatistiksel olarak anlamlı bulunmuştur ($p=0,028$).

Sonuç: Bu çalışma, kas iskelet sistemi rahatsızlıklarını önlemek için çalışma ortamında ergonomik olarak uygun koşulların sağlanmasının önemini göstermiştir.

Anahtar Sözcükler: Ergonomi, kas-iskelet sistemi rahatsızlıkları, COVID-19, uzaktan eğitim, çevrimiçi öğrenim

Introduction

Musculoskeletal disorders (MSDs) are defined as conditions that can occur as a result of single trauma such as fractures, sprains and strains or cumulative trauma such as nerve compression disorders (carpal tunnel syndrome etc.), osteoarthritis and rheumatoid arthritis. They cover a wide range of inflammatory and degenerative conditions affecting muscles, ligaments, tendons, nerves, bones and joints (1). They are characterized by pain (usually permanent) and limitations in mobility, dexterity, and general functioning which causes varying degrees of deterioration in the quality of life of individuals (2).

The MSD is among the leading causes of morbidity all over the world. The 2019 analysis of Global Burden of Disease data showed that approximately 1.71 billion people worldwide had MSD (2). Low back pain and other musculoskeletal conditions are among the 10 causes with the largest absolute increases in Disability Adjusted Life Years (DALY) between 1990 and 2019 and are common from young to older age. In addition, between 1990 and 2019, an increase by 30.7% was found in age-standardized DALY for other MSDs (3). According to the data of the "National Burden of Disease Study" conducted in Turkey in 2013, the burden of disease due to low back and neck pain among non-communicable diseases increased by 37% between 2000 and 2013 (4).

Repetitive situations such as keyboard and mouse use, static position and wrong body posture may cause MSDs in computer users (5). Although working in a sitting position does not require much physical effort, working in long-term and inappropriate body postures can lead to MSDs. (6). Many studies involving office workers using computers have shown that prolonged sitting and computer use cause MSDs and exacerbate existing problems. Madhwani and Kishare. (7) reported that employees with 4-7.5 hours of sitting time had significantly more MSD symptoms than those who worked 2-4 hours.

In addition, the physical conditions of the working environment and the ergonomic inappropriateness of the tables, chairs and other equipment used can lead to the formation of MSD. Korhonen et al. (8) reported that physical characteristics such as the lighting, temperature and size of the working environment were associated with neck pain. In a systematic review by van Niekerk et al. (9), it was shown that ergonomic chair intervention with adjustable features reduced MSDs in desk workers.

The daily habits, working and educational conditions of millions of people have changed drastically due to the measures taken within the scope of combating the coronavirus disease 2019 (COVID-19) pandemic. The distance education process has started in schools all over the world in different forms and levels. With the decision taken by the Council of Higher Education in our country, universities have started distance education within their capacity as of March 23, 2020 (10). In a study examining the risk factors of MSD related to ergonomic conditions and working style in distance education students, Edwar et al. (11) reported that limited workplace support and working posture were effective on MSD. Karingada and Sony. (12) stated that approximately 80% of the students experienced some MSD symptoms in the head, neck and eyes since they started online learning.

In this study, it was aimed to evaluate the effects of MSDs and ergonomic conditions in Karadeniz Technical University students who received distance education due to COVID-19.

Methods

Research Population

The population of this descriptive study consisted of 33,219 students continuing their education at Karadeniz Technical University. Students continued their education by distance education from March 23, 2020 until July 18, 2021. This process took approximately 16 months. Participants to be included in the study were selected using convenience sampling method. In this study, which was based on volunteerism, the question "Do you want to participate in the study?" was asked at the beginning of the questionnaire. Three hundred two university students who volunteered to participate in the study by answering "yes" and completed the form completely were included in the study.

Data Collection

A survey form developed by the researchers was used as a data collection tool. This form was converted into an online survey form via SurveyMonkey. The link of the online survey form was sent to the e-mail addresses of the students registered in the system via Karadeniz Technical University Data Processing Center. Reminders were made via e-mail addresses 15 days after the questionnaire was sent. Data collection was carried out between 31.05.2021 and 18.07.2021.

The questionnaire form used in the research consisted of 4 parts.

Sociodemographic and personal characteristics: In this section, gender, age, school and class of education, height, weight, smoking and chronic disease status, refractive errors in the eyes and use of glasses/lenses were questioned.

