Received: 19 Feb 2023 | **Accepted:** 15 May 2023 **Genel Tıp Derg. Volume** 33/**Issue** 3 (June), 316-321
DOI: 10.54005/geneltip.1253098

ORIGINAL ARTICLE

The Relationship of Musculoskeletal System Disorders with Sleep Quality Among Office Workers

Ofis Çalışanlarında Kas İskelet Sistemi Rahatsızlıklarının Uyku Kalitesi ile İlişkisi

[1]Fatih Okan

[1]Tokat Gaziosmanpasa University, Faculty of Health Science, Public Health Nursing Department. Tokat, 60250, Türkiye.

Correspondence

Fatih Okan, Tokat Gaziosmanpasa University Faculty of Health Science, Taşlıçiftlik Campus, 60250, Tokat,Türkiye.

E-Mail: ftthokn@yahoo.com

How to cite ?

Okan F. The Relationship of Musculoskeletal System Disorders with Sleep Quality among Office Workers. Genel Tıp Dergisi. 2023; 33(3)316-321.

ABSTRACT

Objective: The aim of the study was to evaluate the musculoskeletal pain frequency and relationships of musculoskeletal pain with the sleep quality among office workers.
Material and Methods: This cross-sectional study included 186 office workers evaluated between April-August 2022. The data were obtained from the socio-demographic characteristics information form, the Extended-Nordic Musculoskeletal Questionnaire, and the Pittsburgh Sleep Quality Index.
Results: It was found that 83.3% of office workers had musculoskeletal pain and 74.7% had poor sleep quality. Knee pain (p=0.016; OR=3.670; 95% CI = 1.280-10.342) and lower back pain (p=0.003; OR=4.380; 95% CI= 1.680-11.517) were significant predictors of poor sleep quality. There was a moderate positive correlation between the number of body areas where the pain was reported and the PSQI score (r: 0.367, p<0.001). The presence of poor sleep quality was significantly higher among those who reported musculoskeletal pain than those who did not (p=0.001).
Conclusion: Musculoskeletal pain is common among office workers and associated with poor sleep quality. Factors that can cause the development of poor sleep quality and musculoskeletal pain among office workers should be identified, and preventive and therapeutic strategies should be developed.

Keywords: Musculoskeletal System, Pain, Sleep Quality, Workers

ÖZ

Amaç: Çalışmada ofis çalışanlarında kas iskelet sistemi ağrısı sıklığının ve kas iskelet sistemi ağrıları ile uyku kalitesi arasındaki ilişkinin değerlendirilmesi amaçlandı.
Gereç ve Yöntem: Kesitsel tipte planlanan çalışmaya Nisan-Ağustos 2022 tarihleri arasında bir üniversite kampüsünde çalışan 186 ofis çalışanı dahil edildi. Bireylere araştırmacı tarafından oluşturulan veri toplama formu, Genişletilmiş Nordic Kas İskelet Sistemi Anketi ve Pittsburgh Uyku Kalitesi İndeksi formları uygulandı.
Bulgular: Ofis çalışanlarının %83.3'ünün kas iskelet sistemi ağrısına sahip olduğu ve %74.7'sinin uyku kalitesinin kötü olduğu tespit edildi. Diz ağrısının (p=0.016; OR=3.670; 95% CI= 1.280- 10.342) ve bel ağrısının (p=0.003; OR=4.380; 95% CI= 1.680- 11.517) anlamlı şekilde kötü uyku kalitesinin prediktörü olduğu saptandı. Ağrının bildirildiği vücut bölgelerinin sayısı ile PSQI puanı arasında orta düzeyde pozitif korelasyon tespit edildi (r: 0.367, p<0.001). Kas-iskelet sistemi ağrısı bildirenlerde kötü uyku kalitesi varlığı, bildirmeyenlere göre anlamlı şekilde daha yüksekti (p=0,001).
Sonuç: Kas iskelet sistemi ağrıları ofis çalışanlarında oldukça yaygınıdır. Kas iskelet sistemi ağrıları kötü uyku kalitesi ile ilişkilidir. Ofis çalışanlarında kas iskelet sistemi ağrısı ve kötü uyku kalitesi gelişimine neden olabilecek faktörler belirlenmeli; önleyici ve tedavi edici stratejiler geliştirilmelidir.

