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Assessing Pain, Disability and Quality of Life in Patients Diagnosed With Lumbar Disc Herniation

Lumbal Disk Hernisi Tanısı Alan Hastalarda Ağrı, Engellilik ve Yaşam Kalitesinin Değerlendirilmesi

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ABSTRACT

Aim: Lumbar disc herniation (LDH) is a common condition in young adults, causing pain radiating to the hip and leg and often accompanied by neurological symptoms. LDH leads to significant pain, functional impairment, and reduced quality of life (QoL). This study aimed to examine the associations among pain intensity, disability, and QoL in individuals diagnosed with LDH.

Methods: This cross-sectional study included 155 patients (74 females, 81 males; mean age 34.1±7.71 years) who presented to Çankırı State Hospital with MRI-confirmed LDH. Pain intensity was assessed with the Visual Analog Scale (VAS), disability with the Oswestry Disability Index (ODI), and QoL with the WHOQOL-BREF. Because the study variables were non-normally distributed, associations were analyzed using Spearman's rank correlation coefficients.

Results: Pain intensity showed significant negative correlations with the physical (ρ= −0.281), psychological (ρ= −0.265), social (ρ= −0.205), and environmental (ρ= −0.162) QoL domains (p<0.05). ODI scores demonstrated low negative correlations with the physical (ρ= −0.220), social (ρ= −0.255), and environmental (ρ= −0.235) domains, and a moderate negative correlation with the psychological domain (ρ= −0.357; p<0.05). A strong positive correlation was found between VAS and ODI scores (ρ= 0.732; p<0.05).

Conclusion: Pain intensity, disability, and QoL were significantly interrelated in individuals with LDH. Higher pain levels were associated with greater disability and poorer QoL. These findings highlight the importance of early diagnosis, spinal health awareness, regular exercise, and weight management to help maintain function and QoL in this population.

Keywords: Pain, disability, intervertebral disc disease, lumbosacral region, quality of life.

ÖZ

Amaç: Lumbal disk hernisi (LDH), genç erişkinlerde sık görülen, kalça ve bacak ağrısı ile nörolojik semptomların eşlik ettiği bir klinik tablodur. LDH, ağrıya, fonksiyonel yetersizliğe ve yaşam kalitesinde (YK) azalmaya yol açarak bireylerin günlük yaşam aktivitelerini ve toplumsal katılımını olumsuz etkiler. Bu çalışma, LDH tanısı konulan bireylerde ağrı düzeyi, fonksiyonel engellilik ve YK arasındaki ilişkiyi değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntem: Kesitsel tasarımlı bu çalışmaya,Çankırı Devlet Hastanesi'ne başvuran 155 LDH hastası (74 kadın, 81 erkek; yaş ortalaması 34,1 ± 7,71 yıl) dahil edilmiştir. Ağrı düzeyi Vizüel Analog Skala (VAS), engellilik düzeyi Oswestry Engellilik İndeksi (ODI) ve yaşam kalitesi ise Dünya Sağlık Örgütü Yaşam Kalitesi Ölçeği (WHOQOL-BREF) ile değerlendirilmiştir. Değişkenler arasındaki ilişkiler Spearman korelasyon analizi ile incelenmiştir.

Bulgular: Ağrı düzeyi ile YK arasında fiziksel (ρ= −0,281), psikolojik (ρ= −0,265), sosyal (ρ= −0,205) ve çevresel (ρ= −0,162) boyutlarda düşük düzeyde negatif korelasyon saptanmıştır (p < 0.05). ODI ile YK'nın fiziksel (ρ= −0,220), sosyal (ρ= −0,255) ve çevresel (ρ= −0,235) alt boyutları arasında negatif yönde düşük düzeyde; psikolojik boyutla ise negatif yönde orta düzeyde anlamlı ilişki belirlenmiştir (ρ= −0,357; p < 0,05). VAS ve ODI arasında pozitif yönde güçlü bir korelasyon vardır (ρ= 0,732; p < 0,05).

