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Özgün araştırma

Kronik Spesifik Olmayan Bel Ağrılı Bireylerde Ağrı Düzeyi ile İlişkili Faktörlerin Araştırılması

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Öz

Amaç: Bu çalışmanın amacı, kronik spesifik olmayan bel ağrılı (KSOBA) bireylerde ağrı düzeyi ile ilişkili faktörlerin araştırılmasıdır.
Gereç ve Yöntem: Çalışmaya KSOBA tanısı almış 44 erkek, 46 kadın toplam 90 hasta dahil edildi. Hastaların ağrı seviyesi Görsel Analog Skala (GAS) ile, vücut dengesi statik ve dinamik olarak Biodex Stabilite Sistemi ile, quadriceps femoris kas kuvveti izometrik bir dinamometre yardımı ile, özürlülük seviyesi ise Oswestry Özürlülük İndeksi (OÖİ) ile değerlendirildi. Ağrı düzeyini etkileyen faktörleri belirlemek için doğrusal regresyon analizi yapıldı.
Bulgular: Doğrusal regresyon analizi sonuçlarına göre statik denge (anteroposterior, mediolateral ve genel), dinamik denge (anteroposterior, mediolateral ve genel), OÖİ ve quadriceps femoris kas kuvveti (sol, sağ) varyansın %98.1'ini açıkladı. Ayrıca dinamik dengenin tüm alt parametreleri (genel p=0.000, anteroposterior p=0.001, mediolateral p=0.008) ve OÖİ'nin (p=0.000) ağrı seviyesinin bağımsız öngörücüleri olduğu belirlendi.
Sonuç: KSOBA'lı bireylerde ağrı düzeyinin denge kas kuvveti (quadriceps femoris) ve özürlülük seviyesi ile ilişkili olduğu belirlendi. Ayrıca dinamik dengenin ve OÖİ'nin ağrı seviyesini etkileyen faktörler olduğu gözlendi.

Anahtar kelimeler: *kronik spesifik olmayan bel ağrısı, ağrı seviyesi, denge, kas kuvveti, özür*

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Original Research

Investigation of Factors Associated with Pain Level in Individuals with Chronic Non-Specific Low Back Pain

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Abstract

Objectives: The aim of this study was to investigate the factors associated with pain levels in individuals with chronic non-specific low back pain (CSLBP).
Material and Methods: A total of 90 patients (44 males and 46 females) diagnosed with CS LBP were included in the study. Pain level was assessed by the Visual Analogue Scale (VAS), body balance was assessed statically and dynamically by the Biodex Stability System, quadriceps femoris muscle strength was assessed by an isometric dynamometer, and disability level was assessed by the Oswestry Disability Index (ODI). A linear regression analysis was performed to determine the factors affecting pain level.
Results: According to the results of linear regression analysis, static balance (anteroposterior, mediolateral, and general), dynamic balance (anteroposterior, mediolateral, and general), ODI, and quadriceps femoris muscle strength (left, right) explained 98.1% of the variance. In addition, all sub-parameters of dynamic balance (general p=0.000, anteroposterior p=0.001, mediolateral p=0.008) and ODI (p=0.000) were independent predictors of pain level.
Conclusion: It was determined that pain level was associated with balance, muscle strength (quadriceps femoris), and disability level in individuals with CSBP. It was also observed that dynamic balance and ODI were factors affecting the pain level.

Keywords: *chronic non-specific low back pain, pain level, balance, muscle strength, disability*

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Introduction

Low back pain (LBP) is a common global disorder that negatively affects activities of daily living (Morris *et al.* 2020). LBP is one of the most common musculoskeletal disorders worldwide. It is stated that approximately 60-80% of the adult population suffer from this disorder at least once during their lifetime (Meucci *et al.* 2015). About 10 percent of patients with LBP have prolonged symptoms and develop chronic LBP. In addition, the source of pain is unknown in approximately 85% of patients with LBP, and it is classified as chronic non-specific low back pain (CNSLBP) (Hayden *et al.* 2019). Therefore, determining the factors associated with CNSLBP will be important in the evaluation of these individuals and in determining rapid rehabilitation programs.

Pain level is very important in patients with LBP. Because pain can negatively affect activities of daily living, body balance and muscle strength. For example, Liu-Ambrose et al. reported that pain level and body balance were related in patients with LBP (Liu-Ambrose *et al.* 2002). Keller et al. concluded that leg muscle strength and pain level were related in patients with LBP (Keller *et al.* 1999). In another study, Horng et al. argued that there is a relationship between increased pain intensity and decreased quality of life in people with LBP (Horng *et al.* 2005). In a study examining pain levels in patients with non-specific LBP in Southern China, it was reported that lower education levels, long-term LBP in the past year, smoking, higher body mass index, and long-term driving were related to more severe VAS score (Sribastav *et al.* 2018).