Anahtar Kelimeler: Kas İskelet Sistemi, Ağrı, Çalışanlar, Uyku Kalitesi

Introduction

Work-related musculoskeletal disorder (MSD) is one of the most common occupational disease worldwide and has been recognized as an important problem since the 17th century (1). Musculoskeletal disorders are conditions that affect the musculoskeletal system and are associated with impaired physical function and pain (2). Musculoskeletal system disorders are observed at a high rate among office workers. Long-term sitting, static postures, repetitive work, computer work, and poor environmental conditions lead to the development of MSD (3). The prevalence of MSD among office workers was reported as 28.2%-58.1% in the lower back, 22.9%-49% in the neck, 37.8%-41.5% in the upper back, and 18.8%-50.2% in the shoulders (4-6). Musculoskeletal pain (MSP) can negatively affect subjective sleep quality and cause sleep disturbance due to persistent pain. Poor sleep quality makes MSP worse, resulting in a vicious cycle of sleep disturbance and pain (7). Sleep disturbance can also impair the mental-physical health of employees, leading to anxiety or depression, lower daytime functions and quality of life, higher work-related accidents and reduced job success among employees (8).

In this study, it was aimed to evaluate the frequency of MSD among office workers and their relationship with sleep quality.

Material and Methods

Study Design: The cross-sectional study was conducted with 186 office workers at a university campus between April 2022 and August 2022.

Research Universe and Sample: The universe of the study consisted of 400 office workers aged 18 and over who had been working at the Tokat Gaziosmanpaşa University campus for at least 1 month. Based on

Peer-Review: Double anonymized - Two External
Plagiarism Checks: Yes - iThenticate
Complaints: geneltip@selcuk.edu.tr

a similar study (9), the minimum sample size was calculated as 186 office workers with an error rate of 0.05 and a power of 0.90 (PASS 2015). For the selection of the sample, a list of 400 office workers was created, and 204 office workers were invited to the study with the help of computerized random numbers taking into account a 10% unresponsiveness rate. Exclusion criteria were malignancy, neuropathic pain, inflammatory rheumatic disease, sleep apnea syndrome, chronic obstructive pulmonary disease, psychiatric disease, previous orthopedic surgery, and use of sleeping pills. Five individuals with chronic disease-related pain, three with inflammatory rheumatic disease, one using sleeping pills and nine individuals with missing data collection forms were excluded (Figure 1).

Data Collection Method: The socio-demographic characteristics information form created by the researcher, the Pittsburgh Sleep Quality Index (PSQI) and the Extended Nordic Musculoskeletal System Questionnaire (NMQ-E) were distributed to the individuals selected for sampling during working hours, and the forms filled out by the office workers themselves were collected at the end.

Data Collection Tools

Socio-demographic characteristics information form consists of 15 questions regarding the demographic and clinical characteristics of the participants.

PSQI evaluates an individual's sleep quality in the last 30 days and consists of 24 questions in total. Each question is evaluated on a scale of 0 to 3. Those with a total score of 5 or lower had "good" sleep quality while those with a score of > 5 are considered "poor" in sleep quality (10).

NMQ-E was used to evaluate MSD. NMQ-E asks yes/ no questions regarding whether there has been ache, pain, or discomfort in nine body areas so far, within the last 12 months, within the last four weeks, and on the day of the assessment (11).

Ethical Considerations: Before the study, institutional and ethical permissions were obtained from the Tokat Gaziosmanpaşa University Social and Human Science Research Ethics Committee (04.2022:07.27). Participating office workers were informed about the aim and scope of the research and their written and verbal informed consents were obtained. The study was carried out in accordance with the principles of the Declaration of Helsinki.

Statistical analyses: Analyses of the data obtained in the research were carried out using SPSS software (Version 22.0, SPSS Inc., Chicago, IL, USA). Frequency distributions of categorical data are reported as numbers and percentages while descriptive statistics are presented as mean ± standard deviation for normally distributed continuous data. The normality of the distribution was examined by Kolmogorov–Smirnov test. For the comparison of two independent sample means of continuous variables, the significance test of the difference between the two means was used when parametric test assumptions were satisfied. Spearman's correlation coefficient was used to examine the correlation between the variables. The chi-square test was used for ratio comparisons of the study groups for categorical variables. Logistic regression analysis was employed to determine the risk factors. A value of $p < 0.05$ was considered statistically significant.

Results

The study included 57 female and 129 male desk office workers with an average age of 43.02 ± 8.51 years. The mean working time was 17.51 ± 9.20 years, and the daily time spent in front of the computer was 7.04 ± 1.99 hours. It was found that 83.3% of office workers (n:155) had MSP and 74.7% (n:139) had poor sleep quality. It was also found that 25.8% (n:48) of the employees took sick leave due to MSP, and 24.7% (n:46) were prevented from doing their normal work (data not shown in the table).

