The Relationship Between Musculoskeletal Pain and Chronobiology in Musicians

Müzisyenlerde Kas-iskelet Sistemi Ağrısı ile Kronobiyoloji Arasındaki İlişki

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Abstract

Objective: This study aimed to investigate chronotype as one of the risk factors for musculoskeletal pain in musicians.

Materials and Methods: A total of 135 musicians were included in the study. The musculoskeletal pain questioning of the participants was evaluated with the Cornell musculoskeletal discomfort questionairre (CMDQ). The chronotype preferences of the participants were evaluated with the morningness-eveningness questionnaire. In addition, participants' depression symptoms evaluated with Beck depression inventory, anxiety symptoms evaluated with Beck anxiety inventory.

Results: The mean CMDQ value of the participants was found to be 47.80±55.88. The region with the highest pain score of the participants was the upper extremity. In the Pearson correlation analysis, a weak negative correlation was found between morningness-eveningness questionnaire and mean CMDQ. A moderate positive correlation was found between weekly performance time and Beck anxiety index and CMDQ.

Conclusion: Eveningness, long working hours and anxiety are the determining factors on the risk of pain in musicians. The potential effect of chronobiology on pain in musicians should be taken into consideration.

Keywords: Musician, musculoskeletal pain, chronotype, CMDQ, anxiety

Öz

Amaç: Bu çalışmada, müzisyenlerde kas-iskelet sistemi ağrısı için risk faktörlerinden biri olarak kronotipin araştırılması amaçlanmıştır.

Gereç ve Yöntem: Çalışmaya toplam 135 müzisyen dahil edilmiştir. Katılımcıların kas-iskelet sistemi ağrısı sorgulamaları Cornell kas-iskelet sistemi rahatsızlık anketi (CMDQ) ile değerlendirilmiştir. Katılımcıların kronotip tercihleri sabahçılık-akşamcılık anketi ile değerlendirilmiştir. Ayrıca, katılımcıların depresyon belirtileri Beck depresyon envanteri, anksiyete belirtileri ise Beck anksiyete envanteri ile değerlendirilmiştir.

Bulgular: Katılımcıların ortalama CMDQ değeri 47,80±55,88 olarak bulunmuştur. Katılımcıların en yüksek ağrı skoruna sahip bölgesi üst ekstremitedir. Pearson korelasyon analizinde, sabahçılık-akşamcılık anketi ile CMDQ ortalamaları arasında zayıf negatif korelasyon bulunmuştur. Haftalık performans süresi ile Beck anksiyete indeksi ve CMDQ arasında orta düzeyde pozitif bir korelasyon bulunmuştur.

Sonuç: Akşamcıllık, uzun çalışma saatleri ve anksiyete, müzisyenlerde ağrı riskini belirleyen faktörlerdir. Kronobiyolojinin müzisyenlerde ağrı üzerindeki potansiyel etkisi dikkate alınmalıdır.

Anahtar kelimeler: Müzisyen, kas-iskelet ağrısı, kronotip, CMDQ, anksiyete

Introduction

Musicians frequently experience physical discomfort and pain due to the demanding nature of musical performance, which involves repetitive, fast, and complex motor activities (1). Across all categories of musicians, the prevalence of pain has been reported to range from 29.0% to 90.0% (2). Previous studies have identified several risk factors for playing-related musculoskeletal pain, including female gender, body weight, posture, years of practice, and weekly instrument playing time (3-5). Additionally,

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psychological factors such as anxiety and depression have been documented to affect pain among musicians (6,7), and these conditions frequently contribute to musculoskeletal pain in the broader literature.

In recent years, chronotype has emerged as another factor associated with pain, particularly in conditions such as fibromyalgia and other rheumatic disorders (8-11). Chronotype, also referred to as circadian preference, represents individual differences in the timing of sleep-wake cycles throughout the day. The circadian rhythm is regulated by an endogenous biological clock with genetic foundations and is influenced by environmental factors. These individual variations lead to substantial fluctuations in energy and alertness across the day: Morning types tend to be more active and focused in the early hours, evening types exhibit higher alertness later in the day, and intermediate types fall between these two extremes (12). Circadian rhythms regulate and mediate hormone secretion, receptor activity, signal transduction pathways, enzyme kinetics, and gene expression at the molecular level (13).

