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# MUSCULOSKELETAL PAIN AND ABSENTEEISM: THE INFLUENCE OF ERGONOMIC AWARENESS IN HIGHER EDUCATION EMPLOYEES

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**Keywords**
*Musculoskeletal system*
*Absenteeism*
*Ergonomic awareness*
*Occupational health*
*White-collar worker*

**Abstract**
*This study aims to investigate the relationship between the ergonomic awareness of academic and administrative staff at universities and their reported musculoskeletal pain. It also aims to assess the effect of this pain on absenteeism, as indicated by health reports and sickness permits. The study used a sociodemographic information form to assess absenteeism, the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) to evaluate musculoskeletal pain, and the Postural Habits and Awareness Questionnaire (PHAQ) to measure ergonomic awareness. The study included 242 female and 120 male participants, with an average age of 38 years. Significant pain in the neck, back, and waist was reported by participants in the past 7 days (neck: 10.16%, back: 11.61%, waist: 10.37%). However, neck, back, and waist pain did not contribute to absenteeism (p = 0.776, p = 0.612, p = 0.196). A significant correlation was found between CMDQ scores for neck, back, and waist, and all PHAQ sub-factors. Low ergonomic awareness leads to postural discomfort and absentence from work. Ergonomic training is essential to reduce musculoskeletal pain and enhance productivity among academic and administrative staff. Improving postural awareness can significantly reduce neck, back, and waist pain caused by prolonged sitting and improper work positions.*

# KAS İSKELET AĞRISI VE İŞE DEVAMSIZLIK: YÜKSEKÖĞRETİM ÇALIŞANLARINDA ERGONOMİK FARKINDALIĞIN ETKİSİ

**Anahtar Kelimeler**
*Kas-iskelet sistemi*
*İşe devamsızlık*
*Ergonomik farkındalık*
*İş sağlığı*
*Beyaz yakalı çalışanlar*

**Öz**
*Bu çalışma, üniversitelerdeki akademik ve idari personelin ergonomik farkındalık ile bildirdikleri kas-iskelet sistemi ağrıları arasındaki ilişkiyi araştırmayı ve bu ağrıların, sağlık raporları ve hastalık izinleriyle gösterilen devamsızlık üzerindeki etkisini değerlendirmeyi amaçlamaktadır. Çalışmada, devamsızlık durumu için sosyo-demografik bilgi formu, kas-iskelet sistemi ağrısını değerlendirmek için Cornell Kas-İskelet Sistemi Rahatsızlık Anketi (CMDQ) ve ergonomik farkındalık ölçmek için Postür Alışkanlıkları ve Farkındalık Anketi (PHAQ) kullanılmıştır. Çalışmaya 242 kadın ve 120 erkek katılımcı dahil edilmiştir, ortalama yaşları 38'dir. Yapılan analizler sonucunda, son 7 günde boyun, sırt ve bel ağrılarının anlamlı sıklıkta raporlandığını (sırasıyla %10.16, %11,61, %10.37) ortaya koymuştur. Çalışmamızda, boyun, sırt ve bel ağrılarının, katılımcıların devamsızlıklarına katkıda bulunmadığı (sırasıyla p=0.776, p=0.612, p=0.196) bulunmuştur. Boyun, sırt ve bel ağrılarının ağırlıklı CMDQ puanları ile tüm PHAQ alt faktörleri arasında anlamlı bir ilişki bulunmuştur. Sonuç olarak, düşük ergonomik farkındalık, postüral rahatsızlık ve devamsızlığa yol açmakta olup, kas-iskelet ağrılarını azaltmak ve akademik ile idari personelin verimliliğini artırmak için ergonomik uygulamalar konusunda eğitim verilmesi önemlidir. Bu çalışma, yükseköğretim çalışanlarının postür farkındalığını artırmanın, uzun süreli oturma ve yanlış çalışma pozisyonlarına bağlı boyun, sırt ve bel ağrılarını önemli ölçüde azaltabileceğini vurgulamaktadır.*

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## 1. Introduction

In the past, some occupations, such as academicians or office workers, were defined as safe based on occupational risks or diseases. Today, we know sedentary work using computers causes cardiovascular diseases, diabetes, some cancers, and musculoskeletal pain (Dunstan et al., 2012; Ryde et al., 2013; Gao et al., 2024). According to the 2022 health statistics of the Turkish Ministry of Health, as shown by the Global Burden of Disease (GBD) between 2002 and 2019, musculoskeletal diseases increased from 250,226 cases to 424,079 cases, which means an increase of 69.48%, and it became the 6th most common disease (T.C. Ministry of Health, 2022).

The significant increase in musculoskeletal diseases can be attributed to poor workplace ergonomics. Ergonomics, which aims to optimize workplace conditions, is critical in preventing work-related musculoskeletal disorders by reducing physical strain and improving posture during occupational activities (Daneshmandi et al., 2017). For instance, Vink et al. (1995) emphasized that implementing ergonomic practices in manual tasks significantly improves employees' physical and mental health. Similarly, Vieira and Kumar (2004) highlighted that assessing workers' movement and posture is essential for occupational safety. Levanon et al. (2012) further demonstrated that inadequate posture and repetitive movements increase the risk of musculoskeletal disorders. Musculoskeletal disorders have been common complaints among those who work in static jobs or tasks requiring repetitive movement of the upper extremities and prolonged computer work (Daneshmandi et al., 2017; Juzad et al., 2022). The risk of musculoskeletal diseases increases as the number of hours worked sitting increases (Vieira and Kumar, 2004; Daneshmandi et al., 2017; Zawawi et al., 2018; Juzad et al, 2022; Ağar et al., 2022). Although this issue is being examined in global trend, there is a paucity of studies concerning ergonomic awareness and musculoskeletal pains in Türkiye. Majority of these researches were reviews of international studies that aimed at drawing attention to the topic. For example, Özcan et al. (2013), reviewed the risk factors, prevalence, and cost of occupational musculoskeletal diseases and prevention programs and therapies for these disorders. Akpınar et al. (2018) reviewed the literature so as to help to avoid related musculoskeletal disorders of office workers to take advantage of ergonomics applications. Buzak et al., 2019, reviewed the ergonomic risk factors as a means of preventing and protecting healthcare workers against musculoskeletal disorders. In addition to this literature review, Felekoğlu and Taşan (2017), investigated ergonomic risk factors and exposure levels of a company's machining department to develop suggestions to protect the workers. They proposed to do periodic audits and training, prepare forms to be filled out by workers in declaration that they did their job according to ergonomic rules, and report incidents to create an ergonomic culture.