The percentage of women reporting MSP (94.7%) was significantly higher than that of men (78.3%) (p=0.003). The mean PSQI score was significantly higher among those who reported MSP (7.81 ± 2.80) compared to those who did not (5.23 ± 2.61) (p=0.001). The frequency of poor sleep quality was significantly higher among those who reported MSP (91.4%) (p=0.001). There was no significant difference between those with or without MSP for the education status, living place, marital status, smoking, alcohol use, presence of chronic disease, physical activity status, body mass index (BMI), age, length of employment and daily time spent on the computer (p>0.05) (Table 1).

A comparison of PSQI scores of patients grouped based on the body area where MSP was reported is presented in Table 2. The mean PSQI scores of those who had pain in the neck, shoulder, lower back, knee, and ankle were significantly higher than those without pain in those areas (p = 0.041, p = 0.001, p = 0.001, p = 0.001, p = 0.042, respectively). The mean PSQI scores of those with and without pain in the elbow, wrist, upper back, and hip region, on the other hand, were similar (p>0.05, Table 2).

It was revealed that 48.9% of the individuals participating in the study had pain in the neck, 45.2% in the lower back, 29.6% in the shoulder, 29.6% in the knee, 25.8% in the upper back, 23.7% in the ankle, 15.6% in the wrist, 14.5% in the hip and 8.6% in the elbow. Of the individuals included in the study, 25.8% (n=48) reported pain in one body area, while 3.2% reported pain in nine body regions. There was a moderate positive correlation between the number of body areas where the pain was reported and the PSQI score (r=0.367, p<0.001) (Figure 2).

Binary logistic regression performed on poor sleep quality provided a significant model (likelihood ratio: chi-squared 176.777, p < 0.006, Negelkerke's R2=0.243). Results showed that knee pain (p=0.016; OR=3.670; 95% CI = 1.280-10.342) and lower back pain (p=0.003; OR=4.380; 95% CI= 1.680-11.517) were significant predictors of poor sleep quality (Figure 3). Gender, ankle pain, hip pain, wrist pain, elbow pain, upper back pain, shoulder pain, neck pain, total time

spent in front of the computer, alcohol consumption, ex-smoker, and current smoker status, BMI, and age were not significant predictors of poor sleep quality (p>0.05).

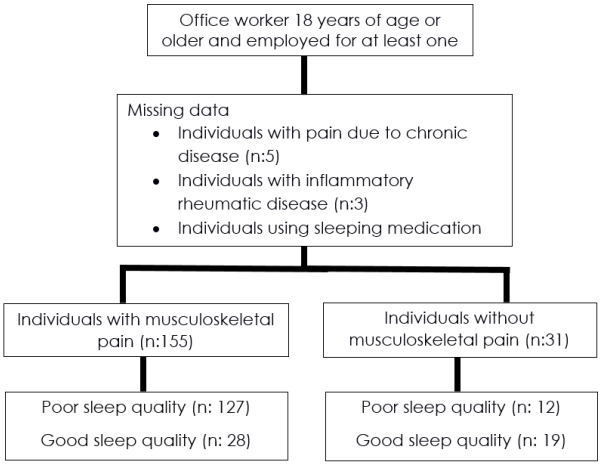

Figure 1. The study flowchart

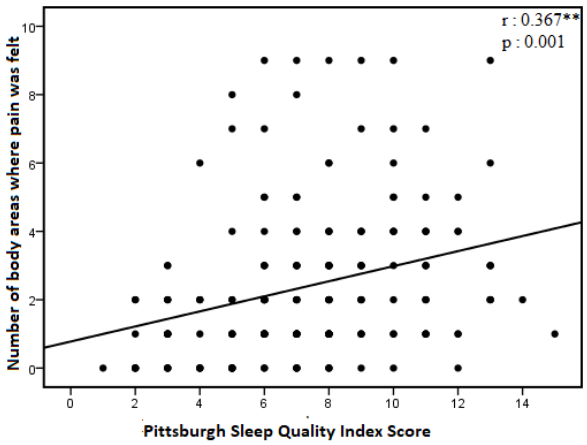

Figure 2. Relationship between PSQI score and the number of body areas where pain was felt. Spearman's correlation coefficient was used. **Correlation is significant at 0.01 level (two-tailed).

