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Factors Influencing Chronic Low Back Pain-Related Disability in Patients with Diabetes Mellitus: A Cross-Sectional Study

Diabetes Mellitus Hastalarında Kronik Bel Ağrısı ile İlişkili Engelliliği Etkileyen Faktörler: Kesitsel Çalışma

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ABSTRACT Objective: To evaluate the factors associated with chronic low back pain (CLBP)-related disability in patients with diabetes mellitus (DM). **Material and Methods:** Two hundred and twenty-four patients with DM were included in the study between September 2023 and January 2024. Disability related to chronic LBP was evaluated using Oswestry Disability Index (ODI). Pain intensity was assessed using the 100-mm visual analog scale (VAS). **Results:** The median age of the participants was 56.0 years (interquartile range, 50.0-62.0). The prevalence of chronic LBP was 31.3% in patients with DM. Female patients had a higher median ODI score than in male patients (p=0.002). The median ODI score was higher in patients with diabetic neuropathy than in those without (p=0.004). The ODI score was positively correlated with body mass index (BMI) (r=0.209, p=0.003) and VAS score (r=0.906, p<0.001), and negatively correlated with education duration (r=-0.215, p=0.001). Univariate regression analysis showed that female gender (B=3.594, p=0.010), BMI (B=0.226, p=0.021), duration of education (B=-0.616, p=0.002), duration of DM (B=0.014, p=0.041), and presence of diabetic neuropathy (B=3.861, p=0.018) were associated factors for CLBP-related disability in patients with DM. Multivariate linear regression analysis showed that duration of education was a predictive variable for CLBP-related disability in patients with DM (B=-0.482, p=0.012) (R2=0.036). **Conclusion:** Clinicians should be aware of the risk factors for CLBP-related disability in patients with DM. Patients with lower years of education, female gender, higher BMI, longer duration of DM, and the presence of diabetic neuropathy should be followed regularly for CLBP-related disability.

Keywords: Chronic low back pain; disability; diabetes mellitus

ÖZET Amaç: Çalışmanın amacı, diabetes mellitus (DM) hastalarında kronik bel ağrısına bağlı engellilik ile ilişkili faktörleri değerlendirmektir. **Gereç ve Yöntemler:** Eylül 2023-Ocak 2024 tarihleri arasında 224 DM hastası çalışmaya dâhil edildi. Kronik bel ağrısı ile ilişkili engellilik Oswestry Bel Ağrısı Engellilik Anketi [Oswestry Disability Index (ODI)] kullanılarak değerlendirildi. Ağrı yoğunluğu 100-mm görsel analog skala [visual analog scale (VAS)] kullanılarak değerlendirildi. **Bulgular:** Katılımcıların ortanca yaşı 56,0 (çeyrekler açıklığı, 50,0-62,0) idi. DM'li hastalarda kronik bel ağrısı prevalansı %31,3 idi. Kadın hastaların ortanca ODI skoru erkek hastalara göre daha yüksekti (p=0,002). Ortanca ODI skoru diyabetik nöropatisi olan hastalarda olmayanlara göre daha yüksekti (p=0,004). ODI skoru; beden kitle indeksi (BKİ) (r=0,209, p=0,003) ve VAS skoru (r=0,906, p<0,001) ile pozitif, eğitim süresi ile negatif korele idi (r=-0,215, p=0,001). Tek değişkenli regresyon analizinde, kadın cinsiyet (B=3,594, p=0,010), BKİ (B=0,226, p=0,021), eğitim süresi (B=-0,616, p=0,002), DM süresi (B=0,014, p=0,041) ve diyabetik nöropati varlığı (B=3,861, p=0,018) DM hastalarında kronik bel ağrısı ile ilişkili engellilik için bağımsız değişkenler idi. Çoklu doğrusal regresyon analizinde ise eğitim süresi DM'li hastalarda kronik bel ağrısı ile ilişkili engellilik için tek bağımsız değişken idi (B=-0,482, p=0,012) (R2=0,036). **Sonuç:** Klinisyenler DM hastalarında kronik bel ağrısı ile ilişkili engellilik için risk faktörlerinin farkında olmalıdır. Eğitim seviyesi düşük, kadın cinsiyette, BKİ yüksek, DM süresi uzun olan ve diyabetik nöropatisi olan hastalar kronik bel ağrısına bağlı engellilik açısından düzenli olarak takip edilmelidir.