Sonuçlar: LDH tanısı konulan bireylerde ağrı düzeyi, fonksiyonel yetersizlik ve yaşam kalitesi arasında anlamlı ilişkiler bulunmuştur. Ağrının artması, engellilik düzeyinde yükselme ve YK'da azalma ile ilişkilidir. Bu bulgular, erken tanı, omurga sağlığının korunması, düzenli egzersiz ve sağlıklı kilo yönetiminin önemini vurgulamaktadır.

Anahtar Kelimeler: Ağrı, engellilik, intervertebral disk hastalığı, lumbosakral bölge, yaşam kalitesi.

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Introduction

Lumbar disc herniation (LDH) occurs when the nucleus pulposus protrudes through the annulus fibrosus—most commonly in a posterior direction—resulting in narrowing of the central canal and potential compression of neural structures [1]. LDH is a major cause of low back, hip, and leg pain, as well as neurological dysfunction, and its clinical significance derives from both the symptom burden and its substantial socioeconomic impact worldwide [1]. Epidemiological studies report a prevalence ranging from 1.6% to 13.4%, an incidence between 2.2% and 34%, and a lifetime incidence of 13–43% [2]. Approximately 95% of LDH cases occur at the L4–L5 or L5–S1 levels, predominantly affecting individuals between 30 and 50 years of age. Established risk factors include older age, male sex, obesity, smoking, and diabetes mellitus [3]. Pain is typically the primary presenting complaint and frequently involves a neuropathic component due to somatosensory system involvement, leading to substantial deterioration in quality of life (QoL) [3]. Consequently, LDH is often characterized by chronic pain, functional disability, and reduced QoL [1–3].

Spinal disorders remain a prevalent health problem across all age groups globally, imposing significant clinical, social, and economic burdens [4]. In high-income countries, the lifetime prevalence of low back pain (LBP) reaches 60–70%, particularly among working-age populations, where it represents one of the leading causes of disability and work absenteeism [5]. Within this broader context, LDH is among the most common spinal conditions associated with functional limitations and diminished QoL [5]. LBP has wide-ranging biological and functional consequences, including physical disability, decreased muscle strength and endurance, difficulties in performing activities of daily living, and an increased risk of obesity. Behavioral consequences such as kinesiophobia may further exacerbate functional decline by promoting activity avoidance [6]. Additionally, psychological comorbidities—including catastrophizing, depression, and anxiety—as well as sleep disturbances, are frequently observed. These factors, in combination with pain and functional loss, contribute to reduced social participation, extended work absences, and cumulative declines in QoL [6].

The direct and indirect costs associated with LDH are considerable, making its management a persistent challenge for both clinicians and health systems [7]. Although appropriate therapeutic interventions can lead to meaningful improvements in QoL, the interrelationships among pain intensity, functional disability, and QoL in patients with newly diagnosed LDH have not been thoroughly investigated. Addressing this knowledge gap is critical for improving clinical assessment strategies and informing effective management approaches. Therefore, the present study was designed to examine the associations among pain, disability, and QoL in patients newly diagnosed with LDH.

Methods

Study Design

The sample size and methodological framework of the present study were informed by prior clinical research on chronic low back pain, particularly the randomized controlled trial conducted by Yakşi et al. [8]. Their study included adults aged 18–65 years with symptoms persisting for more than three months and employed inclusion criteria that closely parallel those of the current research. With a total sample size of 74 participants, the study by Yakşi et al. provided an empirical benchmark for estimating the feasibility of recruitment and the expected variability within a comparable clinical population.

To enhance precision in estimating the associations among pain, disability, and quality of life, we intentionally recruited a substantially larger cohort (n = 155), thereby exceeding the sample size of prior comparable studies by more than twofold. Although a formal a priori power analysis could not be performed due to insufficient effect size data specific to newly diagnosed LDH populations, the expanded sample size—guided by the methodological characteristics of the existing literature—supports the statistical adequacy and robustness of our analyses.