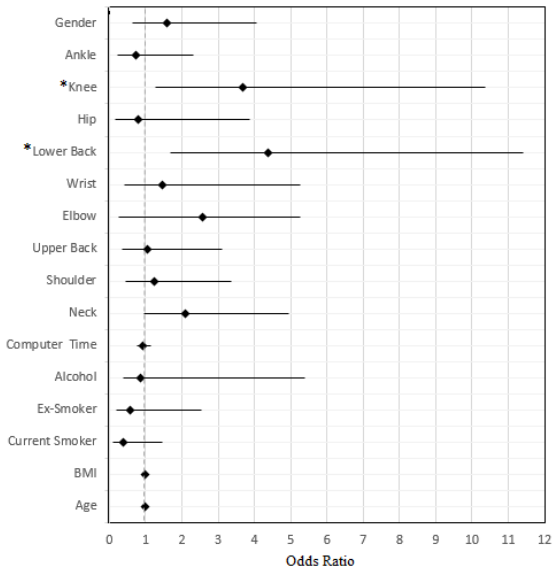

Figure 3. Predictors of poor sleep quality.

Binary logistic regression model dependent variable: poor sleep quality, good sleep quality. Graphic representation of odds ratio and relative 95% confidence intervals for each predictor: gender (reference: male), ankle pain (reference: yes), knee pain (reference: yes), hip pain (reference: yes), lower back pain (reference: yes), wrist pain (reference: yes), elbow pain (reference: yes), upper back pain (reference: yes), shoulder pain (reference: yes), neck pain (reference: yes), total time spent in front of the computer, alcohol, ex-smoker and current smoker (reference: non-smoker), BMI, age. *p <0.05 statistically significant

Table 1. Descriptive characteristics of the participants with or without musculoskeletal pain

	Individuals without musculo-skeletal pain	Individuals with musculo-skeletal pain	Test	
	n (%)	n (%)		
Gender	Female	3 (5.3)	54 (94.7)	x^2=7.695* p=0.003
	Male	28 (21.7)	101 (78.3)	
Educational status	Primary school	1 (50.0)	1 (50.0)	
	High school	0 (0.0)	17 (100.0)	x^2=6.056* p=0.109
	College	28 (18.9)	120 (81.1)	
	Graduate	2 (10.5)	17 (89.5)	
Living place	Provincial central town	31 (17.0)	151 (83.0)	x^2=1.476** p=0.479
	District town	0 (0.0)	4 (100.0)	
Marital status	Married	25 (16.8)	124 (83.2)	
	Single	6 (23.1)	20 (76.9)	x^2=2.971* p=0.226
	Widow/Divorced	0 (0.0)	11 (100.0)	
Smoking	Yes	8 (17.6)	52 (82.4)	
	No	19 (13.3)	89 (86.7)	x^2=0.947* p=0.623
	Ex-smoker	4 (22.2)	14 (77.8)	
Alcohol consumption	Yes	3 (15.6)	4 (84.4)	x^2=2.786** p=0.092
	No	28 (42.9)	151 (57.1)	
Chronic disease	Yes	7 (17.1)	116 (82.9)	x^2=0.092* p=0.761
	No	24 (15.2)	39 (84.8)	
Physical activity	Yes	10 (20.8)	38 (79.2)	x^2=0.809* p=0.369
	No	21 (15.2)	117 (84.8)	
Poor sleep quality	Yes	12 (8.6)	127 (91.4)	x^2=25.561* p=0.001
	No	19 (40.4)	28 (59.6)	
Age (years) Mean ± SD	44.16 ± 9.12	42.79 ± 8.40	t= -0.561 p= 0.515	
BMI (kg/m^2) Mean ± SD	26.17 ± 3 .72	26.43 ± 3.84	t= -0.814 p= 0.416	
Length of employment (years) Mean ± SD	17.76 ± 10.10	17.47 ± 9.40	t= -0.018 p=0.985	
Total time spent in front of the computer (hours) Mean ± SD	6.54 ± 2.17	7.13 ± 1.95	t= -1.259 p=0.258	
Pittsburgh Sleep Quality Index Mean ± SD	5.23 ± 2.61	7.81 ± 2.80	t= -4.442 p=0.001	

*Chi-square test was used, **= Fisher's exact test, Student t test was used.