Anahtar Kelimeler: Kronik bel ağrısı; disabilite; diabetes mellitus

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Low back pain (LBP) is an important health care problem in modern society, and many studies have been conducted on the complexity and consequences of LBP.[1-3] The prevalence of chronic low back pain (CLBP) is varying between 3.9% and 25.4% worldwide.[4-6] CLBP can lead to disability, reduced quality of life, and economic burden, including absenteeism, long-term medical treatment, chronic pain management, and assistance with activities of daily living.[2,7]

Diabetes mellitus (DM) is a chronic disease that affects an estimated 537 million adults worldwide.[8] It is also estimated that the prevalence of DM will increase over the years.[8] DM can cause microvascular and macrovascular chronic complications.[9] Previous studies in the literature demonstrated that the prevalence of CLBP is higher in patients with DM than in those without.[1,10-12]

Because CLBP is a leading cause of disability, it is important to identify risk factors for CLBP-related disability in order to develop strategies to prevent and manage disability. Previous studies have shown that the risk factors for disability in CLBP include a variety of factors such as sociodemographic and psychological factors, and pain characteristics.[2,7] To the best of our knowledge, there is a lack of knowledge regarding associated factors for CLBP-related disability in patients with DM in the literature. The aim of this study is to evaluate the factors associated with CLBP and LBP-related disability in patients with DM.

MATERIAL AND METHODS

This study was designed as a cross-sectional study and approved by the Ankara Etlik City Hospital Ethics Committee (date: September 06, 2023, no: AESH-EK1-2023-511) in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants.

STUDY POPULATION

Two hundred and twenty-four consecutive diabetic patients aged 18 years and older who presented to the endocrinology and metabolism outpatient clinic between September 2023 and January 2024 were included in the study. Patients with inflammatory rheumatologic disorders, renal failure (estimated glomerular filtration rate <60 mL/min/1.73 m^2), liver failure, malignancy, psychiatric or cognitive disorders, pregnancy, and orthopedic and neurologic disorders causing disability were excluded.

Sociodemographic variables [age, sex, marital status, years of education, height (cm), weight (kg), body mass index (BMI) (kg/m^2)], comorbidities, type of DM, duration of DM, presence of microvascular complications such as retinopathy, nephropathy, and neuropathy were recorded. Laboratory results including glycosylated hemoglobin (HbA1C) (%), fasting blood glucose (mg/dL), postprandial blood glucose (mg/dL), triglycerides (mg/dL), high-density lipoprotein (HDL) (mg/dL), and low-density lipoprotein (LDL) (mg/dL) were noted.

CLBP was defined as pain between the twelfth rib and the gluteal fold lasting more than 12 weeks.[3]

OSWESTRY DISABILITY INDEX

Disability related to chronic LBP was evaluated using Oswestry Disability Index (ODI).[13] The 10-item questionnaire consists of pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and travelling. Each item is scored between 0 (no disability) and 5 (greatest disability). The disability score is calculated by dividing the total score by the total possible score and multiplying the result by 100, expressed as a percentage. Higher scores on the ODI indicate a greater level of disability.[7,14]

VISUAL ANALOG SCALE

Pain intensity was assessed using the 100-mm visual analog scale (VAS) (0=no pain, 100=worst pain).[15]

STATISTICAL ANALYSIS

Normality of the data was tested using the Shapiro-Wilk's Test. Descriptive statistics were presented as frequencies (percentages) and median [interquartile range (IQR)]. The Mann-Whitney U test was used to compare two independent groups for variables that were not normally distributed. The Spearman's test was used for correlations between variables that were not normally distributed or ordinal variables. Both the total ODI score and the scores of the subcategories of the ODI (pain intensity, self-care, lifting, walking, sitting, standing, sleeping, sexual life, social life, and travel) were included in the correlation analyses. The final predictors of ODI were determined using univariate and multivariate linear regression analysis. Age, sex, BMI, years of education, duration of DM, presence of neuropathy, HbA1C, and LDL levels were included in the multivariate regression analysis model using a stepwise procedure.