Participants

This cross-sectional study was conducted at

Çankırı State Hospital between March and July 2024, in accordance with the Declaration of Helsinki. All participants provided written informed consent. The protocol received approval from the Research Ethics Committee of Çankırı Karatekin University. The eligibility criteria were: Participants were adults aged 18–65 years with low back pain lasting longer than 3 months who presented to Çankırı State Hospital for their initial clinical evaluation. The term 'first visit' refers to the fact that, although symptoms were chronic, participants had not previously undergone assessment or treatment at our facility. Lumbar disc herniation was confirmed by MRI, with all images interpreted by an experienced radiologist using standardized radiological criteria and sagittal and axial T1- and T2-weighted sequences. Herniation levels were recorded; however, morphological subtypes (e.g., protrusion, extrusion, sequestration) were not reported in the available radiology documentation and were therefore not included in the analysis. Additional inclusion criteria were that the participants could perform daily living activities independently, they had completed primary education and were willing to participate. Exclusion criteria were previous surgery for LBP, pregnancy, spinal fracture, malignancy, lower-extremity neurological deficit, polyneuropathy, multiple sclerosis, any orthopedic condition that would preclude the study assessments, and spinal cord injury.

Outcome measures

Sociodemographic information, such as age, sex, body mass index (BMI), education level, work schedule, occupation, and smoking were collected using a form.

Pain tolerance, pain intensity

Pain intensity was assessed using a 10 cm visual analogue scale (VAS), with the 0 cm point indicating no pain and the 10 cm point marking unbearable pain. Patients were asked to mark and measure in cm the point that expressed their pain tolerance [9]. Participants were also asked to identify where they felt the pain and label these points on a picture of the human body.

Functional disability

Functional disability was assessed using the Oswestry disability index (ODI). The questionnaire has ten domains: pain and self-care, and the ability to perform daily living activities of lifting, walking, sitting, standing, sleeping, sex, social life, and travelling. Each item was scored on a 0–5 scale where 0 indicated no functional limitations and 5 indicated severe functional limitations, due to back pain. In the questionnaire, 0 represented no disability and 50 marked 100% disability. The Turkish version of the ODI has been validated and was reported to be reliable in people with LBP [10].

Quality of life assessment

QoL was measured using the World Health Organization Quality of Life Scale (WHOQOL-BREF), which consists of 26 items. In the Turkish version, an additional national item (Item 27) is included and incorporated into the environmental domain (Environmental-TR). Domain scores range from 4 to 20, with higher scores indicating better quality of life. [11].

Statistical Analysis

All statistical analyses were performed using the Jamovi software package (Version 2.4, 2023). The distribution of continuous variables, including VAS pain scores, ODI disability scores, and WHOQOL-BREF domain scores, was evaluated using the Shapiro–Wilk test. The results indicated that these variables did not follow a normal distribution ($p < 0.05$).

Accordingly, group comparisons were conducted using parametric or non-parametric tests based on the distributional properties of each variable. Independent-samples t-tests or one-way ANOVA with Tukey post-hoc tests were used when normality assumptions were met, whereas the Mann–Whitney U test and the Kruskal–Wallis H test with Dwass–Steel–Critchlow–Fligner post-hoc procedures were applied when assumptions were violated.

Given the non-normal distribution of the main study variables, correlations between pain, disability, and quality of life were examined using Spearman's rank correlation coefficient (ρ). All tests were two-tailed, and a p-value < 0.05 was accepted as statistically significant.

Results

The demographic characteristics of the participants, disc herniation levels, and the mean scores of VAS, ODI, and WHOQOL domains (physical, psychological, social, and environmental) are presented in Table 1. As illustrated in Figure 1, VAS scores demonstrated a significant but weak negative correlation with all WHOQOL domains ($p < 0.05$). ODI scores showed a similar pattern, exhibiting weak negative correlations with the physical, social, and environmental domains and a moderate negative correlation with the psychological domain ($p < 0.05$). A strong positive correlation was observed between VAS and ODI scores ($p < 0.05$).