Ergonomic awareness is understood as the awareness of oneself regarding ergonomic principles, the observation of compliance with ergonomic standards, the perception and attentiveness to ergonomic knowledge, and the maintenance of ergonomic conditions in human life, stemming from an appreciation of the subject's significance. This leads to the conclusion that ergonomic awareness is a specific state of mind, a state of perception based on an accurate knowledge of ergonomics that focuses on ensuring that the external environmental conditions are adjusted to the psychological and physical conditions of the person (Taibi et al., 2021). Certain psychosocial work characteristics can increase or exacerbate the risk of specific health-related outcomes in occupational sectors. For instance, the prevalence of musculoskeletal diseases among frequent computer users (3-5 hours per day) ranges from 40% among university students (Ijmker et al., 2017), 50% among new employees in their first year at work (Menéndez et all, 2009) and over 70% among university staff (Gerr et al., 2002). Chen et al. (2023) investigated economic outcomes of health issues related to musculoskeletal diseases that are attributable to high body mass index in 192 countries and territories. They figured out that 7.3 million years of living with disability and $180.7 billion in total expenses related to musculoskeletal illnesses to high BMI. These figures represent the total years lived with disability and expenses across all individuals in the 192 countries and territories included in the study, and are based on average data for these populations, with the figures adjusted for regional and country-specific factors. These numbers show that this disorder takes quite an important place in health expenses not only of countries but in globally aspects, too. In our country, most of the musculoskeletal disorders are treated with home remedies. That is why, most of the disorders could not be reported to be higher than the official figures and our health expenses could be higher than officially known. Apart from the direct health expenses, various additional costs exacerbate the economic burden of work-related musculoskeletal disorders, including compensation and risk management expenditures, diminished productivity, overtime incurred for compensating injured employees, modifications to the workplace and/or supervision of affected workers, recruitment and retraining of replacement personnel, human resources costs for injury management, and, regrettably, legal fees in certain situations (Felekoğlu and Taşan, 2017; Akıncı et al., 2018; Akpınar et al., 2018; Taibi et al., 2021; Chen et al., 2023).

In the literature, numerous studies have been conducted to profile the outline of ergonomics. However, the absence of work due to the inadequate working conditions, musculoskeletal pains of the workers, and financial expenses are increasing continuously on the rise. Therefore, in ergonomics, it can be argued that the human factors still need improvement and need to be researched to understand the solutions to the problems. Work-related musculoskeletal problems are both controllable and preventable, and they are also a substantial opportunity for cost savings. Technological developments, insufficient physical activity, and occupational and environmental risks could affect academic and administrative staff as much as workers who use physical strength. Therefore, this study aims to evaluate the relationship between ergonomic perceptions and their musculoskeletal pains of academic and administrative staff at universities and their musculoskeletal pains. This study aims to investigate the role of this relationship by analyzing through health reports and sick leave data the absence of academic and administrative staff due to musculoskeletal pain. The main research question of this study is: How does ergonomic awareness influence musculoskeletal pain and absen absence from work among academic and administrative staff?

$H_0$: There is no significant relationship between ergonomic awareness and musculoskeletal pain and work absenteeism

$H_1$: Low ergonomic awareness is associated with a significant relationship between musculoskeletal pain and work absenteeism.

## 2. Methods

A questionnaire survey to identifying the ergonomic awareness of academic and administrative staff of the universities and to identify the factors that caused their non-attendance to work of them a questionnaire survey was conducted. Participants were involved in the study voluntarily, and the Declaration of Helsinki and Good Clinical Practice principles were observed. The aim of the study were explained and informed written consent was obtained from each participant. This research was conducted using the descriptive survey research, which is one of the quantitative method designs. The data of the cross-sectional study were collected between April 2023 and May 2024 through a face-to-face survey and online via Google Forms (Hedt & Pagano 2011; Levy & Lemeshow,2013). The Social and Humanities Ethics Committee of İstanbul Aydin University approved the research (26.01.2023-2023/01). This study was conducted in Türkiye and included academic and administrative staff from both public and private universities. The data collection process was based on voluntary participation, and an invitation email containing detailed information about the study was sent to potential participants. Additionally, the snowball sampling method was employed to reach a broader participant pool. The sample size for the Postural Habits and Awareness Questionnaire and the Cornell Musculoskeletal Discomfort Questionnaire was calculated as 190 participants, based on the guideline of 10 times the number of items in the Postural Habits and Awareness Questionnaire (Terwee et al., 2007). A total of 362 academic and administrative staff participated in the study.

### 2.1. Questionnaire

The questionnaire was consisted of three parts. The demographic information part is the first part of the questionnaire. The second part of the questionnaire is cited from the study by Erdinç et al. (2011). The third part of the questionnaire has 19 items which has been cited from the study by Bayar et all. (2022). Sections brief information is given below:

*1. Demographical information*; the purpose of this section was to gather data about academic and administrative staff, including their sociodemographic information like gender, age, height, weight, education level, job position, job experience, working style with computer, daily working period at a desk, working mobility, their exercises habits, health condition, musculoskeletal diseases, and their health report necessitated by their musculoskeletal discomfort condition.