Table 2. PSQI scores based of the reported area of musculoskeletal pain

The area of the body for which musculoske-letal pain was reported	PSQI score (Mean ± SD)	Test	
Neck	Yes	7.82 ± 2.71	t = -2.086 p = 0.041
	No	6.95 ± 3.08	
Shoulder	Yes	8.44 ± 2.82	t = -3.277 p = 0.001
	No	6.93 ± 2.87	
Upper back	Yes	7.77 ± 2.62	t = -1.082 p = 0.281
	No	7.24 ± 3.02	
Elbow	Yes	8.63 ± 2.18	t = -1.792 p = 0.075
	No	7.26 ± 2.97	
Wrist	Yes	7.48 ± 2.23	t = -0.212 p = 0.736
	No	7.36 ± 3.05	
Lower back	Yes	8.30 ± 2.62	t = -4.046 p = 0.001
	No	6.62 ± 2.96	
Hip	Yes	8.37 ± 2.48	t = -1.918 p = 0.057
	No	7.21 ± 2.97	
Knee	Yes	8.67 ± 2.67	t = -4.066 p = 0.001
	No	6.83 ± 2.87	
Ankle	Yes	8.16 ± 2.73	t = -2.043 p = 0.042
	No	7.13 ± 2.95	

Student t test was used.

Discussion

It was found that 83.3% of the individuals participating in the study (n:155) had MSP. Similarly, in a study evaluating the prevalence of MSD among 250 office workers at a university, it was found that 88.4% of office workers had MSD in the last 12 months (12). In a cross-sectional study evaluating bank officials in Kuwait, it was reported that 80% of the participants had MSD in the last 12 months (13). In another cross-sectional study in which 217 office workers were evaluated, the majority of the participants (71.9%) had work-related MSD (5). The view in the previous studies that the frequency of MSP is quite high among office workers was also supported by the present study. The increase in time spent on the computer, inappropriate monitor use and sitting positions, and low physical activity levels (6,14,15) of office workers are associated with an increase in musculoskeletal pain. Among office workers with a high incidence of MSD, driving factors such as ergonomics, duration of employment, time spent on the computer and physical activity level should be investigated and arrangements should be made to take necessary precautions.

In this study, the most common pain areas were neck (48.9%), lower back (45.2%), shoulder (29.6%), and knee (29.6%). Similarly, in a cross-sectional study investigating MSD and related factors among office workers in Iran, it was revealed that the most common areas of MSD were the neck (60.16%), lower back (57.10%) and shoulders (54.03%) (16). In the study conducted with office workers in Turkiye, the prevalence of pain was 67.85% for the neck, 66.33% for the upper back, and 59.49% for the lower back (17). The high frequency of neck pain among office workers could be related to the time spent on the computer, the frequency of breaks, and the posture of workers during computer use (18). In contrast to the studies reporting that the most common pain area was the neck among office workers, one study reported that the most common pain area among office workers was the lower back (19). Computer users often need to maintain an upright posture that requires low-grade trunk muscle contraction, and this can cause lower back pain (20). Unlike other studies (17,21), no significant relationship was found between the time spent on the computer and pain. However, it is known that prolonged sitting can cause prolonged static contraction of the muscles and increase tension on ligaments and muscles and pressure on intervertebral discs (22). Therefore, besides the time spent on the computer, the time spent sitting at a desk, lack of breaks, inappropriate keyboard and monitor use and wrong sitting positions may also cause MSP. Among the individuals reporting MSP in our study, the number of those who performed physical activity was very low. In a systematic review and meta-analysis evaluating the effects of workplace physical activity programs on MSP, it was emphasized that physical activity significantly reduced MSP (23). Therefore, the presence of factors that can cause MSP among office workers should be determined, strategies to prevent pain formation should be developed, and education programs should be planned regarding break times, correct sitting positions, and physical activity benefits.

In the literature, it was reported that MSDs are more common among women (17). Similarly, MSP was more common among women in the present study. Thus, previous studies support our findings by reporting higher rates of MSD among women (17,24). Contrary to this finding, Omokhodion et al. (2003) reported higher work-related MSDs among men (25). This difference between the genders may be related to the fact that workplaces are more likely designed according to the male gender and to anthropometric differences between women and men (26,27). Another reason why women have specific musculoskeletal problems may be related to biology of the female gender. Men and women differ in body size, functional capacity, structure of muscle fibers, cardiovascular endurance and stress level. Endocrine effects, including menstruation, oral contraceptive use, pregnancy, and hysterectomy may increase the risk of musculoskeletal disorders among women (28). A study conducted in Nigeria found that women had the responsibility of managing the household and doing various household chores even after a busy day in the office, and possibly as a result of this, they were reported to be subjected to greater physical exertion, which could cause an increase in MSD (5). Female employees who reported discrimination or sexual harassment at workplace are on average less likely to report very good health than women workers who did not report being exposed to such psychosocial risk (29). Since the frequency of MSP is higher in women, especially female employees should be evaluated for the presence of MSP, physical

and psychosocial effects should be evaluated, and arrangements should be made for women in the working environment.

