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# Examination of Fatigue, Sleep, and Grip Strength in Office Workers with Pain Problems: A Controlled Study

# Ağrı Sorunu Olan Ofis Çalışanlarında Yorgunluk, Uyku ve Kavrama Kuvvetinin İncelenmesi: Kontrollü Çalışma

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## Abstract

The aim of this study is to examine fatigue, sleep, and grip strength, which may primarily affect the work health of office workers with pain issues, within the scope of a controlled study design. Individuals aged 18-65 working in an office environment were included in the study. Pain intensity, fatigue, and sleep problem severity were assessed using a Visual Analog Scale. Pain threshold was measured using an Algometer, and grip strength was measured with a Jamar Hand Dynamometer. A total of 89 participants, 46 of whom had pain, were included in the study. When comparing office workers with and without pain, it was found that those with pain had lower pain thresholds, experienced more fatigue and sleep problems, and had lower grip strength ($p<0.05$). However, no significant difference was found in sleep durations between the two groups ($p>0.05$). The pain issues experienced by employees may hinder their productivity in the workplace. Therefore, we believe that identifying potential musculoskeletal problems and risk factors, as well as determining preventive interventions for these problems, is important.

**Keywords:** Discomfort, musculoskeletal pain, occupation, occupational health.

## Özet

Bu çalışmanın amacı, ağrı sorunu olan ofis çalışanlarının iş sağlığını öncelikle etkileyebilecek yorgunluk, uyku ve kavrama kuvvetini kontrollü bir çalışma tasarımı kapsamında incelemektir. Çalışmaya ofis ortamında çalışan 18-65 yaş arası bireyler dahil edilmiştir. Ağrı şiddeti, yorgunluk ve uyku problemi şiddeti Görsel Analog Skala kullanılarak değerlendirilmiştir. Ağrı eşiği Algometre ile, kavrama kuvveti ise Jamar El Dinamometresi ile ölçülmüştür. Çalışmaya, 46'sı ağrılı toplamda 89 kişi dahil edilmiştir. Ağrısı olan ofis çalışanları ile ağrısı olmayan bireyler karşılaştırıldığında, ağrılı ofis çalışanlarının ağrı eşiklerinin daha düşük olduğu, daha fazla yorgunluk ve uyku problemi yaşadıkları ve kavrama kuvvetlerinin daha düşük olduğu bulunmuştur ($p<0,05$). Ancak iki grubun karşılaştırılmasında uyku süreleri arasında anlamlı bir fark bulunamamıştır ($p>0,05$). Çalışanların yaşadığı ağrı sorunları iş yerinde verimliliklerini engelleyebilir. Bu nedenle, potansiyel kas-iskelet sistemi sorunlarının ve risk faktörlerinin belirlenmesi ve bu sorunlara yönelik önleyici müdahalelerin belirlenmesinin önemli olduğunu düşünmekteyiz.

**Anahtar Kelimeler:** İş, iş sağlığı, rahatsızlık, kas-iskelet sistemi ağrısı.

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## 1. Introduction

Advancements in information technology and changes in job tasks over the past decade have led to an increase in the number of office workers, a rise in computer usage in workplaces, and consequently, a higher incidence of Musculoskeletal System Disorders (MSDs) (Kowalska & Bugajska, 2009). As stated in the European Occupational Health and Safety Report, one of the most significant issues negatively affecting working life and the quality of life of employees is work-related musculoskeletal disorders (Schneider et al., 2010). The causes of this problem include the repetitive tasks performed by employees at the workplace and the non-ergonomic conditions under which the work is carried out (Bingöl et al., 2021). Office workers, whose primary tasks include computer usage, making presentations, preparing for and attending meetings, speaking on the phone, writing, and reading, spend most of their work duties in a sedentary position. Considering that prolonged periods in a static position can lead to health problems in individuals, office workers are at high risk for various chronic diseases and musculoskeletal problems (Küçük et al., 2018; Nguyen et al., 2021).