*2. Cornell Musculoskeletal Discomfort Questionnaires (CMDQ) scale*; this section was aimed to gather data about the aching body parts of academic and administrative staff who experienced and identified the musculoskeletal pain as per its frequency, interference and discomfort score. To determine the frequency of body pains, the statements "never felt it", "during the week I felt it 1-2 times", "during the week I felt it 3-4 times", "Every day, I felt it only once" and "Every day, I felt it many times" were evaluated with weights 0, 1.5, 3.5, 5 and 10, respectively. The severity of the pain was assessed with weights of 1, 2, and 3 as "mild", "moderate", and "severe", respectively, and whether it interfered with their work was assessed with weights of 1, 2, and 3 as "not at all/never", "a little" and "a lot", respectively, and the total score was calculated by summing all values. CMDQ is done for 20 parts of the body. A higher score indicates more frequent, severe, and work-interfering musculoskeletal discomfort, while a lower score reflects less frequent or less severe discomfort. An increase in the total score suggests a greater impact of musculoskeletal discomfort on the individual's daily life and work performance, whereas a decrease indicates improvement or lessening of discomfort. The CMDQ scale is widely used to assess musculoskeletal discomfort and has been validated in various studies for its effectiveness in identifying pain frequency, severity, and interference. The scale contains 3 sub-factors which were frequency, severity, and acts of prevention, and each factors Cronbach's α value were 0,872, 0,979, and 0,985 respectively. Therefore, the scale was considered reliable, with high internal consistency (Cronbach's alpha > 0.80) across different populations (e.g., academic and administrative staff). The validity of the scale has been supported by its strong correlation with other established musculoskeletal pain scales (e.g., Nordic Musculoskeletal Questionnaire), which ensures its construct validity. The CMDQ's scoring system has also been validated to accurately reflect pain experiences based on frequency, severity, and work interference (Erdinç et al., 2011).

*3. Postural Habits and Awareness Questionnaire (PHAQ) scale*: The purpose of this section was to ascertain the administrative and academic staff's behavioral approach to posture difficulties. It is a 5-point Likert-type scale that 1 was "strongly disagree" while 5 was "strongly agree". An increase in the score indicates a stronger agreement with positive postural habits and awareness, while a decrease in the score reflects a weaker agreement or less awareness of proper posture. A higher score suggests better postural habits and greater awareness, while a lower score may indicate poor postural habits and a need for improvement. The scale's construct validity has been confirmed through its correlation with other measures of posture and ergonomic practices. Additionally, factor analysis has supported the PHAQ's ability to distinguish different aspects of postural awareness and habits, making it a reliable tool for examining posture-related behaviors (Bayar et al. ,2022).

## 2.2. Statistics

Data analysis was performed using IBM SPSS Statistics version 20.0.1.0. Descriptive statistics were presented as frequencies and percentages for categorical variables, while means and standard deviations were used for continuous variables. The D'Agostino skewness test, Anscombe-Glynn kurtosis test, and Shapiro-Wilk tests were conducted for normality (Elliott and Woodward, 2007). To identify factors contributing to participant non-attendance, logistic regression analysis was applied. Subsequently, exploratory factor analysis (EFA) was conducted to uncover underlying postural habits and awareness factors, based on the correlations among questionnaire items (Allen et al., 2014; Yaşlıoğlu, 2017). The identified factors were further analyzed to determine their influence on the presence of pain in specific body regions. This relationship was assessed using Pearson bivariate correlation analysis and multiple regression analysis (MRA), which quantified the extent to which these factors explained the variability in reported pain.

SPSS PPROCESS v4.3 program was used to analyze whether working time at the desk by using computers, as an interaction term, affected the relationship between the factors of PHAQ scale, and aching parts of the body (Preacher & Hayes, 2008; Field, 2018).

## 3. Results

282(78%) academic and 80(22%) administrative, in other words, office staff, participated in this study. The normality of the data was assessed using the Shapiro-Wilk test, and all variables met the assumption of normal distribution ($p > 0.05$). In Table 1; 242(67%) were female and 120(33%) were male and 58,6% of them were between 25-38 years old. The most remarkable finding is that the average working hours at the desk for both groups were very close. It was 2.08 (+/- 0.62) for academics and 2.4 (+/- 0.68) for office staff. When the data was analyzed, it was found that one in three participants reported working more than 9 hours sitting, including time spent working from home.

**Table 1. Demographic Information**

| Factors | N (%) |
|---|---|
| **Gender** | |
| Female | 242(66,9) |
| Male | 120(33,1) |
| **Age** | |
| 18-24 | 12(3,3) |
| 25-31 | 106(29,3) |
| 32-38 | 106(29,3) |
| 39-45 | 55(15,2) |
| 46-51 | 26(7,2) |
| 52-60 | 25(6,9) |
| 61 and over | 32(8,8) |
| **Height (cm)** | |
| Between | 148-188 |
| Average | 169.7 |
| **Weight (kg)** | |
| Between | 44-130 |
| Average | 69 |