The association between chronotype and musculoskeletal pain can also be explained through several biological mechanisms. Pain perception is subject to circadian modulation, with evidence demonstrating rhythmic changes in nociceptive sensitivity across the day (14). Cortisol, a hormone with a robust circadian secretion pattern, peaks in the early morning and contributes to the suppression of inflammatory processes; disruptions to this rhythm—more frequently observed in individuals with eveningness—may lead to heightened inflammation and increased pain sensitivity (15,16). Furthermore, inflammatory biomarkers such as tumor necrosis factor-alpha and interleukin-6 exhibit circadian oscillations, and disturbances in these rhythms have been associated with heightened pain perception and musculoskeletal tenderness (17). These mechanisms provide a strong biological rationale for considering chronotype as a factor influencing pain perception and musculoskeletal health.

Eveningness has already been identified as a risk factor for musculoskeletal pain in certain occupational groups (18,19). For instance, a study conducted among male workers in a large automobile manufacturing facility reported lower rates of musculoskeletal pain in morning-type individuals compared with individuals of other chronotypes (20).

Despite these findings, the relationship between chronotype and musculoskeletal pain among musicians has not been previously investigated. Therefore, the objective of the present study was to examine chronotype as a potential risk factor for musculoskeletal pain in musicians.

Materials and Methods

Ethical Approval

The Ethics Committee for Clinical Research at Afyonkarahisar Health Sciences University granted approval for the study (approval date: 02.12.2022; approval number: 2022/595). The research was carried out in accordance with the principles outlined in the Declaration of Helsinki. The STROBE reporting criteria were followed in the study.

Sample Size Calculation

There are 201 musicians at Afyon Kocatepe University State Conservatory. It is necessary to interview at least 133 of the 201 people to achieve a 5% margin of error at the 95% confidence level.

$$n = \frac{Nt^2pq}{d^2(N-1) + t^2pq}$$

N= Number of individuals in the universe
n= Number of individuals to be sampled
p= The incidence (probability) of the event to be examined was 0.5 in the study.
q= Frequency of absence of the event to be examined (1-p)
t= The theoretical value found in the t table at a certain degree of freedom and the detected error level. In the study, 1.96 was taken.
d= It is symbolized as ± deviation according to the incidence of the event.

Participants

A total of 201 musicians were invited to participate in the study. Participants were contacted through visits to the conservatory. After being briefed on the study hypotheses, participants were asked to complete surveys lasting approximately 30 minutes. A total of 56 individuals declined to participate, citing lack of time or unwillingness to share information after reading the surveys. Participants with inflammatory rheumatic disease, malignancy, pregnancy, or major musculoskeletal trauma or surgery in the last 6 months were excluded from the study. A total of 135 musicians from the Afyon Kocatepe University State Conservatory were included in the study (Figure 1). Each participant provided written consent after being fully informed about the study.

Questionnaires

Demographic information of the participants, smoking and alcohol history, dominant extremity, body mass indexes, musicianship duration (years), weekly performance time (WPT) (hours), whether they exercised before performance, performance posture (sitting/standing), and type of instrument recorded. WPT was defined as the total number of hours, including rehearsals, lessons, and private study, and was self-reported by participants. Participants' musculoskeletal pain was evaluated with the Cornell musculoskeletal discomfort questionnaire (CMDQ). Participants' chronotypes were assessed using morningness-eveningness questionnaire (MEQ). In addition, participants' depressive and anxiety symptoms were evaluated with the Beck depression inventory (BDI) and the Beck anxiety inventory (BAI), respectively. Turkish versions of these questionnaires were used in this study.
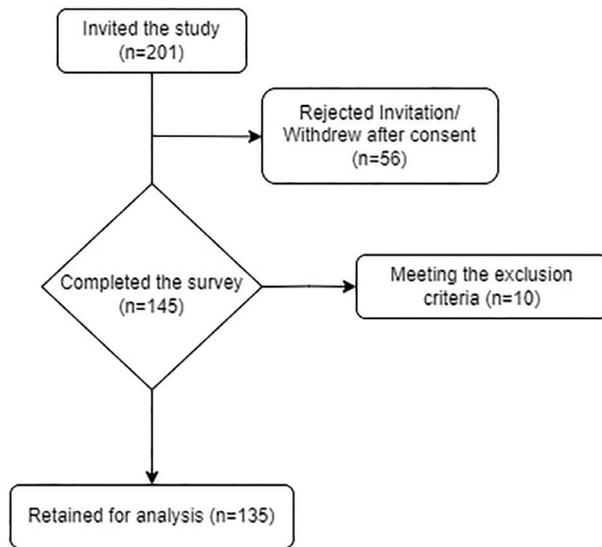
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Figure 1. Flowchart of participant selection for the analysis