Factors that can affect the health of office workers can be classified under three main headings: physical factors, psychosocial factors, and personal factors. Physical factors include repetitive movements, the use of poor or incorrect postures, prolonged work in the same position, excessive and incorrect use of the wrist, and a noisy work environment. Psychosocial factors can be expressed as work stress, occupational monotony, limited social circle, inadequate support, and excessive demands from managers. Examples of personal factors include being overweight, lack of fitness, and smoking (Akpınar et al., 2018). These factors, which often negatively affect the quality of life of workers, can manifest as various problems such as pain, weakness, fatigue, sleep disturbances, numbness, stiffness, coordination disorders, and functional impairments. Among these problems, pain is the most common issue encountered among office workers, and there is generally an increased prevalence of pain among them. When disorders and diseases related to work are examined, recurring and chronic pain is seen as a significant factor causing job losses (Akpınar et al., 2018; Bontrup et al., 2019).

In a study among workers, it was found that 41% of absenteeism was due to ergonomic problems such as muscle and joint pains, and 10% were due to more severe pain, including lower back, shoulder, and neck pain, carpal tunnel syndrome, and tendonitis-related pain. Additionally, neck and upper extremity pains are commonly reported among office workers (Mouatt & Kamper, 2019). Neck pain, particularly, has been reported as the most prevalent pain issue among office workers who spend more time in front of computers. It is estimated that the risk of pain in office workers can rise to 60% (Kocur et al., 2019).

Experiencing pain can lead to increased feelings of fatigue and may result in inefficiency during one's activities (Kocamaz, 2014). Initially, a problem starting with mild pain in workers may manifest as fatigue, and over time, this condition can evolve into chronic pain when accompanied by pain (Mehta et al., 2019). In a study by Ando (2019) and colleagues in Japan, it was observed that as working hours increased, fatigue became more persistent in individuals (Ando et al., 2019). Furthermore, it is noted that insufficient sleep hours in workers can increase fatigue and, at the same time, insufficient sleep hours can lead to chronic pain in individuals. Spyropoulos et al. (2007) found in their research

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with office workers that an increase in pain duration led to an increase in the frequency of sleep problems in individuals, consequently reducing work efficiency among workers (Spyropoulos et al., 2007).

It has been stated that occupation-related physical, psychosocial, and personal factors can also affect individuals' fine motor skills such as grip strength. Many workers who work at computers often encounter arm, hand, and wrist problems. Office workers are among the high-risk working groups for upper extremity health due to prolonged computer use, frequent repetitive movements, and sedentary work styles. It is believed that grip strength will be adversely affected in office workers experiencing upper extremity problems. Some studies have shown a decrease in grip strength, which is an important determinant of fine skills, especially in office workers with prolonged computer use (Özcan & Kesiktaş, 2007; Rostamzadeh et al., 2019). For example, according to a study examining the grip strengths of individuals with different physical workloads, office workers were found to have the lowest grip strength among the examined professions (Rostamzadeh et al., 2019). Fine motor skills are a significant determinant of upper extremity capacity, and adequate grip strength is necessary for functional independence (Huysmans et al., 2012; Rostamzadeh et al., 2019). Pain is a common musculoskeletal issue that frequently affects office workers and has the potential to impact their overall health (Bingöl et al., 2021). There are limited studies on the effects of existing pain problems on fatigue, sleep, and grip strength in office workers. This study was planned to contribute to the existing literature on musculoskeletal problems observed in office workers.

## 2. Method

### *2.1. Aim of the Study*

The aim of this study is to investigate fatigue, sleep, and grip strength, which can primarily affect the occupational health of office workers with pain issues, within the framework of a controlled study design.

### *2.2. Research Questions*

Is there a statistically significant difference in fatigue between office workers with and without pain issues?

Is there a statistically significant difference in sleep problems between office workers with and without pain issues?

Is there a statistically significant difference in grip strength between office workers with and without pain issues?

### *2.3. Population and Sample of the Research*

The study was conducted with individuals aged between 18 and 65 who work in office environments in Ankara, including both those experiencing pain issues and those who do not . All participants were provided with information about the study, and those who agreed to participate signed an informed consent form detailing the purpose and methods of the study. Evaluations were conducted face-to-face with individuals who agreed to participate in the study. The sample size for the study was

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calculated using the G*Power (3.1.9.7) program. The analysis indicated that, with 95% confidence (1-α), 80% test power (1-β), and an effect size of d=0.6, the minimum number of participants required for each group was 47, aiming for a total of 94 participants. Although 95 volunteers were initially included in the study, 5 participants chose to withdraw before completing the research. A total of 89 individuals were therefore included in the study.