RESULTS

A total of 224 patients (female=138, male=86) were included in the study. The median age of the participants was 56.0 years (IQR, 50.0-62.0). The median

TABLE 1: Demographic variables and questionnaire scores of the participants.

	With chronic LBP n=70	Without chronic LBP n=154	p-value
Age (median, IQR)	57.5 (52.0-62.0)	55.0 (48.0-63.0)	0.182
Sex (%)			
Female	51 (37.0%)	87 (63.0%)	0.020
Male	19 (22.1%)	67 (77.9%)	
BMI (kg/m^2) (median, IQR)	31.2 (28.0-35.5)	28.7 (25.5-32.4)	0.003
Marital status (%)			
Single	10 (14.3%)	17 (11.0%)	0.489
Married	60 (87.7%)	137 (89.0%)	
Education duration (year) (median, IQR)	8.0 (5.0-11.0)	11.0 (5.0-11.0)	0.002
Duration of DM (month) (median, IQR)	132.0 (60.0-198.0)	120.0 (48.0-180.0)	0.230
Microvasculary complication (%)			
Yes	25 (36.8%)	43 (63.2%)	0.240
No	45 (28.8%)	110 (71.2%)	
Diabetic neuropathy (%)			
Yes	22 (43.1%)	29 (56.9%)	0.037
No	48 (27.7%)	125 (72.3%)	
Diabetic nephropathy (%)			
Yes	4 (21.1%)	15 (78.9%)	0.316
No	66 (32.2%)	139 (67.8%)	
Diabetic retinopathy (%)			
Yes	8 (27.6%)	21 (72.4%)	0.648
No	62 (31.8%)	133 (68.2%)	
Laboratory test results			
HbA1C (%) (median, IQR)	8.1 (7.1-9.6)	7.7 (6.8-9.7)	0.713
Fasting blood glucose (mg/dL) (median, IQR)	155.5 (126.0-217.0)	139.0 (114.0-190.0)	0.071
Postprandial blood glucose (mg/dL) (median, IQR)	163.0 (146.0-200.5)	189.0 (150.0-218.0)	0.312
Triglycerides (mg/dL) (median, IQR)	153.5 (114.0-246.0)	141.5 (96.0-216.0)	0.176
HDL (mg/dL) (median, IQR)	44.0 (37.0-50.0)	46.0 (37.0-52.0)	0.327
LDL (mg/dL) (median, IQR)	111.5 (85.0-141.0)	118.0 (86.0-142.0)	0.519
Questionnaire scores			
ODI (median, IQR)	11.6 (6.0-24.0)	0.0 (0-0)	<0.001
ODI-pain intensity (median, IQR)	1.0 (0.0-2.0)	0.0 (0-0)	<0.001
ODI-personal care (median, IQR)	0.0 (0.0-0.0)	0.0 (0-0)	<0.001
ODI-lifting (median, IQR)	1.0 (1.0-2.0)	0.0 (0-0)	<0.001
ODI-walking (median, IQR)	1.0 (0.0-1.0)	0.0 (0-0)	<0.001
ODI-sitting (median, IQR)	1.0 (0.0-2.0)	0.0 (0-0)	<0.001
ODI-standing (median, IQR)	1.0 (1.0-2.0)	0.0 (0-0)	<0.001
ODI-sleeping (median, IQR)	0.0 (0.0-1.0)	0.0 (0-0)	<0.001
ODI-sex life (median, IQR)	0.0 (0.0-0.0)	0.0 (0-0)	<0.001
ODI-social life (median, IQR)	0.0 (0.0-1.0)	0.0 (0-0)	<0.001
ODI-travelling (median, IQR)	0.0 (0.0-1.0)	0.0 (0-0)	<0.001
VAS (mm) (median, IQR)	30.0 (15.0-45.0)	0.0 (0-0)	<0.001