In general, although many studies have examined the factors associated with pain levels in patients with CNSLBP, the number of studies that have identified the determinants of pain levels is very limited (Sribastav *et al.* 2018). We hypothesized that balance, muscle strength, and disability level may be predictors of pain severity in individuals with CNSLBP. Thus, the aim of the study was to investigate whether balance, muscle strength, and disability level are independent predictors of pain levels in patients with CNSLBP.

Materials and Methods

Design

This study was planned as a cross-sectional study. Ethical approval was obtained from Muş Alparslan University Scientific Research and Publication Ethics Committee (Number: 1-2023/38). A signed consent form was obtained from the patients before starting the study. Participants applied to Kırşehir Ahi Evran University Physical Medicine Polyclinic and were randomly selected among patients with CNSLBP.

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Participants

Ninety patients aged 18-65 years, diagnosed with CNSLBP by a physical medicine specialist and having low back pain for more than 6 months, were included in the study. Those who had a history of back surgery, a history of malignancy, and an additional musculoskeletal problem were excluded from the study.

To calculate the minimum required sample size, the confidence level was considered as 95%, the power of the study was 80%, and the average prevalence rate of low back pain was 80% (Bozorgmehr *et al.* 2018). This calculation generated a sample size of 85 individuals. However, a total of 90 people were included in the study, with a 5% drop-out risk.

Measures

Just before the start of the study, data such as age, body mass index (kg/m^2), height and weight of the participants were recorded.

Pain Level

The pain level of the participants was evaluated with the Visual Analogue Scale (VAS). It is known that VAS is a valid and reliable subjective measurement method in pain assessment. Patients were asked to mark their pain level on a 10 cm line. The 0 marked on the scale indicates no pain, and the 10 does the unbearable pain level (Ohnhaus and Adler 1975, Revill *et al.* 1976).

Balance

Biodex Balance System (Biodex Medical Systems, Shirley, NY, 11,967–0702, USA) has been found to be reliable in the evaluation of dynamic and static postural balance and has been widely used in recent years. Static and dynamic balance values of the individuals participating in the study were measured with BBS as anterior-posterior, medial-lateral and total values. Patients tried to stay in balance for 20 seconds on the device whose stability was adjusted. This process was repeated three times with rest periods of 10 seconds (Cachupe *et al.* 2001, Özüdoğru *et al.* 2022).

Oswestry Disability Index (ODI)

The Oswestry Disability Index (ODI) frequently evaluates the inability of patients suffering from low back pain in activities of daily living. The Turkish validity and reliability study of the scale was done by Yakut et al. It is a valid and reliable scale in the Turkish language. Each question is scored between 0 and 5 on the scale, which consists of 10 questions in total. A score between 1-10 indicates mild disability, 11-30 indicates moderate disability, and 31-50 indicates severe disability. The score range is 0-50. A higher score indicates a higher disability (Fairbank *et al.* 1980, Yakut *et al.* 2004).

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Muscle Strength

The quadriceps muscle strength of the participants was evaluated with a LaFayette brand isometric dynamometer. It has been reported that inter-rater reliability for knee extensor and flexor muscle strength measurements obtained by hand dynamometer was good to high, and reliability remained consistent irrespective of the severity of symptoms (Dunn and Iversen 2003). While the participants were seated on a flat surface and the knees and hips were 90° flexed, the dynamometer was placed 1-2 cm above the malleolus, and the participant was asked to push the dynamometer with maximum force. Three attempts were made, and the highest score was recorded and recorded in kg (Katoh *et al.* 2011).

Statistical Analysis

Statistical Package for Social Science (SPSS) version 22.0 was used for data analysis. The normality of the data was analyzed using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Simirnov/Shapiro-Wilk) tests. Descriptive statistical information was given as mean and standard deviation (X ± SD) and minimum-maximum. Pearson correlation analysis was used to calculate the correlation between the variables because the data fit the normal distribution. In our study, linear regression analysis (R^2) was performed to examine the factors likely to affect the level of pain in CNSLBP.

Results

The demographic information of the participants and the average of the clinical evaluation parameters are given in Table 1.