Individuals' sociodemographic information was recorded. Pain intensity, fatigue severity, and level of sleep problems were assessed using the Visual Analog Scale. An algometer was used to assess individuals' pain thresholds. Grip strength was evaluated using a hand dynamometer. Regarding individuals' demographic information, data such as gender, age (years), marital status, number of children, smoking and alcohol use, presence of chronic illnesses, height (cm), and weight (kg) were recorded. Height and weight data were used to calculate and record body mass index (BMI) (kg/m²).

### *2.4. Data Collection and Data Collection Tools*

#### *2.4.1. The Visual Analog Scale (VAS)*

The Visual Analog Scale (VAS) was developed by Price and colleagues and is widely accepted internationally. It is used to convert non-numerical values into numerical data. At the two ends of a 10 cm line, the two extreme descriptions of the parameter to be evaluated are written, and the individual is asked to indicate where their condition falls on this line (Wewers & Lowe, 1990). The VAS, which is used worldwide to assess chronic health issues such as pain, fatigue, sleep problems, anxiety, and depression, has been found to be valid and reliable in various studies (Begum & Hossain, 2019; Milette et al., 2011; Tseng et al., 2010). In our study, levels of pain, fatigue severity, and sleep problems were assessed using the VAS. In our study, individuals who reported no pain, fatigue, or sleep problems were considered to have a VAS score of zero.

#### *2.4.2. Pain Threshold*

An algometer (J Tech, USA) with a surface area of 1 cm² was used to assess pain thresholds in individuals. The measurement was taken from the upper trapezius muscle, which is one of the most sensitive points used to assess pain in individuals (Fryer & Hodgson, 2005; Wolfe, 1990). The point at which individuals first perceived pain was recorded as the pain threshold (Ekici et al., 2017).

#### *2.4.3. Assessment of Grip Strength:*

The evaluation of grip strength was conducted using the Jamar Hand Dynamometer. During the measurement, participants were seated upright on a chair without arm support. The evaluation of grip strength for both hands of the participants was measured three times with the forearm positioned at a 90° flexion, and the average was recorded in kilograms (Bohannon et al., 2006; Fess, 1981).

### *2.5. Ethical Considerations*

Ethical approval was obtained for the study from Hacettepe University Non-invasive Research Board in 21.12.2021 (GO 21/1353). Participants were informed about the research requirements and process, and informed consent was obtained from all participants.

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### *2.6. Limitations*

This study, in terms of encompassing office workers from a single center, is valuable for examining the outcomes of individuals working in similar environments. However, it may pose a limitation for generalizing the results. Additionally, factors such as pain can be influenced by various factors like gender role differences. These factors can have a significant impact on the study results, which can be considered another limitation of the study.

### *2.7. Data Analysis*

Statistical analyses were performed using SPSS software, version 24.0 (IBM SPSS Statistics for Windows, Version 24.0, Armonk, NY: IBM Corp., USA). The normality of the variables was examined using visual methods (histograms and probability plots) and analytical methods (Shapiro-Wilk and Kolmogorov-Smirnov tests). Descriptive statistics were provided for numerical variables using mean and standard deviation, while for nominal variables, frequency and percentage were used. When comparing numerical data from two independent groups that did not follow a normal distribution, the Mann-Whitney U test was used, with a statistical significance level set at $p<0.05$.

## 3. Results

A total of 89 office workers, consisting of 46 with pain and 43 without pain, aged between 22 and 58 years, were included in the study. Of the participants, 44 were women and 45 were men. The average age of the participants was recorded as 36.64±7.93 years. The sociodemographic information of the participants is shown in Table 1.