Individuals reporting MSP in the present study had higher PSQI scores and 81.9% had poor sleep quality. It was found that 74.7% of all employees with or without pain had poor sleep quality. In a study from Turkiye in which individuals working at a desk were evaluated, it was found that 54% of the employees had poor sleep quality (30). In another study evaluating the nutritional status and sleep quality of office workers, it was found that 34.4% of regular office workers and 40.6% of shift workers had poor sleep quality (31). In a study conducted with migrant workers in Myanmar, 62.5% of the workers had poor sleep (32). Considering other studies in the literature, the rate of individuals with poor sleep quality was quite high in our study population. Insufficient sleep was reported to have been associated with leading causes of death, including cerebrovascular disease, cardiovascular disease, diabetes and hypertension, malignant neoplasms, and occupational accidents (33). Therefore, it is necessary to identify individuals with poor sleep quality among university office workers, to examine the factors that may cause this, and to provide education on sleep.

Sleep quality is a crucial factor for health. Poor sleep quality can lead to MSP (34). Insufficient sleep can lead to an increase in both pain and fatigue (35). This is an interactive relationship. The presence of MSP is associated with shorter sleep hours and lower sleep quality (7). In this study, it was found that those who had pain in the shoulder, neck, lower back, knee, and ankle regions had a higher mean PSQI score than those who did not. In addition, it was found that the PSQI score increased as the number of pain regions increased. Logistic regression analysis revealed that poor sleep quality was associated with lower back and knee pain. Supporting this finding, a cross-sectional study evaluating individuals with chronic lower back pain found that the sleep quality of the group with lower back pain was lower (36). It is known that knee pain is also associated with poor sleep quality (37). In another study, a relationship was reported between pain in the upper back, shoulder, and toe joints and poor sleep quality, and the number of painful joints was associated with the total sleep quality score (38). The rate of poor sleep quality was found as 45.9% among individuals with MSP and 23.2% among those without MSP (7). Contrary to these studies, Katsifaraki et al. (2018) found no relationship between PSQI scores and pain. Even in that study, other sleep-related factors such as daytime sleepiness and insomnia were associated with MSD (39). MSP is associated with poor sleep quality. Poor sleep quality, in turn, can also make MSP worse. Sleep has a significant impact on mental health, social well-being and productivity as well as physical health in employees. In addition, insufficient sleep leads to loss of working hours, and insomnia can increase the number of accidents and mistakes in the workplace (40). The office workers who have MSP should be identified and these individuals should be directed to treatment plans in order to provide quality sleep, which is very important for a healthy life, and to break the vicious cycle of sleep disorder -pain.

The study makes an important contribution to the literature in terms of the frequent sleep problems among office workers and the relationship between musculoskeletal pain and sleep problems. However, our study has some limitations. It was not possible to comment on whether the pain or the sleep disturbance was the cause or the result of the vicious circle between these two phenomena since it was planned as a cross-sectional study. In the future, a work plan can be made to evaluate the causality relationship between these two variables. Since the present study was performed on office workers, the results of the study cannot be generalized to other groups of employees. Another limitation was that the job descriptions of office workers were not questioned in detail. Finally, since the study subjects did not have any diagnosed psychiatric disorders, it could not be evaluated whether the sleep disorders were due to psychological reasons accompanied.

In conclusion, MSP is quite common among office workers, especially female employees. MSP is associated with poor sleep quality. Especially knee and lower back pain cause poor sleep quality. Health promotion practices should be planned to prevent MSP among office workers and to improve sleep quality, and employees with MSP should be directed to treatment. Future studies can be planned to investigate both physical and psychosocial factors that may cause sleep disorders in office workers.

References

1.Hoe VC, Urquhart DM, Kelsall HL, Zamri EN, Sim MR. Ergonomic interventions for preventing work□related musculoskeletal disorders of the upper limb and neck among office workers. Cochrane Database Syst Rev 2018; 10(10): CD008570

2.Seeberg KGV, Andersen LL, Bengtsen E, Sundstrup E. Effectiveness of workplace interventions in rehabilitating musculoskeletal disorders and preventing its consequences among workers with physical and sedentary employment: systematic review protocol. Syst Rev 2019; 8(1): 1-7

3.Choobineh AR, Rahimi Fard H, Jahangiri M, Mahmood Khani S. Musculoskeletal injuries and their associated risk factors in office workplaces. Iran Occupat Health 2012; 8(4): 70-80