Online education and working environment features: The average daily online course duration, the place where the lecture is attended, the technological device used to listen to the lecture, and the use of an external keyboard were questioned. It was questioned whether the lighting of the room and size of the desk and chair used to attend the lesson were appropriate for studying. The chair used during the lesson was questioned in terms of existence of wheels, 360-degree rotation, height adjustment, adjustment of back inclination, lumbar support, head and neck support, and presence of armrest.

Cornell musculoskeletal disorders questionnaire: It was developed at Cornell University to evaluate MSD (13). Turkish validity and reliability study was performed by Erdinç et al. (14) in 2008. It evaluates the frequency and severity of pain, aches or discomfort in 11 different body parts in the last 7 days and whether it interferes with ability to work. The answers for the frequency of feeling pain are “never, 1-2 times a week, 3-4 times a week, at least once a day, many times a day” and they are scored as 0, 1.5, 3.5, 5 and 10, respectively. The options for pain intensity are “mild, severe, very severe” and hindrance to work is evaluated by multiplying the answers “not at all, a bit of a hindrance, a lot of hindrance” by 1, 2, 3, respectively. The Total Cornell Score, which shows the MSDs, is calculated by adding the scores calculated separately for each region. The Total Cornell Score is scored between 0-1620, and as the score increases, the frequency and severity of MSD and the state of being prevented from doing work increases.

International Physical Activity Questionnaire Short Form: It was developed by Craig et al. (15) but diverse physical activity measures in use prevent international comparisons. The International Physical Activity Questionnaire (IPAQ in 2003 to determine the level of physical activity. Turkish validity and reliability studies were performed by Öztürk (16) in 2005. The questionnaire includes questions about physical activity performed for at least 10 minutes in the last 7 days. Information is provided on how many days in the last 7 days, and for how long per day, vigorous activities, moderate-intensity activities and walking have been done. In the last question, the time spent sitting without moving daily in the last 7 days is questioned in minutes. The MET method is used to determine the level of physical activity. The standard MET values for these activities were determined by Craig et al. as 3.3, 4.0 and 8.0 for walking, moderate-intensity activity, and vigorous activity, respectively. A score is obtained as “MET minutes/week” by multiplying the minute, day and MET value (multiples of resting oxygen consumption). The total activity score is obtained by adding the walking score ($3.3 * \text{walking time} * \text{number of days walked}$), moderate activity score ($4.0 * \text{duration of moderate-intensity activity} * \text{days of moderate-intensity activity}$) and vigorous activity score ($8.0 * \text{duration of vigorous activity} * \text{number of days of vigorous activity}$). According to the total activity score,

the physical activity level is inactive if <600 MET-minutes/week, minimally active if $600-3,000$ MET-minutes/week and very active level if $>3,000$ MET-minutes/week.

Statistic Analysis

Body mass index (BMI) was calculated using the height and weight of the participants. According to the World Health Organization criteria, BMI is classified as <18.5 , $18.5-24.9$, $25.0-29.9$, >30.0 respectively, as underweight, normal weight, overweight and obese (17). The IBM Statistics for Windows SPSS 22.0 statistical package program (SPSS) was used in the analysis of the data. Descriptive statistics; numbers and percentages are given for categorical variables, mean, standard deviation (SD), minimum and maximum values are given for numerical variables. The conformity of the data to the normal distribution was evaluated by visual (histogram and probability graphs) and analytical (Kolmogorov-Smirnov or Shapiro-Wilk tests) methods. Mann Whitney U or Kruskal Wallis Analysis of Variance was used in the analysis of the measurement data. In all statistical analyses, the significance value was accepted as $p<0.05$.

Permissions for the Study

Permission for the research was obtained from the Ethics Committee of Karadeniz Technical University Faculty of Medicine (dated 21.04.2021 and numbered 24237859-378) and the Rectorate of Karadeniz Technical University (dated 10.03.2021 and numbered 44710342-929-12694).

Results

The mean of the participants' Total Cornell Score \pm SD was calculated as 76.6 ± 97.3 (0-624). The mean age of the participants was 22.0 ± 3.2 (18.0-53.0), 141 (46.7%) of them were women. Total Cornell Score of women was significantly higher than men ($p<0.001$). The sociodemographic and personal characteristics of the participants affecting the Total Cornell Score are presented in Table 1.