Table 1. Demographic data of the participants (n=155)

	X±SD	Min-Max
Age (year)	34.1±7.71	18.0-49.0
BMI (kg/m²)	24.98±4.02	16.42-45.45
Gender		
Female n (%)	74 (47.74)	
Male n (%)	81 (52.25)	
Education level		
Primary school n (%)	31 (20)	
High school n (%)	89 (57.41)	
Postgraduate n (%)	35 (22.58)	
Level of Disc Herniation		
L1-L2 n (%)	3 (1.93)	
L2-L3 n (%)	4 (2.58)	
L3-L4 n (%)	3 (1.93)	
L4-L5 n (%)	75 (48.38)	
L5-S1 n (%)	70 (45.16)	
VAS (0-10)	5.21±1.55	2.00-10.00
ODI (0-100)	27.8±12.6	6.00-72.00
WHOQOL-PH	15.1±2.42	8.00-20.0
WHOQOL-PS	15.0±2.54	6.67-20.0
WHOQOL-SS	15.1±3.04	4.00-20.0
WHOQOL-ES	15.1±2.03	7.56-19.1

BMI: Body Mass Index, Max:Maximum, Min:Minimum, ODI:Oswestry Disability Index, SD:Standard Deviation, X:Mean, VAS: Visual Analog Scale, WHOQOL-PH: World Health Organisation Quality of Life-Physical Score, WHOQOL-PS: Psychological Score, WHOQOL-SS: Social Score, WHOQOL-ES: World Health Organisation Quality of Life-Environmental Score.

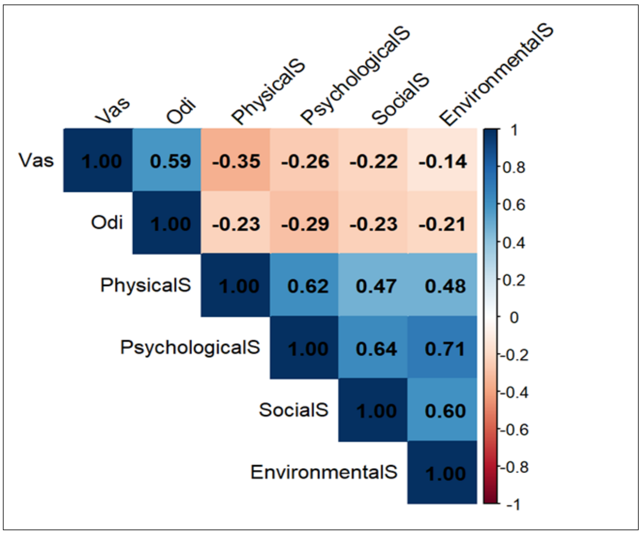

Figure 1. Spearman's correlations (ρ) among ODI, VAS, and WHOQOL-BREF subscales.
(VAS, Visual Analog Scale; ODI, Oswestry Disability Index; WHOQOL-BREF, World Health Organization Quality of Life – BREF)

Sex Differences

No significant differences were detected in VAS ($U = 2790$, $p = 0.448$), ODI ($U = 2929$, $p = 0.809$), psychological ($U = 2635$, $p = 0.193$), social ($U = 2767$, $p = 0.406$), or environmental scores ($U = 2484$, $p = 0.065$) according to sex (Table 2).

In contrast, WHOQOL-Physical scores differed significantly, with higher scores in men compared with women ($t[153] = –2.311$, $p = 0.022$).

Body Mass Index (BMI) Groups

Similarly, BMI was not associated with significant differences in VAS ($U = 2524$, $p = 0.134$), ODI ($U = 2539$, $p = 0.096$), psychological ($U = 2656$, $p = 0.323$), social ($U = 2697$, $p = 0.399$), or environmental ($U = 2889$, $p = 0.892$) scores.