Cornell Musculoskeletal Discomfort Questionairre

CMDQ measures the frequency and severity of pain in 12 body regions (neck, shoulder, back, upper arm, waist, forearm, wrist, hip, upper leg, knee, lower leg, and foot) during the last 7 days and whether this pain hinders the ability to perform work. The score for each region is calculated as the product of th scores for pain frequency, pain severity, and work disability. According to the scoring system, each region's score ranges from 0 to 90. To interpret the results of the questionnaire applied in our study more clearly, CMDQ can be defined as three grouped regions: Spine (neck, back, waist), lower extremity (hip, upper leg, knee, lower leg, foot), and upper extremity (shoulder, upper arm, forearm, wrist). It was evaluated in three parts and by a total score. The validity and reliability of the Turkish version have been established (18).

Morningness-eveningness Questionnaire

This 19-item screening questionnaire has a rating range between 16 and 86. High scores indicate morningness, whereas low scores indicate eveningness. Scoring results were categorized as follows: Evening type: Scores between 16 and 41; morning type: Scores between 59 and 86; and none: Scores between 42 and 58. The MEQ's Cronbach's alpha value in the current study was 0.765 (19). The Turkish version has been shown to have good validity and reliability (21).

BDI, BAI

BDI and BAI are self-assessment tools comprising 21 items. The highest score that could be obtained from the scales was 63, and the lowest score was 0. Higher scores on the scales indicate greater severity of depression and anxiety. The Turkish versions of the BDI (22,23) and BAI (24) were shown to have good validity and reliability.

Statistical Analysis

Descriptive statistics used in the study included frequency, percent, mean, and standard deviation. Categorical data were analyzed using Pearson's chi-square test. Normality of the data was assessed using the Kolmogorov-Smirnov test. Pearson correlation analysis was used to evaluate relationships among CMDQ, MEQ, BAI, BDI, and WPT scores. A multiple linear regression was calculated to predict CMDQ. A p-value <0.05 was considered statistically significant. The obtained data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY).

Results

Descriptive statistics for the variables are presented in Table 1. Eighteen (13.3%) participants were in the morningness group, 34 (25.2%) in the eveningness group, and 83 (61.5%) were in neither group. The MEQ, BAI, BDI, and CMDQ characteristics of the participants are summarized in Table 2. The mean CMDQ (total) value was found to be 60.96±60.59 in females and 36.95±49.50 in males (p=0.045). The region of the musculoskeletal system in which participants had the highest pain score was the upper extremity. Mean CMDQ scores by painful body area are shown in Figure 2, and CMDQ groups are shown in Figure 3.

In the Pearson correlation analysis, a weak negative correlation was found between MEQ and CMDQ (r1=-0.174; p<0.001). A moderate positive correlation was found between WPT and BAI (r1=0.485, p<0.001) and between WPT and CMDQ (total) (r1=0.413, p<0.001). Table 3 shows the Pearson correlation coefficients between the variables. A multiple linear regression, adjusted for gender, was performed to predict CMDQ (total) from WPT, BAI, and MEQ (Table 4). A significant regression equation was found [F (3,132) =74.638, p<0.001], with an R^2 of 0.629. Participants' predicted CMDQ (total) =1.630*BAI-0.145*MEQ + 1.565*WPT.

Discussion

This study, conducted to examine musculoskeletal pain, chronotype, and other related factors in musicians, found that eveningness correlated with pain scores. Weekly practice hours and anxiety levels significantly affected musicians' pain.

Although the area where musculoskeletal pain is most commonly seen varies among different instruments, when all instrument families are considered, the most frequent pain is found in the neck and shoulders (20). Ioannou and Altenmüller (25) reported that the wrist, forearm, and fingers are three of the four most frequently impacted body parts. According to Berque et al. (26) the right and left hands and wrists were among the areas most impacted. We found the highest risk of pain in the upper extremities, followed by low back and other back pain.