Of the participants, 63 had chronic disease. Chronic diseases of the participants were;

MDS in 19 (30.2%), respiratory system diseases in 11 (17.5%), psychiatric diseases in 9 (14.3%), endocrine diseases in 6 (9.5%), digestive system diseases in 6 (9.5%), migraine in 5 (7.9%), kidney diseases in 4 (6.3%), allergic diseases in 3 (4.8%), immune system diseases in 3 (4.8%), cardiovascular system diseases in 2 (3.2%) and dermatological diseases in 2 (3.2%). The daily lesson duration of the participants on average was 3.4 ± 2.3 (0.3-12) hours. There was no significant difference between the daily lesson time and the Total Cornell Score. Distance education and working environment characteristics affecting the Total Cornell Score of the participants are presented in Table 2.

The chairs used by 205 (67.9%) of the participants during the lesson did not have wheels and the Total Cornell Score of the participants who did not use a chair with wheel was found to be higher than those who used it ($p=0.046$). The features of the chairs used during the lesson that affect the Total Cornell Score are presented in Table 3.

Discussion

The COVID-19 pandemic has caused many changes in lifestyles. As a result of the measures implemented, the education of the students continued in the form of distance education. Therefore, as a result of not providing ergonomic conditions at home, students have a risk of developing MSD.

Total Cornell Score in women was statistically higher than men. Woo et al. (18) showed that women reported more upper extremity MSD than men. This difference can be explained by the lower body size or muscle mass in women. In addition, the fact that women were more willing to report or seek medical help for pain or discomfort may have affected this result (19,20).

Total Cornell Score of participants with normal BMI was found to be statistically significantly higher than overweight/obese participants. Evaluations made with BMI do not provide detailed information about body composition, such as body fat percentage and lean body mass (21). BMI could be calculated as higher than 24.9 in people with more muscle mass. For this reason, the Total Cornell Score may have been found to be lower in those who were overweight/obese according to BMI, since their muscle mass was higher.

Many studies show that sitting for a long time causes MSD. However, in our study, no significant difference was found

Table 1. Sociodemographic and personal characteristics of the participants affecting the Total Cornell Score (n=302)

Features	Mean ± SD	Min.-max.	Total Cornell Score		p value
			Median	Min.-max.	
Age	22.0 ± 3.2	18.0-53.0			
≤21 years old			51.0	0-624.0	0.077
>21 years old			34.5	0-454.5	
Gender	n	%			
Female	141	46.7	62.0	0-522.0	<0.001
Male	161	53.3	26.5	0-624.0	
BMI	n	%			
Underweight	21	7.0	51.0	3.0-280.0	0.029
Normal weight	188	62.3	52.0 ^a	0-624.0	
Overweight	65	21.5	30.5 ^b	0-258.0	
Obese	28	9.3			
Smoking	n	%			
Yes	66	21.9	53.0	0-624.0	0.370
No	199	65.9	45.5	0-522.0	
Quitted	37	12.3			
	Mean ± SD	Min.-max.			
Pack year of cigarettes (n=66)	3.4 ± 3.7	0-18.0			
≤2 packs/year			82.0	1.5-462.0	0.110
>2 packs/year			43.7	0-624.0	
Chronic disease status	n	%			
Yes	63	20.9	62.0	0-522.0	0.051
No	239	79.1	43.5	0-624.0	
Eye refractive error	n	%			
Yes	131	43.4	47.0	0-522.0	0.585
No	171	56.6	47.0	0-624.0	
Use of glasses/lenses (n=131)	n	%			
Yes	116	88.5	47.0	0-522.0	0.942
No	15	11.5	49.0	0-434.0	
Physical activity level	n	%			
Inactive	122	40.4	47.2	0-624.0	0.859
Minimally active	112	37.1	42.5	0-522.0	
Very active	68	22.5	49.5	0-447.5	

^{a,b}Significant difference was found between different letters, SD: Standard deviation, Min: Minimum, max: Maximum

Table 2. Distance education and working environment characteristics that affect the Total Cornell Score of the participants