However, WHOQOL-Physical scores varied significantly across BMI categories, with participants in the normal BMI range scoring higher than those with elevated BMI ($U = 2286$, $p = 0.019$).

Education Level

Education level did not significantly affect ODI ($X^2 = 3.32$, $p = 0.190$) or social scores ($X^2 = 5.01$, $p = 0.082$).

Significant differences were identified for VAS (X^2

Table 2. Group comparisons of pain (VAS), disability (ODI), and WHOQOL-BREF domains by sex and BMI category

Outcome	Group	n	Mean	Median	SD	Test (statistic)	Mean difference	p
A) Sex (Female vs Male)								
VAS (pain)	Female	74	5.32	5.00	1.62	Mann–Whitney (U = 2790)	—	0.448
VAS (pain)	Male	81	5.11	5.00	1.49			
ODI (disability)	Female	74	28.03	26.00	12.69	Mann–Whitney (U = 2929)	—	0.809
ODI (disability)	Male	81	27.60	26.00	16.06			
WHOQOL-PH	Female	74	14.62	14.86	2.58	t-test (t(153) = −2.311)	0.89	0.022
WHOQOL-PH	Male	81	15.51	15.43	2.20			
WHOQOL-PS	Female	74	14.75	15.33	2.66	Mann–Whitney (U = 2635)	—	0.193
WHOQOL-PS	Male	81	15.28	15.33	2.41			
WHOQOL-SS	Female	74	14.83	14.67	3.11	Mann–Whitney (U = 2767)	—	0.406
WHOQOL-SS	Male	81	15.28	16.00	2.98			
WHOQOL-ES	Female	74	14.77	15.11	2.12	Mann–Whitney (U = 2484)	—	0.065
WHOQOL-ES	Male	81	15.40	15.56	1.91			
B) BMI category (Normal vs Above-normal)								
VAS (pain)	Normal	77	5.03	5.00	1.31	Mann–Whitney (U = 2524)	—	0.134
VAS (pain)	Above-normal	76	5.41	5.00	1.78			
ODI (disability)	Normal	77	25.60	24.00	10.40	Mann–Whitney (U = 2539)	—	0.096
ODI (disability)	Above-normal	76	30.00	28.00	14.20			
WHOQOL-PH	Normal	77	15.46	15.43	2.32	Mann–Whitney (U = 2286)	—	0.019
WHOQOL-PH	Above-normal	76	14.60	14.86	2.41			
WHOQOL-PS	Normal	77	15.13	15.33	2.60	Mann–Whitney (U = 2656)	—	0.323
WHOQOL-PS	Above-normal	76	14.83	15.33	2.43			
WHOQOL-SS	Normal	77	15.26	14.67	2.85	Mann–Whitney (U = 2697)	—	0.399
WHOQOL-SS	Above-normal	76	14.81	14.67	3.21			
WHOQOL-ES	Normal	77	14.97	15.11	2.25	Mann–Whitney (U = 2889)	—	0.892
WHOQOL-ES	Above-normal	76	15.18	15.11	1.76			

BMI, body mass index; VAS, Visual Analog Scale; ODI, Oswestry Disability Index; WHOQOL-PH: World Health Organisation Quality of Life-Physical Score, WHOQOL-PS: Psychological Score, WHOQOL-SS: Social Score, WHOQOL-ES: World Health Organisation Quality of Life-Environmental Score. Data are Mean, Median, SD. Nonparametric comparisons used Mann–Whitney U; an independent samples t-test was used for the Physical domain under Sex where assumptions were met. p-values in bold indicate p < 0.05. "Above-normal BMI" denotes the study's overweight/obesity category.

= 8.14, p = 0.017), WHOQOL-Physical (F[2,152] = 9.72, p < 0.001), psychological (X^2 = 11.36, p = 0.003), and environmental scores (X^2 = 18.88, p < 0.001).