LBP: Low back pain; IQR: Interquartile range; BMI: Body mass index; DM: Diabetes mellitus; HbA1C: Glycosylated hemoglobin; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; ODI: Oswestry Disability Index; VAS: Visual analog scale.

age of females was 57.0 years (IQR, 51.0-62.0) and the median age of males was 54.0 years (IQR, 47.0-6.0) (p=0.237). 92% of the patients had type 2 DM. 43.8%, 10.7%, and 6.3% of patients had a history of hypertension, coronary artery disease, and thyroid disease, respectively.

The prevalence of chronic LBP was 31.3% in patients with DM. The prevalence of CLBP was higher in female patients than in male patients (37.0% vs. 22.1%) (p=0.020). Median BMI was higher and the duration of education was lower in patients with CLBP than in those without CLBP (p=0.003 and p=0.002, respectively). Demographics, laboratory data, and questionnaire scores of diabetic patients with and without CLBP are presented in Table 1.

The median ODI score in patients with DM was 0.0 (IQR, 0.0-6.0). Female patients had a higher median ODI score than in male patients [0.0 (IQR, 0.0-10.0) vs. 0.0 (IQR, 0.0-0.0)] (p=0.002). In addition, the median ODI score was higher in patients with diabetic neuropathy than in those without [2.0 (IQR, 0.0-12.0) vs. 0.0 (IQR, 0.0-6.0)] (p=0.004). Marital status, comorbidities, retinopathy, and nephropathy were not associated with ODI score (p>0.05).

The ODI score was positively correlated with BMI (r=0.209, p=0.003) and VAS score (r=0.906, p<0.001), and negatively correlated with education duration (r=-0.215, p=0.001). Correlations between demographic variables, laboratory results, and scores of ODI and its subcategories in patients with DM are presented in Table 2.

Univariate regression analysis showed that female gender (B=3.594, p=0.010), BMI (B=0.226, p=0.021), duration of education (B=-0.616, p=0.002), duration of DM (B=0.014, p=0.041), and presence of diabetic neuropathy (B=3.861, p=0.018) were associated factors for CLBP-related disability in patients with DM (Table 3). Multivariate linear regression analysis showed that duration of education was only independent variable for LBP-related disability in patients with DM (B=-0.482, p=0.012) (R^2=0.036).

DISCUSSION

The results of the current study showed that the prevalence of CLBP in patients with DM was 31.3%. The ODI score was positively correlated with BMI and VAS score, and negatively correlated with duration of education. The median ODI score was higher in women than in men and in patients with diabetic neuropathy than in those without. Furthermore, lower education duration was the only independent variable for LBP-related disability in patients with DM.

Previous studies in the literature demonstrated that the prevalence of CLBP is higher in patients with DM than in those without.[1,10-12] In addition, Jacob et al. reported that the 10-year cumulative incidence of CLBP was higher in patients with type 2 DM than in those without.[16] The researchers concluded that the findings may be associated with insulin resistance, obesity, or low-grade systemic inflammation.[16] Insulin resistance may cause inhibition of protein synthesis and protein degradation via inhibition of mammalian target of rapamycin.[16] Insulin resistance, chronic inflammation, accumulation of glycation products, and increased oxidative stress can lead to a reduction in muscle mass, which may result in the development of sarcopenia.[16,17] Low muscle mass in the trunk and legs may lead to extra load on the intervertebral discs and may cause back pain.[9] In addition, diabetic neuropathy may lead to muscle atrophy.[9] On the other hand, obesity and low-grade inflammation are risk factors for both type 2 DM and CLBP.[16,18] Low-grade inflammation may play a role in type 2 DM pathogenesis by increasing insulin resistance through molecular pathways.[16] Proinflammatory molecules may contribute to back pain via sensitization of peripheral nociceptors.[16] As a result of hyperglisemia and altered lipid metabolism, pathoanatomical changes such as early degeneration of the intervertebral disc, cartilage, or spine may occur.[10,12] Modic changes in the lumbar vertebrae may be seen.[19] Abnormal trunk fat distribution may lead to spinal disorders such as intervertebral disc degeneration, disc herniation, and spinal stenosis via mechanical stress.[9] Moreover, Stevans et al. reported that obesity was a risk factor for transition from acute LBP to CLBP.[3] Supporting the literature, the current study showed that higher BMI was not only associated with CLBP, but also associated with higher disability and VAS scores in patients with DM. A positive correlation was found between BMI and the