Features	Mean ± SD	Min.-max.	Total Cornell Score		p value
			Median	Min.-max.	
Daily lesson duration (hours)	3.4 ± 2.3	0.3-12.0			
≤3 hours			45.5	0-624.0	0.941
>3 hours			49.0	0-522.0	
Duration of a lesson	38.0±27.5	0-180.0			
≤40 minutes			47.0	0-522.0	0.858
>40 minutes			47.0	0-624.0	
Location when attending lectures	n	%			
Study desk	235	77.8	43.5	0-522.0	0.353
Sofa-armchair	29	9.6			
Dinner table	20	6.6	51.0	0-624.0	
Bed	18	6.0			
Technological product mostly used while joining lectures					
Laptop	235	77.8	47.0	0-522.0	0.489
Mobile phone	32	10.6	50.7	0-624.0	
Desktop computer	29	9.6	39.0	0-274.5	
Tablet	6	2.0	17.0	4.5-624.0	
Using an external keyboard					
Yes	79	26.2	29.0	0-454.5	0.024
No	223	73.8	51.5	0-624.0	
Phone/tablet holder use (n=38)*					
Yes	10	26.3	66.0	0-450.0	0.497
No	28	73.7	45.7	0-624.0	
Evaluation of the physical environment used while studying by the participants					
Comfort of the desk					
Yes	132	43.7	33.2 ^a	0-522.0	<0.001
Partially	109	36.1	52.0 ^b	0-462.0	
No	61	20.2	56.5 ^b	0-624.0	
Comfort of the chair					
Yes	88	29.1	32.5 ^a	0-522.0	0.007
Partially	107	35.4	47.0 ^b	0-462.0	
No	107	35.4	51.0 ^b	0-624.0	
Suitability of room lighting					
Yes	180	59.6	43.2 ^a	0-522.0	0.028
Partially	77	25.5	49.0	0-462.0	
No	45	14.9	70.0 ^b	0-624.0	
Reflection on the screen of the technological device					
Yes	72	23.8	51.5	0-624.0	0.131
Partially	63	20.9	52.0	0-434.0	
No	167	55.3	43.5	0-522.0	
Adequacy of room size					
Yes	207	68.5	42.5 ^a	0-522.0	0.015
Partially	56	18.5	69.3 ^b	0-447.5	
No	39	12.9	74.5 ^b	0-624.0	

*Participants who mostly use phones or tablets answered.
^{a,b}Significant difference was found between different letters.
 SD: Standard deviation, Min: Minimum, max: Maximum

between the daily lesson time and the Total Cornell Score. In a study conducted by Karingada and Sony (12) on university students, daily online learning hours of students were found to be positively correlated with MSD symptoms in some body regions.

The Total Cornell Score was found to be statistically lower in those whose room used during the lesson was adequately lit than in those whose room was not adequately lit, and in those whose room size was sufficient compared to those whose room was partially adequate or not. D'Errico et al. (22) reported

Table 3. The features of the chair used during the lesson that affect the Total Cornell Score

Features	n	%	Total Cornell Score		p value
			Median	Min.-max.	
Wheel presence					
Yes	97	32.1	37.0	0-454.5	0.046
No	205	67.9	49.0	0-624.0	
Number of wheels (n=97)	Mean ± SD	Min.-max.			
	4.8 ± 0.7	3.0-6.0			
Ergonomically suitable (5 wheels)			30.5	0-454.5	0.211
Ergonomically unsuitable			53.0	0-366.0	
360° rotation	n	%			
Yes	97	32.1	35.0	0-454.5	0.045
No	205	67.9	49.0	0-624.0	
Height adjustable					
Yes	98	32.5	38.0	0-454.5	0.081
No	204	67.5	49.0	0-624.0	
Keeping the feet flat on the floor while sitting in the chair					
Yes	251	83.1	45.5	0-624.0	0.018
No	51	16.9	80.0	0-46.0	
The height of the back is high enough to support the head and neck region					
Yes	61	20.2	29.5	0-299.0	0.029
No	241	79.8	49.0	0-624.0	
Has head and neck support					
Yes	28	9.3	17.5	0-299.0	0.009
No	274	90.7	47.75	0-624.0	
Suitability of the head and neck support for the individual (n=28)					
Yes	24	85.7	12.7	0-299.0	0.066
No	4	14.3	63.7	24.0-280.0	
Having lumbar support					
Yes	109	36.1	33.0	0-522.0	0.006
No	193	63.9	51.5	0-624.0	
Suitability of the lumbar support to the individual (n=109)					
Yes	56	51.4	17.7	0-299.0	0.001
No	53	48.6	54.0	1.5-522.0	
Adjustable back inclination					
Yes	44	14.6	32.5	0-299.0	0.045
No	258	85.4	47.5	0-624.0	
Having arm rest					
Yes	124	41.1	41.5	0-624.0	0.116
No	178	58.9	51.2	0-522.0	
Adjustable armrest (n=124)					
Yes	13	10.5	17.0	0-91.0	0.184
No	111	89.5	43.0	0-624.0	

SD: Standard deviation, Min: Minimum, max: Maximum

that neck and shoulder symptoms were more common in participants with insufficient desk lighting. Insufficient lighting may cause movements that will disrupt body posture, such as approaching and leaning towards the screen in order to provide a better view, and MSD can develop as a result of the repetition of these movements. In the study conducted by Helland et al., more MSD was reported in participants with a small study room size (23). The small size of the room may cause musculoskeletal discomfort by preventing people from using sufficiently large tables, chairs and other equipment and reducing the distance they can move.