| | |
|---|---|
| **Job Position** | |
| Academic | 282(77,9) |
| Administrative | 80(22,1) |
| **Education status** | |
| College (2 years) | 24(6,6) |
| Bachelor | 47(13,0) |
| Master | 123(34,0) |
| Doctoral | 168(46,4) |
| **Job experience** | |
| 1-5 year | 131(36,2) |
| 6-10 year | 109(30,1) |
| 11-15 year | 42(11,6) |
| 16-20 year | 21(5,8) |
| 21 year and over | 59(16,3) |
| **Weekly working hour** | |
| Less than 35 hours | 40(11,0) |
| 36-45 hours | 215(59,4) |
| 46 hours and over | 107(29,6) |
| **Daily working on desk *(including home)*** | |
| Less than 4 hours | 53(14,6) |
| 5-8 hours | 205(56,6) |
| More than 9 hours | 104(28,7) |
| **Working style on desk** | |
| Desktop computer | 120(33,1) |
| Laptops | 55(15,2) |
| Both | 187(51,7) |
| **Discomfort due to working immobility** | |
| Yes | 105(29,0) |
| No | 257(71,0) |
| **Health condition according to self-assessment** | |
| Bad | 28(7,7) |
| Moderate | 186(51,4) |
| Well | 148(40,9) |
| **Taking health report due to KİSR** | |
| Yes | 32(8,8) |
| No | 330(91,2) |
| **Health report period (*day/year*)** | |
| Between | 1-30 |
| Average | 1,3 |

105(29%) participants declared that they had some musculoskeletal discomfort which could be attributed to the work immobility. According to the self-assessment of health condition by participants, only 148(40,9%) of them implied that they were well. The other 214(%59,1) participants, who had bad or moderate health condition, reported musculoskeletal pains especially neck, back and waist parts of the body, herniated disc, cervical disc herniation, loss of cervical lordosis etc. Because of the musculoskeletal conditions, all of our participants have used a total 283 days, which varried from 1 day to 30 days, health reports or work permits in the last year. In terms of job loss, it means 78% of total participants lost one working day. To identify the factors, which caused losing days to the health reports or work permits, logistic regression analysis was conducted. The model demonstrated an accuracy of 93.2% in predicting factors contributing to days of absence from work. As shown in Table 2, the activity condition of the participants (p=0.000, Exp(B)=53.07), the job posture in an academic work environment (p=0.000, Exp(B)=0.106), and spending long hours daily working at a desk (p=0.018, Exp(B)=2.387) were significant predictors of non-attendance at work (Nagelkerke $R^2$=0.452).

### 3.1. Cornell Musculoskeletal Pain Scale

The pain experienced by the participants was calculated for 18 body parts using the CMDQ scale, considering the frequency, severity, and interference of the pain with work (Erdinç et al., 2011). According to the weighted pain score, the back, neck, and waist had the highest scores, while the upper arms and legs had the lowest. The calculated weighted score of the back was 11,61 (20,8), for the neck it was 10,16 (17,7), and for the waist it was 10,37 (20,5) (details can be seen in Table 3). To ascertain whether these calculated weighted scores of the body parts caused the absentence of the participants, an Independent-Samples T Test was conducted. First, taking health report because of the neck pain by participants (n = 32) to not taking health report (n = 330) was compared.

**Table 2. Predictor Coefficients for the Model Predicting Turnover (N = 362)**

| Factors | B | S.E. | Sig. | Exp(B)[95% C.I.] |
|---|---|---|---|---|
| Gender | -,144 | ,499 | ,773 | ,866 [,325, 2,304] |
| Age | ,162 | ,215 | ,450 | 1,176 [0,772, 1,791] |
| Job position | -2,246 | ,551 | **,000** | ,106 [0,036, 0,312] |
| Job experience | -,034 | ,249 | ,892 | ,967 [,594, 1,574] |
| Daily working period on the desk | ,870 | ,366 | **,018** | 2,387 [1,164, 0,895] |
| Working style on desk | -,127 | ,254 | ,616 | ,880 [1,535, 1,448] |
| Activity condition | 3,972 | ,693 | **,000** | 53,072 [13,644, 206,431] |
| Constant | -,402 | 1,126 | ,721 | 0,669 |

The assumption of normalcy was upheld because neither Shapiro-Wilk statistic was significant. Since Levene's test was likewise non-significant, it is reasonable to suggest that the variances are equal. The t test for neck was statistically insignificant, with the “taking health report” group (M = 11.02, SD = 21.76), 95% CI [−5.52, 7.38], t(360) = 0.284, p =0.776. The test was repeated for back and waist pains, respectively. The results were insignificant for them, too. For back pain (M = 9.83, SD = 14.98), 95% CI [−9.55, 5.63], t(360) = -0.507, p =0.612. For waist pain (M = 14.84, SD = 26.23), 95% CI [−2.54, 12.36], t(360) = 1.296, p =0.196. Therefore, it could be concluded that the neck, back, and waist scores did not cause the absence of the participants from work.

### 3.2.Postural Habits and Awareness Questionnaire (PHAQ) scale

Postural habits and awareness scale were used to understand the ergonomic awareness of the participants. Bayar et all. (2022), stated that the scale contains 19 items with 5 sub-factors and each factor’s Cronbach’s α value varied between 0.619 and 0.832. To ensure the high psychometric quality of the scale, in particular, high reliability, the multi-item scales used in behavioral science must have high internal consistency (Allen vd., 2014; Yaşlıoğlu, 2017). However, the reliability value of our dataset was 0.535 which means low-reliability. The item deletion approach is utilized to raise the Cronbach alpha coefficient value. Therefore, items A1, A5, A6, F6 and F8 were deleted respectively, the analysis was repeated, and the Cronbach Alpha coefficient of the new scale was calculated as 0.706.

**Exploratory Factor Analysis (EFA)** is a preferred method for simplifying data by clustering methods based on correlations to understand the general tendencies of attitudes, perceptions, and beliefs of participants who share similar experiences, particularly in similar intuitions (Allen vd., 2014; Yaşlıoğlu, 2017).

The Kaiser–Meyer–Olkin (KMO) test was used to assess the appropriateness of the data related to the PHAQ sub-scale. KMO value (0.782) and Bartlett’s test ($p < 0.05$) results were suitable to do factor analyses.