Post-hoc analyses revealed that:

- VAS scores progressively decreased from the primary/high school group to the undergraduate and graduate groups.
- WHOQOL-Physical scores were lowest among the primary/high school group and significantly higher in both the undergraduate and graduate groups.
- WHOQOL-Psychological scores were significantly lower in the primary/high school group compared with the graduate group.
- WHOQOL-Environmental scores were significantly lower in the primary/high school group compared with both higher education groups.

Employment Status

Employment status was not associated with significant differences in VAS (X^2 = 2.899, p = 0.408), ODI (X^2 = 0.866, p = 0.834), WHOQOL-Physical (X^2 = 1.830, p = 0.608), psychological (X^2 = 0.209, p = 0.976), social (X^2 = 0.584, p = 0.900), or environmental scores (X^2 = 4.295, p = 0.231).

Work Schedule

ODI (X^2 = 4.33, p = 0.115) and social scores (X^2 = 2.67, p = 0.263) did not differ significantly across work schedule categories.

Table 3. Comparison of VAS (pain), ODI (disability), and WHOQOL-BREF domain scores by education level, employment status, and work schedule (mean ± SD).

Outcome	Grouping Variable	Group A	Group B	Group C	Group D	F	p	Post-hoc (direction)
		Primary/ Secondary (n=31)	Undergraduate (n=89)	Postgraduate (n=35)				
VAS Score	Education level	5.94 ± 1.81	5.07 ± 1.37	4.94 ± 1.61		8.14	0.017	Primary/Secondary > Undergraduate > Postgraduate
ODI Score	Education level	32.26 ± 14.79	27.00 ± 11.30	25.83 ± 13.00	—	3.32	0.190	—
WHOQOL-PH	Education level	13.55 ± 2.56	15.27 ± 2.34	15.95 ± 1.92	—	9.72	<0.001	Primary/Secondary < Undergraduate; Primary/Secondary < Postgraduate
WHOQOL-PS	Education level	14.09 ± 2.34	14.96 ± 2.72	16.04 ± 1.81	—	11.36	0.003	Primary/Secondary < Postgraduate
WHOQOL-SS	Education level	14.62 ± 2.49	14.89 ± 3.04	15.89 ± 3.40	—	5.01	0.082	—
WHOQOL-ES	Education level	14.42 ± 1.32	14.92 ± 2.22	16.18 ± 1.64	—	18.88	<0.001	Primary/Secondary < Undergraduate; Primary/Secondary < Postgraduate
		Worker (n=16)	Homemaker (n=4)	Self-employed (n=17)	Other (n=118)			
VAS Score	Employment status	5.31 ± 1.08	4.00 ± 1.63	5.47 ± 1.59	5.20 ± 1.60	2.899	0.408	—
ODI Score	Employment status	26.63 ± 6.52	22.50 ± 8.06	27.53 ± 8.56	28.20 ± 13.80	0.866	0.834	—
WHOQOL-PH	Employment status	14.79 ± 2.20	13.86 ± 1.89	15.23 ± 2.10	15.14 ± 2.52	1.830	0.608	—
WHOQOL-PS	Employment status	14.83 ± 2.43	14.83 ± 1.84	14.94 ± 2.73	15.07 ± 2.57	0.209	0.976	—
WHOQOL-SS	Employment status	14.92 ± 2.45	16.00 ± 2.18	15.14 ± 1.70	15.04 ± 3.29	0.584	0.900	—
WHOQOL-ES	Employment status	14.39 ± 1.01	15.44 ± 0.99	15.14 ± 2.55	15.18 ± 2.08	4.294	0.231	—
		Day (n=114)	Night (n=22)	Other (n=19)				
VAS Score	Work schedule	5.06 ± 1.50	5.32 ± 1.09	6.00 ± 2.08	—	6.33	0.042	Day < Other
ODI Score	Work schedule	26.60 ± 12.10	28.00 ± 11.13	34.74 ± 15.37	—	4.33	0.115	—
WHOQOL-PH	Work schedule	15.49 ± 2.18	15.14 ± 2.23	12.54 ± 2.58	—	14.15	<0.001	Day > Night > Other
WHOQOL-PS	Work schedule	15.37 ± 2.44	14.36 ± 2.43	13.72 ± 2.77	—	9.04	0.011	Day > Other
WHOQOL-SS	Work schedule	15.29 ± 2.93	14.30 ± 2.80	14.60 ± 3.86	—	2.67	0.263	—
WHOQOL-ES	Work schedule	15.37 ± 1.97	14.40 ± 2.17	14.29 ± 1.95	—	7.92	0.019	Day > Night