Studies have shown that increased years of experience and higher perceived exertion rates after 45 minutes of continuous practice

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Table 1. Descriptive statistics of variables

		Mean ± SD	
Age (years)		25.81±9.19	
BMI		23.89±4.97	
Musicianship duration (years)		9.97±7.99	
Weekly performance time (hours)		21.68±16.14	
		n	%
Sex	Female	61	45.2
	Male	74	54.8
Dominant hand	Right handed	115	85.2
	Left handed	20	14.8
Smoking	Yes	50	37.0
	No	85	63.0
Alcohol	Yes	73	54.1
	No	62	45.9
Instrument	String	41	30.4
	Woodwind	14	10.4
	Plucked	46	34.1
	Keyboard	34	25.2
Warming up before the pratice	Yes	92	68.1
	No	43	31.9
Performance posture	Sitting	108	80.0
	Standing	27	20.0

SD: Standard deviation, BMI: Body mass index

Table 2. Survey chracteristics

	Mean ± SD
MEQ	47.11±10.29
BDI	14.68±9.95
BAI	12.13±12.15
CMDQ (total)	47.80±55.88

MEQ: Morningness-eveningness questionnaire, BDI: Beck depression inventory, BAI: Beck anxiety inventory, CMDQ: Cornell musculoskeletal discomfort questionairre, SD: Standard deviation

are significantly associated with the musculoskeletal pain (3). It has been shown that musicians who play 15 hours or more per week are more likely to report experiencing musculoskeletal pain (4). The relationship between practice time and pain has also been demonstrated in other studies (25-27). Similarly, we found that weekly practice time was a factor predicting pain risk.

In a review conducted by Stanhope et al. (28) on musculoskeletal complaints in musicians, they compiled a comprehensive inventory of perceived risks or exacerbating factors that had previously been examined. Besides the aforementioned risk factors, they identified several other factors, some of which appear highly personal or not specific to music or to a particular instrument.

According to Jacukowicz (29) musculoskeletal disorders can be caused or worsened by psychological stress and burdens, a fact that has been well-documented by numerous studies conducted on different types of workers. According to Nedelcut et al. (30), musicians have higher anxiety scores than their matched controls. In the study conducted by Matei and Ginsborg (6), performance-related musculoskeletal disorders, anxiety, and reported frequency and severity of physical effort were positively associated. Similarly, we demonstrated that anxiety was correlated with pain scores. Furthermore, anxiety emerged as a determinant of pain risk in the multiple regression analysis. Chronotypes have been associated with many mental health problems, including mood disorders (31). Studies also have indicated that sensitivity to pain may be influenced by chronotype, with evening types exhibiting a greater sensitivity to pain (32). Merikanto et al. (33) noted that evening types have a higher likelihood of joint diseases and back pain compared to morning types. Chronotype should be considered as an indicator of widespread pain, and therefore should be taken into account when assessing a patient's risk for chronic pain (34). There is strong evidence for the link between chronotype and the symptomatology of fibromyalgia syndrome, one of the common pain syndromes, with later chronotypes being more affected by fibromyalgia (9). Less eveningness has been linked with milder depressive symptoms and improved quality of life (35).

When considering exogenous factors and occupational settings, musicians may exhibit eveningness. Our study revealed that approximately 25.2% of individuals exhibited eveningness.
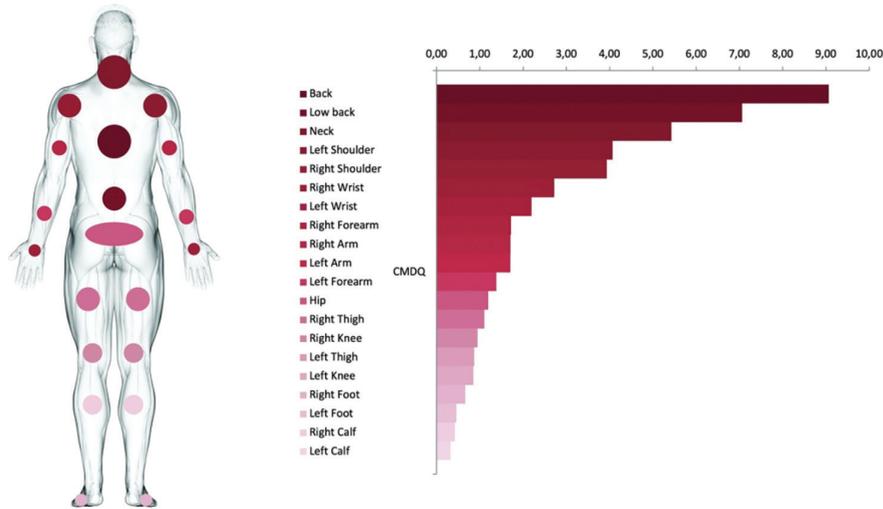
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Figure 2. Mean CMDQ scores according to the painful areas of the body
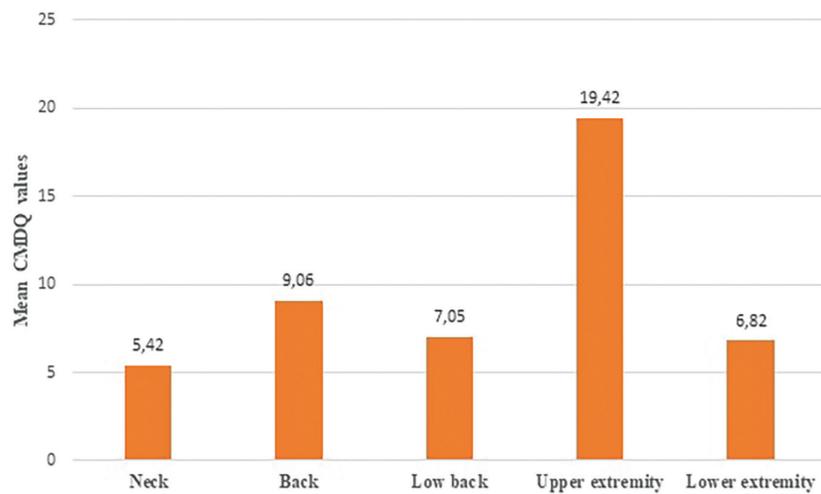*CMDQ: Cornell musculoskeletal discomfort questionairre*