In this study, to investigate the underlying structure of a 14-item questionnaire assessing attitudes toward postural habit and awareness, the data collected from 362 participants were subjected to principal axis factoring with Promax rotation. Prior to running the principal axis factoring, examination of the data indicated that not every variable was perfectly normally distributed. Given the robust nature of factor analysis, these deviations were not considered problematic. Furthermore, the relationships between pairs of variables were generally linear. Three factors (with eigenvalues exceeding 1) were identified as underlying the fourteen questionnaire items (see Table 4). Factor 1 explains 27,05% of the variance, factor 2 explains 21,2%, and factor 3 explains 10,44.

**Table 3. Cornell Muscoloskeletal Pain Scale Weighted Scores**

| **Body parts** | **Pain, aching, discomfort severity frequency** | | | | | **Pain, aching, discomfort severity** | | | **Pain, aching, discomfort preventing work from being done** | | | **Weighted score (Standarf deviation)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Never n (%) | 1-2 times in week n (%) | 3-4 times in week n (%) | Once in a day n(%) | Several times in a day n (%) | Low n (%) | Medium n (%) | Lot n (%) | Never n (%) | Little n (%) | High n (%) | |
| **Neck*** | 106(29,3) | 128(35,4) | 54(14,9) | 23 (6,4) | 51(14,1) | 115(45,1) | 118(46,3) | 22(8,6) | 114(44,7) | 129(50,6) | 12(4,7) | **10,16(17,7)*** |
| **Shoulder (left)** | 223(61,6) | 92(25,4) | 20(5,5) | 12(3,3) | 15(4,1) | 90(61,2) | 51(34,7) | 6(4,1) | 84(57,1) | 58(39,5) | 5(3,4) | 3,44(9,9) |
| **Shoulder (right)** | 187(51,7) | 96(26,5) | 40(11) | 16(4,4) | 23(6,4) | 90(50,3) | 78(43,6) | 11(6,1) | 89(24,6) | 81(22,4) | 9(2,5) | 5,65(12,9) |
| **Back*** | 122(33,7) | 97(26,8) | 65(18) | 27(7,5) | 51(14,1) | 90(37.3) | 122(50,6) | 29(12) | 112(46,5) | 111(46,1) | 18(7,5) | **11,61(20,8)*** |
| **Upper arm (right)** | 286(79) | 50(13,8) | 17(4,7) | 8(2,3) | 1(0,3) | 39(50) | 37(47,4) | 2(2,6) | 46(58,2) | 30(38) | 3(3,8) | 1,36(4,0) |
| **Upper arm (right)** | 271(74,9) | 62(17,1) | 13(3,6) | 8(2,2) | 8(2,2) | 48(52,7) | 38(41,8) | 5(5,5) | 49(53,8) | 38(41,8) | 4(4,4) | 2,39(8,9) |
| **Waist*** | 80(37,4) | 63(29,4) | 38(17,8) | 6(2,8) | 27(12,8) | 58(27,1) | 59(27,6) | 17(7,9) | 75(35) | 50(23,4) | 9(4,2) | **10,37(20,5)*** |
| **Lower arm (left)** | 303(83,7) | 33(9,1) | 15(1,7) | 6(1,7) | 5(1,4) | 35(58,3) | 21(35) | 4(6,7) | 32(52,5) | 25(41) | 4(6,6) | 1,40(4,8) |
| **Lower arm (right)** | 290(80,1) | 39(10,8) | 16(4,4) | 8(2,2) | 95(2,5) | 35(48,6) | 29(40,3) | 8(11,1) | 29(40,8) | 38(53,5) | 4(5,6) | 2,38(9,0) |
| **Elbow (left)** | 284(78,5) | 58(16) | 8(2,2) | 3(0,8) | 9(2,5) | 41(52,6) | 33(42,3) | 4(5,1) | 46(59) | 28(35,9) | 4(5,1) | 1,92(7,2) |
| **Elbow (right)** | 248(68,5) | 76(21) | 16(4,4) | 10(2,8) | 12(3,3) | 59(51,8) | 47(41,2) | 8(7) | 57(50) | 50(43,9) | 7(6,1) | 3,32(10,3) |
| **Hip** | 253(69,9) | 62(17,1) | 27(7,5) | 10(2,8) | 10(2,8) | 64(58,7) | 39(35,8) | 6(5,5) | 70(64,8) | 32(29,6) | 6(5,6) | 3,19(11,8) |
| **Upper leg (left)** | 285(78,7) | 49(13,5) | 14(3,9) | 5(1,4) | 9(2,5) | 50(63,3) | 24(30,4) | 5(6,3) | 50(63,3) | 24(30,4) | 5(6,3) | 2,05(8,5) |
| **Upper leg (right)** | 284(78,5) | 51(14,1) | 16(4,4) | 7(1,9) | 4(1,1) | 41(51,2) | 36(45) | 3(3,8) | 48(60) | 29(36,3) | 3(3,8) | 1,59(5,2) |
| **Knee (left)** | 256(70,7) | 59(16,3) | 28(7,7) | 7(1,9) | 19(3,3) | 46(43,4) | 52(49,1) | 8(7,5) | 60(56,6) | 40(37,7) | 6(5,7) | 3,30(10,5) |
| **Knee (right)** | 253(69,9) | 56(15,5) | 27(7,5) | 16(4,4) | 10(2,8) | 42(38,5) | 60(55) | 7(6,4) | 59(54,1) | 43(39,4) | 7(6,4) | 3,39(10,2) |
| **Lower leg (left)** | 294(81,2) | 41(11,3) | 17(4,7) | 4(1,1) | 6(1,7) | 33(47,1) | 35(50) | 2(2,9) | 42(61,8) | 23(33,8) | 3(4,4) | 1,72(7,0) |
| **Lower leg (right)** | 292(80,7) | 42(11,6) | 17(4,7) | 5(1,4) | 6(1,7) | 18(8,4) | 21(9,8) | 1(0,5) | 40(57,1) | 27(38,6) | 3(4,3) | 1,79(7,1) |
| **Foot (left** | 271(74,9) | 47(13) | 27(7,5) | 8(2,2) | 9(2,5) | 42(46,2) | 39(42,9) | 10(11) | 50(54,9) | 37(40,4) | 4(4,4) | 2,54(7,5) |
| **Foot (right)** | 265(73,2) | 53(14,6) | 25(6,9) | 10(2,8) | 9(2,5) | 46(47,4) | 41(42,3) | 10(10,3) | 55(56,7) | 40(41,2) | 2(2,1) | 2,62(7,6) |