TABLE 2: Correlations between demographic variables, laboratory results, and ODI scores in patients with diabetes mellitus.

	Age	BMI	Education duration	Disease duration	HbA1C	Fasting glucose	Triglycerides	HDL	LDL	VAS
VAS	r=0.089	**r=0.159**	**r=-0.189**	**r=0.196**	r=0.047	**r=0.136**	r=0.115	r=-0.074	r=-0.049	-
	p=0.193	**p=0.025**	**p=0.006**	**p=0.005**	p=0.506	**p=0.048**	p=0.106	p=0.379	p=0.486	
ODI score	r=0.116	**r=0.209**	**r=-0.215**	r=0.132	r=0.035	r=0.128	r=-0.045	r=-0.083	r=-0.046	**r=0.906**
	p=0.084	**p=0.003**	**p=0.001**	p=0.054	p=0.613	p=0.056	p=0.597	p=0.313	p=0.504	**p<0.001**
ODI-pain intensity	p=0.067	**p=0.217**	**p=-0.198**	**r=0.192**	r=0.070	**r=0.147**	r=0.062	r=-0.018	r=-0.029	**r=0.835**
	r=0.318	**r=0.002**	**r=0.003**	**p=0.005**	p=0.308	**p=0.028**	p=0.374	p=0.828	p=0.672	**p<0.001**
ODI-personal care	r=0.092	r=0.07	r=-0.082	r=0.094	r=0.107	r=-0.020	r=-0.030	r=-0.028	r=-0.065	**r=0.318**
	p=0.170	p=0.920	p=0.224	p=0.174	p=0.122	p=0.763	p=0.668	p=0.739	p=0.350	**p<0.001**
ODI-lifting	r=0.083	**r=0.160**	**r=-0.230**	**r=0.172**	r=0.056	**r=0.145**	r=-0.082	r=-0.053	r=-0.099	**r=0.871**
	p=0.219	**p=0.023**	**p=0.001**	**p=0.012**	p=0.417	**p=0.031**	p=0.333	p=0.523	p=0.150	**p<0.001**
ODI-walking	r=0.089	**r=0.141**	**r=-0.207**	r=0.085	r=0.085	r=0.065	**r=0.182**	r=-0.081	r=-0.037	**r=0.739**
	p=0.183	**p=0.044**	**p=0.002**	p=0.217	p=0.216	p=0.338	**p=0.009**	p=0.330	p=0.595	**p<0.001**
ODI-sitting	r=0.089	**r=0.171**	**r=-0.163**	r=0.101	r=0.028	r=0.126	r=0.070	r=0.017	r=-0.017	**r=0.798**
	p=0.184	**p=0.015**	**p=0.015**	p=0.139	p=0.680	p=0.062	p=0.320	p=0.840	p=0.802	**p<0.001**
ODI-standing	r=0.031	**r=0.213**	**r=-0.207**	r=0.086	r=0.045	r=0.122	r=0.129	**r=-0.172**	r=-0.015	**r=0.831**
	p=0.642	**p=0.002**	**p=0.002**	p=0.209	p=0.515	p=0.069	p=0.065	**p=0.036**	p=0.831	**p<0.001**
ODI-sleeping	r=0.079	r=0.103	**r=-0.141**	r=0.111	r=0.089	r=0.039	r=0.060	r=-0.060	r=-0.119	**r=0.752**
	p=0.241	p=0.141	**p=0.036**	p=0.104	p=0.198	p=0.559	p=0.388	p=0.388	p=0.082	**p<0.001**
ODI-sex life	r=-0.028	r=0.031	r=-0.109	r=0.024	r=0.089	r=0.039	r=0.060	r=-0.040	r=-0.133	**r=0.486**
	p=0.688	p=0.141	p=0.110	p=0.771	p=0.198	p=0.559	p=0.388	p=0.629	p=0.053	**p<0.001**
ODI-social life	r=0.076	r=0.100	r=-0.113	r=0.121	**r=0.147**	r=0.078	r=0.023	r=-0.064	r=-0.074	**r=0.577**
	p=0.259	p=0.154	p=0.093	p=0.076	**p=0.032**	p=0.250	p=0.740	p=0.443	p=0.285	**p<0.001**
ODI-travelling	r=0.093	r=0.134	r=0.134	r=0.069	r=0.060	r=0.022	r=0.110	r=-0.063	r=-0.034	**r=0.710**
	p=0.166	p=0.056	p=0.056	p=0.315	p=0.383	p=0.746	p=0.115	p=0.445	p=0.617	**p<0.001**