4.Piranveyseh P, Motamedzade M, Osatuke K, Mohammadfam I, Moghimbeigi A, Soltanzadeh A et al. Association between psychosocial, organizational and personal factors and prevalence of musculoskeletal disorders in office workers. Int J Occup Saf Ergon 2016; 22(2): 267-73

5.Okezue OC, Anamezie TH, Nene JJ, Okwudili JD. Work-Related Musculoskeletal Disorders among Office Workers in Higher Education Institutions: A Cross-Sectional Study. Ethiop J Health Sci 2020; 30(5): 715-724

6.Basakci Calik B, Yagci N, Oztop M, Caglar D. Effects of risk factors related to computer use on musculoskeletal pain in office workers. Int J Occup Saf Ergon 2022; 28(1):269-274

7.Kim BI, Yoon SY, Kim JS, Woo KH, Cho SY, Lee H et al. Factors related with quality on sleep of daytime workers. Ann Occup Environ Med 2018; 30: 63

8.Furuichi W, Shimura A, Miyama H, Seki T, Ono K, Masuya J et al. Effects of Job Stressors, Stress Response, and Sleep Disturbance on

Presenteeism in Office Workers. Neuropsychiatr Dis Treat 2020; 16: 1827-1833

9.Oha K, Animägi L, Pääsuke M, Coggon D, Merisalu E. Individual and work-related risk factors for musculoskeletal pain: a cross-sectional study among Estonian computer users. BMC Musculoskelet Disord 2014; 15: 181

10.Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res 1989; 28(2): 193-213

11.Dawson AP, Steele EJ, Hodges PW, Stewart S. Development and test-retest reliability of an extended version of the Nordic Musculoskeletal Questionnaire (NMQ-E): a screening instrument for musculoskeletal pain. J Pain 2009; 10(5): 517-26

12.Mohammadipour F, Pourranjbar M, Naderi S, Rafie F. Work-related Musculoskeletal Disorders in Iranian Office Workers: Prevalence and Risk Factors. J Med Life 2018; 11(4): 328-333

13.Akrouf QA, Crawford JO, Al-Shatti AS, Kamel MI. Musculoskeletal disorders among bank office workers in Kuwait. East Mediterr Health J 2010; 16(1): 94-100

14.Yüzügüllü D. Musculoskeletal Disorders and Relationship with Physical Activity in Office Workers. Ergoterapi ve Rehabilitasyon Dergisi 2023; 11(1): 19-26

15.Kaya Aytutuldu G, Birinci T, Tarakcı E. Musculoskeletal pain and its relation to individual and work-related factors: a cross-sectional study among Turkish office workers who work using computers. Int J Occup Saf Ergon 2022; 28(2):790-797

16.Besharati A, Daneshmandi H, Zareh K, Fakherpour A, Zoaktafi M. Work-related musculoskeletal problems and associated factors among office workers. Int J Occup Saf Ergon 2020; 26(3): 632-638

17.Ardahan M, Simsek H. Analyzing musculoskeletal system discomforts and risk factors in computer-using office workers. Pak J Med Sci 2016; 32(6): 1425-1429

18.Johnston V, Souvlis T, Jimmieson NL, Jull G. Associations between individual and workplace risk factors for self-reported neck pain and disability among female office workers. Appl Ergon 2008; 39(2): 171-82

19.Celik S, Celik K, Dirimese E, Taşdemir N, Arik T, Büyükkara İ. Determination of pain in musculoskeletal system reported by office workers and the pain risk factors. Int J Occup Med Environ Health 2018; 31(1): 91-111

20.Cho CY, Hwang YS, Cherng RJ. Musculoskeletal symptoms and associated risk factors among office workers with high workload computer use. J Manipulative Physiol Ther 2012; 35(7): 534-40

21.Ranasinghe P, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N, Rajapakse S, et al. Work related complaints of neck, shoulder and arm among computer office workers: a cross-sectional evaluation of prevalence and risk factors in a developing country. Environ Health 2011; 10(1):70

22.Janwantanakul P, Pensri P, Jiamjarasrangsri V, Sinsongsook T. Prevalence of self-reported musculoskeletal symptoms among office workers. Occup Med (Lond) 2008; 58(6): 436-8

23.Moreira-Silva I, Teixeira PM, Santos R, Abreu S, Moreira C, Mota J. The Effects of Workplace Physical Activity Programs on Musculoskeletal Pain: A Systematic Review and Meta-Analysis. Workplace Health Saf 2016; 64(5): 210-22