In total, these factors accounted for around 59,14% of the variance in the questionnaire data. Beside these, we also analysed the working time and PHAQ scale relation. However, there were no relation between total PHAQ scale and working times scores according to bivariate correlation analysis. It was $r(358) = -0.005$, $p > .05$ for weekly working hours; $r(358) = -0.017$, $p > .05$ for job experience, and $r(358) = -0.024$, $p > .05$, for daily working on desk (including home).

**Table 4. Principal Component Analyses, and Rotated Matrices For PHAQ**

| Factor name | %[a] | Code | Loading |
|---|---|---|---|
| **Factor1** **(**Posture Habits) | 27,500 | F3_ters | ,850 |
| | | F4_ters | ,811 |
| | | A2 | ,666 |
| | | A4_ters | ,638 |
| | | A3 | ,586 |
| **Factor 2** (Posture Disturbing Factors Awareness) | 21,200 | F11 | ,881 |
| | | F10 | ,873 |
| | | F12 | ,807 |
| | | F9 | ,692 |
| **Factor 3** **(**Postural Awareness) | 10,436 | F1 | -,782 |
| | | A7 | -,679 |
| | | F7 | -,654 |
| | | F5 | -,637 |
| | | F2 | -,497 |

To estimate the proportion of variance in everyday pain with neck, back, and waist experienced by our participants which can be accounted for by three factors, a standard multiple regression analysis (MRA) was performed. Before the analysis, MRA assumptions were controlled. The first standardized residuals distribution plot shows our data were normally distributed and whether or not it fit the residuals to a normal distribution. In our data set, most of them lay around the normal distribution line, but there were slight deviations at the extremes. The second, the scatter plot of standardized residuals of our data, showed that the residuals were generally close to a normal distribution but may have been slightly skewed (see figure 1a and 1b). And standardized residuals versus predicted values tests showed a random distribution, indicating that the homoscedasticity assumption was met and that the residuals had a constant variance. The third, in the data file Mahalanobis distance did not surpass the critical $\chi 2$ for df = 3 (at $\alpha$ = .001) of 16.27, suggesting that multivariate outliers were not cause for concern. The fourth, multicollinearity would not interfere to interpret the outcome of the MRA.

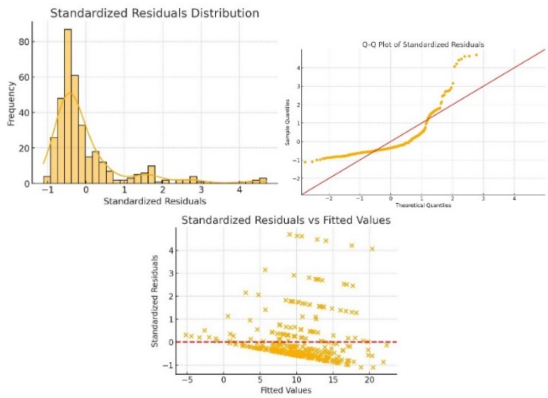


**Figure 1a: The Scatter Plot of Standardized Residuals For Neck**

### 3.3. Correlation Analysis

#### 3.3.1. Correlation Analysis of Neck, Back, Waist Pains and Health Report/Work Permit

We analyzed the correlation between taking the health report or work permit, which caused the absentence of the participants from work, and their pain. For this aim a bivariate Pearson's correlation analysis was conducted (see Table 5). We concluded that there were a significant correlation between the weighted CMDQ scores of neck, back and waist, and all sub-factors of the PHAQ scale with a 99% confidence interval. To evaluate the size and direction between the pain scores and factors, Pearson's (r) was calculated.

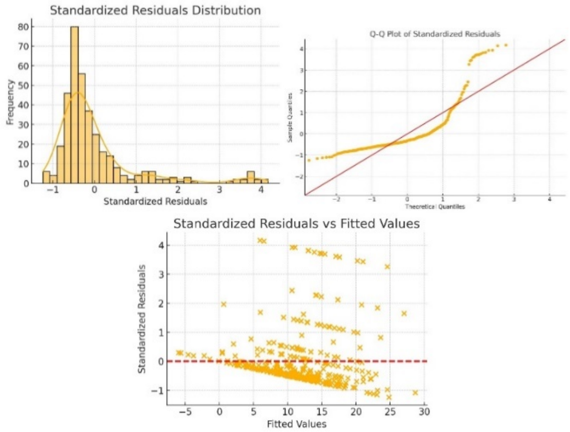


**Figure 1b: The Scatter Plot Of Standardized Residuals For Back**

The bivariate correlation between neck, back and waist pain and factor 1 variables were negative and small r(360) = -0.156, p < .05; r(360) = -0.193, p < .05; r(360) = -0.150, p < .05, respectively. For factor 2 and CMDQ scores of the neck, back and waist, correlation was positive and small. The relation for factor 2 and neck pain, r(360) = 0.150, p < .05; for back pain, r(360) = 0.127, p < .05; and for waist pain, r(360) = 0.166, p < .05. The bivariate relation between factor 3 and neck, back and waist scores were negative and small. It was r(360) = -0.167, p < .05 for neck pain; r(360) = -0.2023, p < .05 for back pain and r(360) = -0.118, p < .05, for waist pain.