ODI: Oswestry Disability Index; BMI: Body mass index; HbA1C: Glycosylated hemoglobin; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; VAS: Visual analog scale.

TABLE 3: Univariate analysis for CLBP-related disability in patients with diabetes mellitus.

Variables	B	95% CI	p-value
Age	0.094	(-0.032)-(0.220)	0.142
Female gender	3.594	0.853-6.335	0.010
BMI	0.226	0.034-0.418	0.021
Duration of education	-0.616	(-1.004)-(-0.228)	0.002
Duration of diabetes mellitus	0.014	0.001-0.028	0.041
Microvasculary complication	2.019	(-0.911)-(4.950)	0.176
Diabetic neuropathy	3.861	0.675-7.047	0.018
Diabetic nephropathy	0.119	(-3.911)-(4.150)	0.953
Diabetic retinopathy	3.052	(-1.787)-(7.891)	0.215
HbA1C	-0.009	(-0.196)-(0.178)	0.924
Fasting blood glucose	0.009	(-0.010)-(0.028)	0.350
Triglycerides	0.009	(-0.005)-(0.022)	0.201
HDL	-0.066	(-0.197)-(0.065)	0.322
LDL	-0.027	(-0.064)-(0.010)	0.155

CLBP: Chronic low back pain; BMI: Body mass index; HbA1C: Glycosylated hemoglobin; HDL: High-density lipoprotein; LDL: Low-density lipoprotein.

total ODI score, as well as the pain intensity, lifting, walking, sitting, and standing subcategories' scores of the ODI. In addition, the prevalence of CLBP and the median ODI score were higher in patients with diabetic polyneuropathy than in those without.

Previous studies have reported that female patients with DM have a higher risk of CLBP than male patients.[10,12,16,20,21] Consistent with these data, the present study showed that the prevalence of CLBP and the median ODI score were higher in female patients than in male patients. The reason for the higher prevalence of LBP in women has not been elucidated, but it may be related to multiple bio-psychosocial factors including sex hormones, genetic, pain coping, gender roles, and menaupose.[10,20] The median age of females in our study was 57.0 years, reflecting the postmenopausal period.

Feldman and Nahin conducted a population-based study and investigated the relationship between severe CLBP and disability.[2] They reported that being over 65 years and being obese were associated with mobility difficulties.[2] Sirbu et al. reported that age was a predictor for disability in patients with CLBP.[7] In contrast, there was no statistically significant association between age and either CLBP or disability in our study. The discrepancy between the results of our study and the literature may be related to the different sample groups; we included only diabetic patients in the study. Further studies are needed to investigate the effect of age on CLBP-related disability in patients with DM.

The VAS score was positively correlated with both total and all subcategory ODI scores. In support of our results, previous studies reported that higher pain intensity was associated with disability in patients with CLBP.[7,22] In light of these data, an effective pain management is crucial in preventing disability.