**Table 1.** Participants' sociodemographic characteristics.

| | | **Painful Office Workers *(n=46)* *n (%)*** | **Pain-Free Office Workers *(n=43)* *n (%)*** |
|---|---|---|---|
| **Sex** | Woman | 34 (38.2) | 10 (11.2) |
| | Male | 12 (13.4) | 33 (37.07) |
| **Marital Status** | Married | 31 (34.8) | 29 (32.5) |
| | Single | 15 (16.8) | 14 (15.7) |
| **Having Chronic Disease** | Yes | 11 (12.3) | 2 (2.2) |
| | No | 35 (39.3) | 41 (46.06) |
| **Smoking** | Yes | 15 (16.8) | 11 (12.3) |
| | No | 31 (34.8) | 32 (35.9) |
| | | ***Mean±SD*** | ***Mean±SD*** |
| **Age (year)** | | 35.17±7.44 | 38.20±8.22 |
| **BMI (kg/m$^2$)** | | 24.86±4.23 | 24.93±3.05 |

*BMI= Body Mass Index, SD= Standard Deviation.*

The participants' pain threshold, pain intensity, average sleep duration, level of sleep problems, fatigue severity, and right and left hand grip strength were evaluated, and the averages of the obtained data are shown in Table 2. The pain threshold, level of sleep problems, fatigue severity, and grip strength parameters of participants with and without pain were compared, and significant differences were found between participants with and without pain. However, no significant difference was found in the average daily sleep duration between the groups (Table 2).

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**Table 2.** Comparison of groups' pain threshold, sleep, fatigue, and grip strength scores.

| | Painful Office Workers *(n=46)* X±SD | Pain-Free Office Workers *(n=43)* X±SD | Z | p |
|---|---|---|---|---|
| **Pain Thresholds (kg/cm²)** | 6.16±2.45 | 10.52±1.61 | -6.828 | **.0001*** |
| **Right** | 6.59±2.93 | 10.45±1.73 | -5.570 | **.0001*** |
| **Left** | | | | |
| **Fatigue (VAS 1-10 cm)** | 7.34±1.92 | 3.44±2.66 | -6.133 | **.0001*** |
| **Sleep Problem (VAS 1-10 cm)** | 4.80±2.42 | 1.13±1.47 | -6.463 | **.0001*** |
| **Sleep Time (hours/day)** | 5.84±1.68 | 4.95±2.93 | -.519 | .604 |
| **Grip Strength (kg)** | | | | |
| **Right** | 24.39±7.38 | 36.46±6.86 | -6.270 | **.0001*** |
| **Left** | 22.72±7.08 | 33.65±6.17 | -6.048 | **.0001*** |

*VAS= Visual Analog Scale, * p<0,05.*

## 4. Discussion

In this study, aimed at comparing fatigue, sleep, and grip strength between office workers with and without pain problems, it was observed that individuals with pain experienced more fatigue, sleep problems, and grip strength issues compared to those without pain.

Office workers typically spend prolonged periods sitting without much movement due to the nature of their work, heavily utilize their upper extremities, and have poor body posture resulting from prolonged sedentary sitting (Cho et al., 2012; Janwantanakul et al., 2011). All these factors can lead to work-related musculoskeletal disorders, resulting in pain for individuals. Although musculoskeletal pain is common in the general population, it is known that office workers, especially experience higher frequencies of neck, back, and shoulder pain compared to the general population (Cho et al., 2012; Côté et al., 2008; Korpinen et al., 2012).

Fatigue is a commonly reported complaint among the working population and arises from an imbalance between job demands and the ability or capacity of workers to perform their tasks (Bültmann et al., 2002). In this study, it was also observed that office workers with pain experienced more fatigue compared to those without pain. Prolonged fatigue can increase the risk of workplace accidents and sickness absence (Janssen et al., 2003; Van Amelsvoort et al., 2002). Additionally, it is known that musculoskeletal pain can contribute to the development of fatigue (Sundstrup et al., 2016). Bos et al. (2006) reported in their study that reducing fatigue could also alleviate pain (Bos et al., 2006). Sirge et al. (2014) concluded that pain in the lower back, neck, knees, and shoulders was significantly associated with occupational fatigue (Sirge et al., 2014). Considering the relationship between pain and fatigue, we believe that organizational and environmental adjustments should be made to protect the health of office workers.

Musculoskeletal pain can negatively affect subjective sleep quality, and it has been stated that prolonged pain can lead to sleep disturbances (Kim, 2018). According to the results of our study, it

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was observed that office workers with pain problems had a higher level of sleep problems compared to those without pain problems. Consistent with our study findings, previous research has also shown that poor sleep quality is common in populations with chronic pain (Harman et al., 2014). Okan's (2023) research with office workers revealed that the majority of individuals with musculoskeletal problems experienced more sleep problems (Okan, 2023). Another study conducted in Turkey, focusing on individuals working at desks, found that 54% of the workers experienced sleep problems (Gergin, 2020). Previous studies have shown that pain problems are often examined alongside musculoskeletal issues. Compared to other studies, it is directly evident in our study population that office workers with pain problems experience sleep problems.