The relationship between the weighted CMDQ scores of the neck, back and waist, and all sub-factors of the PHAQ scale were correlated with a 99% confidence interval. For neck pain, these factors explain 5,9% of the variability, adjusted R2=0,051 (and R2=0,059), F(7,44), p=0,000. For Fac1 (p = 0.244), Fac2 (p = 0.007), Fac3 (p = 0.004). For back pain, these factors explain 6,4% of the variability, adjusted R2= 0.064 (and R2=0,072), F(9.17), p=0,000. For Fac1 (p = 0.061), Fac2 (p = 0.031), Fac3 (p = 0.001). For waist, a standard MRA was not performed because the assumptions of regression were violated especially the normality and homoscedasticity of residuals. Unstandardized (B) and standardized (β) regression coefficients and squared semi-partial correlations ($sr^2$) for each predictor in the regression model were reported in Table 6. According to Table 5, Fac3 has a negative effect on neck and back pain. So, we concluded that neck and back pains were explained only by Fac2.

We concluded that neck and back coefficients from the regression analysis were similar. This could be because postural habits and awareness factors had similar effects on both. To examine the direction and size of the linear relationship between pain of the neck and back, a bivariate Pearson's product-moment correlation coefficient (r) was calculated. The bivariate correlation between the neck and back was positive and strong, r(51,4), p < .001. Because of the correlation between the neck and back we decided to combine them by using arithmetical mean method. Therefore, the new variable is called score_neck_back_avg. In this study, we analyzed whether working time at the desk by using computers, as an interaction term, affected the relationship between the Factor2, posture disturbing factors awareness, and ached parts of the body.The analysis was conducted, and b=-,0268 (-,1880,1343) was calculated as 95% confidence interval, t=-,3277, p=0,499. It was concluded that there was no interaction effect of the interaction term.

## 4. Discussion

In this study, 58.3% of our participants were between 25-38 years old and 240 (66.2%) of our participants had less than 10 years' experience. According to Turkish Statistical Institute (TUİK) and World Health Organization (WHO) reports, our participants were described as young adults whose physical and cognitive development were continuing (TUİK, 2023; WHO, 2022). In accordance with the definition of young adults, we attempt to identify occupational health risks and how these risks interact, if not to prevent our young participants from suffering from pains, at least to prevent them from incurring high medical costs to treat themselves and less expense for our state. Furthermore, to prevent them from causing harm to their social lives and families. Studies on the relationship between ergonomics and musculoskeletal system health issues frequently seen in office workers point to the importance of appropriate ergonomic arrangements in preventing these problems (Ağar et all., 2022).

Musculoskeletal problems and absence from work are significant and easily accessible indicators for institutions to evaluate employees' health and safety. A group of researchers developed a simulation model in ergonomic approaches to determine the effects and significance of physical recuperation and overtime on employee absenteeism They found that an additional hour of work led to a 44% increase in physical overload, resulting in 5 leave requests and 48 days of absence per year (Lucas et al., 2024).

**Table 5. Correlation Analysis of Factors with Highest 3 Cornell Pain Scale Scores (Neck, Back and Waist)**

| Expressions | | Factor 1 | Factor 2 | Factor 3 | Neck | Back | Waist |
|---|---|---|---|---|---|---|---|
| **Factor 1** | r | - | - | - | - | - | - |
| | p value | - | - | - | - | - | - |
| **Factor 2** | r | -,258** | - | - | - | - | - |
| | p value | ,000 | - | - | - | - | - |
| **Factor 3** | r | ,322** | ,094 | - | - | - | - |
| | p value | ,000 | ,074 | - | - | - | - |
| **Neck** | r | -,156** | ,150** | -,167** | - | - | - |
| | p value | ,003 | ,004 | ,002 | - | - | - |
| **Back** | r | -,193** | ,127* | -,202** | ,514** | - | - |
| | p value | ,000 | ,015 | ,000 | ,000 | - | - |
| **Waist** | r | -,150** | ,166** | -,118* | ,375** | ,429** | - |
| | p value | ,004 | ,002 | ,025 | ,000 | ,000 | - |
| **. Correlation is significant at the 0.01 level (2-tailed).<br>*. Correlation is significant at the 0.05 level (2-tailed). | | | | | | | |

**Table 6. Regression Coefficients and Correlations**

| **Variable** | coefficients **B[95% CI]** | standardized coefficients<br>**β** | squared semi-partial correlations<br>**$sr^2$** |
|---|---|---|---|
| Mean_Fac1 | -1.2844[-3.45, 0.88] | -0.06 | 0,00 |
| Mean_Fac2 | 3.4415[0.95, 5.93] | 0.10 | 0,02 |
| Mean_Fac3 | -3.8034[-6.40, -1.19] | -0.12 | 0,02 |
| Note: N=CI = confidence interval. *p < .05, **p < .01 | | | |

In the present the study, one in three participants reported working more than 9 hours sitting, including time spent working from home. Almost three in five participants described their health conditions as fair to poor. One in three reported musculoskeletal pain, especially in the neck and back parts of the body and totally 286 days in a year they did not go to work. These pains were related to overall sitting time and immobility at work, which caused decreasing labor productivity and unattendance to work (Dunstan et al., 2012; Ryde et al., 2013; Dere & Günay, 2021; Gao et al., 2024). Although inactivity and sitting for long hours at desk cause to muscle weakness and serious diseases over time which can be prevented with ergonomic awareness (Silverstein & Clark, 2004; Özünlü et all., 2009; Levanon et al., 2012; Akıncı et al., 2018).