Previous studies demonstrated that higher HbA1C level was associated with back pain in diabetic patients.[23,24] Rinaldo et al. reported that elevated LDL level was associated with chronic back pain.[24] They also noted that elevated HDL level was negatively associated with chronic back pain.[24] However, there is a lack of knowledge in the literature about the relationship between chronic LBP-related disability and laboratory parameters in diabetic patients.[1,10-12] Aghara et al. conducted a cross-sectional study including patients with LBP.[25] They reported that 59 of the participants had DM and that diabetic patients had a higher level of disability than those without DM.[25] They also noted that ODI score was positively correlated with age and HbA1C level.[25] The current study showed that there was no statistically significant difference between patients with and without CLBP in terms of HbA1C, fasting blood glucose, postprandial blood glucose, HDL, triglycerides, and LDL levels. HbA1C levels were positively correlated with the social life component of the ODI score in our study. Fasting glucose levels were positively correlated with the VAS score and pain intensity and lifting subcategory scores of the ODI. Triglyceride levels were positively correlated with the walking component score of the ODI. HDL levels were negatively correlated with the standing subcategory score of the ODI. These findings may be related to the bidirectional relationship between disability and DM. Hyperglisemia and altered lipid metabolism may cause pathoanatomical changes in the spine leading to CLBP and disability, or reduced physical activity due to LBP may lead to sedentary lifestyle, obesity, hyperlipidemia, and may predispose to DM.[10,12]

In the present study, the median duration of education was lower in patients with CLBP than in those without CLBP. In addition, the duration of education was negatively correlated with VAS score, total ODI score, and the pain intensity, lifting, walking, sitting, standing, and sleeping component scores of the ODI. Moreover, duration of education was only predictive variable for CLBP-related disability in patients with DM in multivariate regression analysis. Consistent with our results, Stewart Williams et al. reported that there was an inverse relationship between education level and back pain and disability in adults aged 50 years and older.[20]

In the present study, there was no statistically significant difference in the duration of DM between patients with CLBP and without CLBP. However it was positively correlated with the VAS score, as well as the scores for pain intensity and lifting components of the ODI. Moreover, longer diabetes duration was an independent variable for LBP-related disability in univariate analysis. There is a lack of information in the literature regarding the relationship between the duration of diabetes and disability related to CLBP. These findings can be explained by the fact that longer exposure to insulin resistance, low-grade systemic inflammation, accumulation of glycation products, increased oxidative stress, and sedentary lifestyle may lead to sarcopenia and eventually disability in diabetic patients.[10,12,16-18] Further studies are needed to explain the mechanism of disease duration and CLBP-related disability in diabetic patients.

Strengths of this study include evaluating the relationship between CLBP-related disability and specific characteristics of DM such as type, duration, and laboratory findings were evaluated. Limitations of the study include the lack of a healthy control group and the lack of assessment of sarcopenia, medication for DM, physical activity levels, and depression/anxiety in the participants. Although the generalizability of the results is limited by the cross-sectional nature of our study, there is no reason to believe that the results would not be applicable to individuals outside of the study sample.

CONCLUSION

Clinicians should be aware of the risk factors for CLBP-related disability in patients with DM. Patients with lower years of education, female gender, higher BMI, longer duration of DM, and the presence of diabetic neuropathy should be followed regularly for CLBP-related disability.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Dilek Baday Keskin, Sema Hepşen, Erman Çakal;* ***Control/Supervision:*** *Sema Hepşen, Erman Çakal;* ***Data Collection and/or Processing:*** *Sema Hepşen, Erman Çakal;* ***Analysis and/or Interpretation:*** *Dilek Baday Keskin, Sema Hepşen;* ***Literature Review:*** *Dilek Baday Keskin, Sema Hepşen;* ***Writing the Article:*** *Dilek Baday Keskin, Sema Hepşen;* ***Critical Review:*** *Dilek Baday Keskin, Sema Hepşen, Erman Çakal.*

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