Figure 3. Mean CMDQ group scores
CMDQ: Cornell musculoskeletal discomfort questionairre

Table 3. Correlation analyses of variables						
		WPT	**MEQ**	**BDI**	**BAI**	**CMDQ**
WPT	r	1				
MEQ	r	0.02	1			
BDI	r	0.06	**-0.336****	1		
BAI	r	0.15	-0.155	**0.529****	1	
CMDQ (total)	r	**0.485****	**-0.174***	**0.286****	**0.413****	1
**: p<0.001, p<0.05 p-value is the result of Pearson correlation, WPT: Weekly performance time, MEQ: Morningness-eveningness questionnaire, BDI: Beck depression inventory, BAI: Beck anxiety inventory, CMDQ: Cornell musculoskeletal discomfort questionairre						

Paine et al. (36) reported that 49.8% of the total population was morning type and 5.6% had evening type. Compared with the general population, musicians have a greater preference for evening activities.It has been shown that evening chronotype is a risk factor for work-related musculoskeletal disorders in different occupational groups. For instance, in a study with 119 male production workers, the rate of musculoskeletal pain was significantly lower for morning-type workers (37). In nurses, evening chronotype was found to be linked with higher risk of work-related musculoskeletal disorders (38). Heikkala et al. (34) also noted that eveningand intermediate chronotypes are associated with musculoskeletal pain, but that mental distress, insomnia, and comorbidities may also play a role in these relationships. Our study is the first to examine chronotype in musicians, a population with a high prevalence of musculoskeletal problems, and to find that evening chronotype, along with performance duration and anxiety, was a significant factor in pain risk.

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Table 4. Regression analyzes for CMDQ (total)					
	β	R²	Adj. R²	F	p
WPT	1.63				
MEQ	-0.145	0.629	0.621	74.648	<0.001
BAI	0.346				
BAI: Beck anxiety inventory, CMDQ: Cornell musculoskeletal discomfort questionairre, MEQ: Morningness-eveningness questionnaire					

Study Limitations

A strength of this study is that it is the first to examine chronobiology among musicians. Furthermore, the inclusion of depression and anxiety, which can be influenced by chronobiology, strengthens the study.

Musculoskeletal problems are closely related to sleep and sleep quality. One limitation of this study is that sleep quality was not assessed. The small sample size is a limitation.

In conclusion, musicians are at higher risk of developing musculoskeletal pain, particularly in the upper extremities and back. Eveningness, long working hours, and anxiety are determinants of pain risk.

Ethics

Ethics Committee Approval: The Ethics Committee for Clinical Research at Afyonkarahisar Health Sciences University granted approval for the study (approval date: 02.12.2022; approval number: 2022/595).

Informed Consent: Each participant provided written consent after being fully informed about the study.

Footnotes

Authorship Contributions

Design: S.A., C.K.T., Data Collection or Processing: S.A., Analysis or Interpretation: S.A., C.K.T., Literature Search: S.A., C.K.T., Writing: S.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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