The basic aim of ergonomics is to create a safe working environment. In many studies, it has been shown that ergonomic awareness was strongly and positively related with job and life satisfaction in the office environment (Akpınar et al., 2018; Tosun, 2022; Doğan, and Altınbaş, 2024).

According to mean the value of the PHAQ scale we calculated that the participants postural habits and awareness level were quite high. That means they followed the ergonomic rules while they were doing their job as well as in their daily life. Identifying the ergonomic awareness dimensions, according to participant's postural attitudes and perceptions, EFA was conducted. A three-factor, which explained 59,14% of the variance in PHAQ, indicated to us that the scale was sufficient. The first factor, named posture habits, showed that our participants were aware of their posture while sitting or standing. The second factor, which was named posture disturbing factors awareness, showed that tiredness, moods, pain, and illness were reasons to change their posture. It had also the highest mean score, which means our participants were highly aware of posture disturbing factors without causing harm to their body while doing their jobs. The third factor, which was named postural awareness, showed that our participants were careful when they were lifting things from the floor, doing their job while sitting or standing and resting.

According to regression model results, we concluded that posture disturbing factors awareness contribute positively to everyday pain, while higher awareness levels appear to alleviate pain. In a similar study conducted in higher education (Khan et al., 2020), lecturers reported 46.8% neck pain and 73.5% back pain in static posture and emphasized that these pains may be caused by habitual postural habits. Another study found that teachers experienced the highest prevalence of low back, neck, and shoulder pain over the past one year, underscoring the critical need for the implementation of ergonomic interventions within educational environments. Enhancing postural awareness and improving working conditions not only alleviates musculoskeletal pain but also contributes to the overall quality of education delivered to students (Kraemer et al., 2021). In a study comprising 217 higher education workers, a notable correlation was identified between prolonged desk work over many years and the prevalence of musculoskeletal pain, particularly in the cervical, lumbar, and shoulder regions. This association was found to be significantly linked to the postural working conditions and habitual practices of the participants. The findings suggest that the ergonomics of the workspace, along with the maintenance of proper posture during work activities, play a critical role in the development of musculoskeletal disorders among this population (Chinedu et al., 2020).

In literature a lot of studies emphasized that prolonged sitting and inadequate physical activity causes musculoskeletal diseases besides cardiovascular health problems, diabetes, even some types of cancers (Dunston et all, 2012; Gao et all., 2024). In this study, the participants claimed that according to the frequency, severity and interference of the pain with work they had neck, back and waist pain. We also calculated which sub-factors of PHAQ scale were statistically correlated with neck, back and waist pains.

In our study, while a significant relationship was found between high ergonomic awareness and reduced musculoskeletal pain, no such relationship was observed between ergonomic awareness and absence of work. This finding partially differs from previous research. For instance, Attia et al. (2023) highlighted a positive link between ergonomic awareness and work productivity in their study on staff nurses in Oman. However, in our study, we couldn't find any effects of our participants' sitting working time on the relation between the ergonomic awareness scale and their pain. Some of the data were collected during the online education period of the universities after the big earthquake on 6 February 2023 (URL 1, 2024). Therefore, it is possible that our participants could have engaged in some stretching or other relaxing physical movements that couldn't be addressed as physical exercises (Attia et all., 2023)

This outcome suggests that while ergonomic awareness may improve musculoskeletal health, it may not have a direct impact on more complex health outcomes, such as absence from work. Absence is influenced not only by physical health issues but also by psychosocial factors, job satisfaction, and work-related stress levels, among other variables. Consequently, while improvements in ergonomic awareness and musculoskeletal pain were observed, these did not translate into a direct reduction in absenteeism (Taibi et all.,2021). Additionally, this finding underscores the need for a deeper investigation into the various psychosocial and organizational factors that affect absenteeism. Future studies should further explore the potential relationship between ergonomic awareness and absenteeism.

## 5. Conclusion

Numerous studies have been done to emphasize the importance of ergonomic awareness, increasing the quality of life, and preventing chronic and musculoskeletal diseases. There are still a lot of reasons to continue it. Low ergonomic awareness leads to discomfort from postural disorders, resulting in absenteeism which creates financial and social issues. Consequently, training in ergonomic and postural awareness becomes increasingly essential. These training programs also improve the productivity of employees. This study indicated that without essential ergonomic changes, the prevalence of musculoskeletal pain among academic and administrative personnel will increase. Encouraging these workers to move more reduces health issues and enhances productivity. Some data for this study were collected after the Kahramanmaraş Earthquake, which affected 11 cities, caused the death of 53,537 people, and injured over 107,000 individuals on February 6, 2023. Numerous academics were assigned to provide voluntary assistance to those affected, and unfortunately, some lost their relatives during this tragedy. Consequently, the number of responses was lower than expected, which constitutes a limitation of this study. Based on the findings of this study, it is recommended that academic and administrative staff engage in regular ergonomic adjustments to their workspaces. For instance, ensuring that desks and chairs are appropriately adjusted, and that computer screens are at eye level, can help reduce musculoskeletal discomfort. Furthermore, providing training on posture awareness and body mechanics may significantly decrease neck, back, and waist pain. Regular breaks, stretching exercises, and physical activity should also be encouraged to prevent the adverse effects of prolonged sedentary behavior. It is also advised that universities offer opportunities for physical activity, such as dance events, Pilates, yoga, or other wellness programs, which can improve overall physical health. Regular "desk stretches" or exercises can also be implemented to reduce tension and improve posture. Additionally, creating an environment where frequent breaks are encouraged will help alleviate discomfort and promote better health. Finally, regular health assessments to monitor musculoskeletal conditions could help with early detection and management of pain, ensuring a healthier and more productive workforce.

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