Factors associated with VAS are shown in Table 2. A statistically significant positive correlation was found between the VAS score and ODI, static and dynamic balance sub-parameters ($p<0.05$). A negative correlation was found between VAS score and QMS (left, right) ($p<0.05$, Table 2).

According to the results of Linear Regression analysis, Static AP, Static ML, Static Overall, Dynamic AP, Dynamic ML, Dynamic Overall and ODI explaining 98.1% of the variance were found as independent determinants of VAS ($p<0.05$, Table 3). The order of magnitude of the effects of the statistically significant variables on pain was found to be Dynamic Overall ($\beta=0.476$, $p=0.000$), Dynamic AP ($\beta=0.289$, $p=0.001$), Dynamic ML ($\beta=0.274$, $p=0.008$) and ODI ($\beta=0.031$, $p=0.000$), respectively. More precisely, the results of the analyses show that as the level of dynamic balance and disability increases, the pain of the patients also increases with coefficients.

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Table 1. Demographic and clinical characteristics of the participants (n=90)

		X±SD	Min	Max
Age (year)		55.74 ± 8.09	33	67
Height (cm)		164.62 ± 6.36	150	186
Weight (kg)		72.38 ± 14.03	49	120
BMI (kg/m^2)		26.94 ± 6.03	17.17	41.52
VAS (score)		4.43 ± 2.61	1	9
Biodex static balance (anteroposterior)		2.08 ± 1.30	0.20	5
Biodex static balance (mediolateral)		1.21 ± 0.81	0.40	3.80
Biodex static balance (overall)		2.69 ± 1.79	0.70	7
Biodex dynamic balance (anteroposterior)		2.85 ± 1.65	0.40	6.10
Biodex dynamic balance (mediolateral)		1.70 ± 0.96	0.20	3.90
Biodex dynamic balance (overall)		3.66±2.04	0.90	7.80
Left Quadriceps muscle strength (kg)		9.15±3.68	4	15
Right Quadriceps muscle strength (kg)		10.54±4.01	4	17.5
Oswestry Disability Index (%)		41.09±30.32	3	90
			n	**%**
Gender	Male		44	48.9
	Female		46	51.1

X±SD: Mean±Standart Deviation, Cm: Centimeter, Kg: Kilogram, BMI: Body mass index, VAS: Visual analogue scale

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Table 2. Correlation between VAS score and other assessments

		Static AP	Static ML	Static Overall	Dynamic AP	Dynamic ML	Dynamic Overall	QMS (left)	QMS (right)	ODI	VAS
Static AP											
Static ML	r	.865									
	p	.000									
Static Overall	r	.926	.965								
	p	.000	.000								
Dynamic AP	r	.926	.851	.886							
	p	.000	.000	.000							
Dynamic ML	r	.869	.834	.868	.870						
	p	.000	.000	.000	.000						
Dynamic Overall	r	.936	.885	.916	.953	.915					
	p	.000	.000	.000	.000	.000					
Left QMS (kg)	r	-.925	-.816	-.875	-.924	-.873	-.944				
	p	.000	.000	.000	.000	.000	.000				
Right QMS (kg)	r	-.918	-.821	-.863	-.917	-.858	-.935	.978			
	p	.000	.000	.000	.000	.000	.000	.000			
ODI (%)	r	.935	.880	.921	.950	.886	.968	-.948	-.943		
	p	.000	.000	.000	.000	.000	.000	.000	.000		
VAS (score)	r	.943	.879	.920	.963	.915	.982	-.943	-.938	.979	
	p	.000	.000	.000	.000	.000	.000	.000	.000	.000	

AP: Anteroposterior, ML: Mediolateral, QMS: Quadriceps muscle strength, ODI: Oswestry disability index, VAS: Visual analogue scale

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Table 3. Linear regression model of VAS

Variable	B	SE	Beta	p
Costant	-0.302	.581	------	.605
Static AP	0.089	.113	.044	.434
Static ML	-0.271	.211	-.084	.203
Static Overall	0.111	.126	.077	.378
Dynamic AP	0.289	.085	.182	.001
Dynamic ML	0.274	.101	.101	.008
Dynamic Overall	0.476	.098	.372	.000
Left QMS (kg)	0.087	.060	.123	.148
Right QMS (kg)	-0.050	.050	-.077	.321
ODI (%)	0.031	.006	.363	.000