Laptops have a compact screen and keyboard. For this reason, when people adjust the screen height in the appropriate position, the keyboard may remain in an ergonomically unsuitable position. In addition, tablets and mobile phones often do not have a keyboard, which can cause fingers to bend while typing. For these reasons, the use of an external keyboard may contribute to the prevention of MSD. In this study, the Total Cornell Score of the participants who did not use an external keyboard was found to be higher than the participants who used it. In the study by Madhwani et al. (24), the use of external keyboard and mouse was found to be associated with MSD.

In a study by Malińska et al. (25), it was stated that the size and shape of the back support, and the use of a chair that would provide a comfortable position, reduced low back and neck pain in women. The Total Cornell Score of the participants whose chair back height was high enough to support the head-neck region and who had head-neck region support was found to be lower. This can be explained by supporting the neck area, preventing the neck from being in an inappropriate position, and reducing the stress on the neck muscles.

Small changes in the chair's back inclination angle significantly affect the load that the upper body must bear. Adjusting the chair back inclination angle can ensure that the upper body, extremities, head and neck are kept in the desired position with less muscle strength requirement (26). The Total Cornell Score of the participants whose chair can rotate 360 degrees and back inclination can be adjusted was found to be lower.

Working chair with ergonomic adjustable features is important in terms of protecting the health of the musculoskeletal system by complying with the anthropometry of the person. While sitting, the intervertebral discs, muscles and ligaments have to bear the load of the lumbar vertebrae. The chair's lumbar support reduces the stress on these structures (27). The Total Cornell Score of the participants who had lumbar support in the chair and thought that the lumbar support was suitable for their body was found to be lower. The Total Cornell Score of the participants who could not touch the ground completely while sitting on the chair was found to be higher than those who could touch it completely. In the study conducted by Kaya Aytutuldu et al. (28), it was stated that approximately 50% of the participants with pain in the lower back, neck and upper extremities did

not touch the ground while sitting. The fact that the chair has 5 wheels can help reduce muscle stress by providing balanced and easy movement. Total Cornell Score of the wheelchair users was lower. However, no significant difference was found with the use of an ergonomic 5-wheel chair. In the study conducted by Malińska et al. (25), it was found that the use of a 5-wheel ergonomic chair reduced the risk of neck and low back pain.

Conclusion

In this study, gender, body mass index, use of an external keyboard, the comfort of the desk and chair used during the lesson, the size of the room and the adequacy of the lighting, and the fullness of the feet while sitting in the chair were found to be effective in the formation of musculoskeletal disorder (MSD). In addition, features of the chairs such as being wheeled, having 360 degree rotation, height of the back to support the head and neck region, presence of head, neck and lumbar support, the conformity of the lumbar support to the body and adjustable back inclination were found to be effective in the formation of MSD. However, refractive error in the eye, duration of the daily lesson and physical activity level were not found to be effective in the formation of MSD.

This study showed the importance of providing ergonomically appropriate conditions in the working environment in order to prevent the occurrence of MSD. The use of foot support to ensure that the feet are fully on the ground while sitting and providing head, neck and lumbar support will reduce the risk of MSD. It would be beneficial to use an external keyboard to prevent ergonomically unsuitable postures. It is thought that improving the physical properties of the working environment such as size and lighting will also be effective in preventing the occurrence of MSD.

Ethics

Ethics Committee Approval: Permission for the research was obtained from the Ethics Committee of KTU Faculty of Medicine (dated 21.04.2021 and numbered 24237859-378) and the Rectorate of KTU (dated 10.03.2021 and numbered 44710342-929-12694).

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Concept: Ü.Ö., K.Ş., M.G.Ü., M.T., N.E.B., Design: Ü.Ö., K.Ş., M.G.Ü., M.T., N.E.B., Data Collection or Processing: Ü.Ö., Analysis or Interpretation: Ü.Ö., K.Ş., M.G.Ü., M.T., N.E.B., Literature Search: Ü.Ö., K.Ş., M.G.Ü., Writing: Ü.Ö., K.Ş., M.G.Ü., M.T., N.E.B.

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