Quality sleep improves both mental and physical well-being and enhances individuals' productivity. Sufficient sleep duration and quality sleep can be supportive factors in pain management (Öztürk & Başkurt). Edwards et al. (2008) evaluated the relationship between sleep duration and pain frequency in healthy adults. The study found that individuals who slept less than 6 hours or more than 9 hours the previous night were more likely to experience pain on the following day . Additionally, previous-day pain in participants similarly shortened their sleep duration (Edwards et al., 2008). In a study by Smith et al., healthy adults were subjected to uninterrupted sleep, fragmented sleep, and restricted sleep. While pain thresholds remained unchanged in the restricted sleep group, an increase in spontaneous pain was observed. The authors suggested that fragmented sleep might have a stronger influence on modulation mechanisms related to pain compared to restricted sleep (Smith et al., 2007). Azevedo et al. (2011) observed that healthy participants exposed to restricted REM sleep and total sleep experienced a decrease in pain thresholds, followed by an increase after a single day of normal sleep (Azevedo et al., 2011). In our study, the difference in average sleep duration between participants with and without pain problems was examined, and no significant difference was found. However, although it varies for each individual, it is observed that participants in both our study and control groups slept below the recommended approximately 7-9 hours of sleep for adults (Hirshkowitz et al., 2015). Adequate sleep hours can reduce musculoskeletal pain. Inadequate sleep has been reported to be associated with leading causes of death, such as cerebrovascular disease, cardiovascular disease, diabetes, hypertension, malignant neoplasms, and occupational accidents (Boubekri et al., 2020). Poor sleep quality can worsen musculoskeletal pain, leading to a vicious cycle of sleep disturbance and pain, while also negatively affecting workers' mental health (Kim, 2018). Therefore, it is necessary to identify individuals with poor sleep quality among office workers, examine factors that may contribute to this, and provide education on sleep to employees.

Previous studies have emphasized the importance of evaluating hand grip strength in office workers as they use their hands for most activities during work, which often involve grip skills (Rostamzadeh et al., 2019). When reviewing the literature, it is observed that office workers who engage in prolonged computer use and have a sedentary work style have lower grip strength compared to the general population (Doğan, 2012; Josty et al., 1997). Additionally, Prasartwuth et al. (2005) suggested in their study that individuals with pain may have lower muscle strength (Prasartwuth et al., 2005). Consistent with these findings, our study indicates that office workers with pain have lower hand grip strength

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compared to those without pain. Research suggests that hand grip strength can be influenced by factors such as age, gender, body mass index, occupation, leisure-time activities, nutrition, and sensory loss, in addition to pain (Doğan, 2012; Rostamzadeh et al., 2019).

We frequently use our hands to perform many activities in daily life, making hand function crucial for daily living activities. According to a study by Kızılay et al. (2001), inadequate grip strength significantly reduces participation in daily life activities (Evcik & Kızılay, 2001). Grip strength impairments can affect participation in work life and the completion of job tasks. Therefore, we believe that assessing grip strength in individuals experiencing pain is essential.

## 5. Conclusion

In conclusion, our study conducted a comprehensive evaluation of office workers with and without pain-related issues from a single center, revealing that those with pain experienced more fatigue and sleep problems, along with lower grip strength. Detecting potential musculoskeletal system problems and risk factors that could hinder productivity in the workplace, and identifying preventive interventions for these issues, are crucial. Furthermore, it has been concluded that problems such as pain and fatigue, which can be influenced by various parameters, require more detailed examination. Nevertheless, advanced studies including a broader range of participants from different occupational groups are needed to obtain more generalizable results.

## Conflict of Interest

The authors declared no conflict of interest.

**Authors Contributions:** Subject selection: ABY, GE; Design: ABY,GE; Planning: ABY,GE; Data collection and analysis: ABY; Manuscript writing: ABY,GE; Critical revision: GE.

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