$R= 0.991$, $R^2= 0.983$, Adjusted $R^2= 0.981$
B: Under standardized regression coefficient, SE: Standard error, $p<0.05$
AP: Anteroposterior, ML: Mediolateral, QMS: Quadriceps muscle strength, ODI: Oswestry disability index
Formula= [VAS= -0.302 + (0.089 × Static AP) + (-0.271 × Static ML) + (0.111 × Static Overall) + (0.289 × Dynamic AP) + (0.274 × Dynamic ML) + (0.476 × Dynamic Overall) + (0.087 × QMS left) + (-0.050 × QMS right) + (0.031 × ODI)]

Discussion and Conclusion

This study indicated a relationship between pain intensity, ODI (level of disability in participation in activities of daily living) score, quadriceps femoris muscle strength, and balance sub-parameters in individuals with CNSLBP. These results mean the magnitude of pain level affects balance, quadriceps femoris muscle strength, and disability level in patients with CNLBP. Furthermore, it was concluded that ODI and dynamic balance sub-parameters (AP, ML, and Overall) were each predictors of pain level in individuals with CNLBP.

Liu-Ambrose et al. demonstrated a correlation between the severity of LBP and body balance among women aged 65-75 with osteoporosis (Liu-Ambrose *et al.* 2002). Similarly, Ruhe et al. observed postural instability in individuals with LBP when compared to healthy counterparts. Their findings indicated that postural oscillations in both anteroposterior and mediolateral directions increased as pain intensity escalated (Ruhe *et al.* 2011). Another study by Kahraman et al. concluded that pain intensity was linked to compromised dynamic balance in individuals with CNSLBP (Kahraman *et al.* 2018). The results obtained from the present study are in line with the literature, and we found a significant correlation between all sub-parameters of dynamic and static balance and pain scores. This result might be attributed to

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increased pre-synaptic inhibition of muscle afferents with heightened pain levels, which potentially has an adverse impact on balance.

Yılmaz et al. documented decreased quadriceps and hamstring muscle strength in individuals with chronic LBP compared to their healthy counterparts. Interestingly, they concluded that the magnitude of pain experienced both at rest and during activity did not correlate with quadriceps and hamstring isokinetic lower extremity muscle strength (Yilmaz and Yılmaz 2019). In individuals with chronic LBP, not only lower extremity muscle strength is affected, but also changes are observed in lumbar and abdominal muscle strength. Core region muscle strength is associated with lower extremity function (Yumuşak *et al.* 2020). Keller et al. concluded that pain is the strongest predictor of isokinetic muscle strength in patients with LBP. In another study, Estlander et al. reported that there is a relationship between pain level and trunk muscle strength in individuals with LBP (Estlander *et al.* 1994). The current study aligns with these findings, revealing a substantial negative correlation between quadriceps muscle strength and pain level. Therefore, in accordance with the existing literature, we can assert that heightened pain levels in individuals with CNLBP have an adverse impact on quadriceps muscle strength.

Horng et al. found a significant relationship between health-related quality of life and pain severity in patients with LBP (Horng *et al.* 2005). Similarly, Kovacs et al. concluded that there is a relationship between pain severity, quality of life and disability level in patients with chronic LBP (Kovacs *et al.* 2005). In another study, Sengul et al. stated that quality of life and severity of pain were related in patients with LBP (Sengul *et al.* 2010). According to the findings of the current study, similar to previous studies, a positive and significant correlation was found between the VAS score assessing the pain level and the ODI score assessing the level of disability in patients with CNSLBP.

The number of studies examining the predictors of pain level in individuals with CNSLBP is limited. In the present study, static AP, static ML, static Overall, dynamic AP, dynamic ML, dynamic Overall, ODI, QMS (left), and QMS (right) values were found to be predictors of VAS score with 98.1% variance. Furthermore, our study revealed that dynamic balance and disability level significantly predict pain in individuals with CNSLBP. Notably, the unique aspect of our research lies in the utilization of objective measurements rather than relying solely on subjective assessments. Additionally, we examined sub-parameters of balance, setting our study apart from existing literature in this field.

Based on our findings, we recommend that clinicians and physiotherapists who work with individuals suffering from CNSLBP in clinical settings should consider determined

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factors, including dynamic balance and disability level, during the design and implementation of their treatment and evaluation programs. Incorporating these predictive factors into clinical practice can potentially lead to more effective and tailored interventions, ultimately enhancing patient outcomes.

Study limitation

The study's primary limitation is the inclusion of both genders, as pain perception has been reported to may vary between sexes. Future research is advised to concentrate on a single gender to possibly achieve more homogeneous data. Moreover, incorporating measurement devices such as algometers for pain assessment could have yielded more objective outcomes. It is thought that forthcoming investigations should encompass assessments of various parameters influencing pain while restricting the study group to one gender.

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