24.Wijnhoven HA, de Vet HC, Picavet HS. Prevalence of musculoskeletal disorders is systematically higher in women than in men. Clin J Pain 2006; 22(8): 717-24

25.Omokhodion FO, Sanya AO. Risk factors for low back pain among office workers in Ibadan, Southwest Nigeria. Occup Med (Lond) 2003; 53(4): 287-9

26.Mansor C, Hazwani C, Zakaria SE, Dawal SZM. Investigation on working postures and musculoskeletal disorders among office workers in Putrajaya. In: Advanced engineering forum. Trans Tech Publ 2013;10: 308–12

27.Miranda H, Kaila-Kangas L, Heliövaara M, Leino-Arjas P, Haukka E, Liira J et al. Musculoskeletal pain at multiple sites and its effects on work ability in a general working population. Occup Environ Med 2010; 67(7): 449-55

28.Rollman GB, Lautenbacher S. Sex differences in musculoskeletal pain. Clin J Pain 2001; 17(1):20-24

29.Isusi I, Corral A, Durán J, Kok J, Snijders J, Bühring T et al. Workforce diversity and musculoskeletal disorders: review of facts and figures and case examples European Risk Observatory. https://oxfordresearch.eu/wp-content/uploads/2021/05/Workforce_diversity_and_MSDs.pdf. Erişim tarihi: 13 Nisan, 2023

30.Gergin, K. Masa başı çalışan yetişkinlerin kahve ve besin tüketimlerinin uyku kalitelerine olan etkilerinin değerlendirilmesi [Evaluation of the effects of coffee and food consumption on sleep quality of adults working at desks) [dissertation]. İstanbul (Turkey): Istanbul Medipol University; 2020. 79 p. Turkish

31. Eroğlu FE. Ofis saatli ve nöbetli çalışan erkeklerin hedonik açlık düzeyleri ile beslenme durumları ve uyku kalitesi arasındaki ilişkinin belirlenmesi [Determining the relationship between hedonic hunger levels, nutritional status and sleep quality of men working with office hours and shifts] [dissertation]. Ankara (Turkey): Baskent University; 2020. 122 p. Turkish

32.Aye LM, Arokiasamy JT, Barua A, Yadav H, Onunkwor OF. Prevalence and determinants of poor sleep quality among Myanmar migrant workers in Malaysia: a cross-sectional study. Br J Med Med Res 2017; 19: 1–9

33.Boubekri M, Lee J, MacNaughton P, Woo M, Schuyler L, Tinianov B et al. The Impact of Optimized Daylight and Views on the Sleep Duration and Cognitive Performance of Office Workers. Int J Environ Res Public Health 2020; 17(9): 3219

34.Harrison L, Wilson S, Munafò MR. Exploring the associations between sleep problems and chronic musculoskeletal pain in adolescents: a prospective cohort study. Pain Res Manag 2014; 19(5): e139-45

35.Irwin MR, Olmstead R, Carrillo C, Sadeghi N, Fitzgerald JD, Ranganath VK et al. Sleep loss exacerbates fatigue, depression, and pain in rheumatoid arthritis. Sleep 2012; 35(4): 537-43

36.Köksal T, Sarıkaya S. Quality of Sleep in Patients with Chronic Low Back Pain; Relationship of Sleep with Pain, Functional Status and Quality of. Med J West Black Sea 2021; 5(3): 481-487

37.Yılmaz T, Başpınar MM, Arslan NG, Yalçınkaya EY, Basat O. Is There an Effect of Pain and Radiological Stage on Quality of Life and Sleep in Patients with Osteoarthritis? J PMR Sci 2021; 24(2): 97-106

38.Li JJ, Appleton SL, Gill TK, Vakulin A, Wittert GA, Antic NA et al. Association of Musculoskeletal Joint Pain With Obstructive Sleep Apnea, Daytime Sleepiness, and Poor Sleep Quality in Men. Arthritis Care Res (Hoboken) 2017; 69(5): 742-747

39.Katsifaraki M, Nilsen KB, Wærsted M, Knardahl S, Lie J-AS, Bjorvatn B et al. The association of sleepiness, insomnia, sleep disturbance and pain: a study amongst shift working nurses Sleep Biol Rhythms 2018; 16(1): 133-140

40.Shimura A, Sugiura K, Inoue M, Misaki S, Tanimoto Y, Oshima A et al. Which sleep hygiene factors are important? comprehensive assessment of lifestyle habits and job environment on sleep among office workers. Sleep Health 2020; 6(3):288-298