Notes: Values are reported as mean ± standard deviation. F and p-values are those reported in the original analyses. VAS: Visual Analog Scale (pain); ODI: Oswestry Disability Index WHOQOL-PH: World Health Organisation Quality of Life-Physical Score, WHOQOL-PS: Psychological Score, WHOQOL-SS: Social Score, WHOQOL-ES: World Health Organisation Quality of Life-Environmental Score. Post-hoc column indicates the direction of significant differences where reported.

However, significant differences emerged for VAS ($X^2 = 6.33$, $p = 0.042$), WHOQOL-Physical ($F[2,152] = 14.15$, $p < 0.001$), psychological ($X^2 = 9.04$, $p = 0.011$), and environmental scores ($X^2 = 7.92$, $p = 0.019$).

Post-hoc analyses indicated that:

- VAS scores were lower in the day-shift group compared with the “other” work schedule category.

- WHOQOL-Physical scores were highest among day-shift workers, followed by night-shift workers, and lowest in the “other” category.
- WHOQOL-Psychological scores were significantly higher in the day-shift group than in the “other” group.
- WHOQOL-Environmental scores were higher in the day-shift group than in the night-shift group.

Discussion

In this cross-sectional cohort of adults newly diagnosed with LDH, higher pain intensity was associated with greater functional disability and lower QoL across all WHOQOL-BREF domains. These findings are consistent with prior studies demonstrating that ODI and WHOQOL-BREF are sensitive instruments for capturing symptom burden and functional status in spine-related disorders [12,13]. The strong correlation between VAS and ODI further highlights the responsiveness of disability measures to variations in pain severity in lumbar conditions. While statistically significant patterns were observed, the clinical interpretation of disability remains best anchored to MCID thresholds rather than p-values alone [14]. Overall, these associations align with epidemiological data positioning LBP as a major contributor to global disability [15].

Participants with normal BMI reported higher physical QoL than individuals with overweight or obesity, which corresponds with evidence linking excess bodyweight to greater pain intensity and disability in LBP and sciatic presentations [17,18]. In contrast, BMI did not influence the environmental QoL domain, a plausible finding given that this domain reflects contextual resources and environmental conditions rather than body-dependent functional capacity [12]. Although causal mechanisms cannot be inferred due to the study’s cross-sectional design, previous observational work demonstrating associations between adiposity, trunk muscle characteristics, and pain supports the biological plausibility of the findings observed here [19,20].

Sex differences were limited to the physical QoL domain, with men reporting slightly higher scores. Pain and disability levels did not differ significantly between sexes. This pattern is compatible with literature indicating that sex-related variations in LDH severity at presentation are generally modest and influenced by contextual factors such as workforce composition rather than biological differences alone [16]. Education level showed an inverse relationship with pain intensity, consistent with evidence indicating that lower socioeconomic position is associated with higher symptom burden and poorer QoL among individuals with LBP [21]. These associations may be shaped by broader social determinants—such as occupational load, health literacy, or the availability of self-management resources—rather than education level alone [22]. Thus, the observed relationships are best interpreted as correlational rather than causal.

Employment characteristics also demonstrated meaningful associations with symptom presentation. Participants working in roles involving manual handling, non-neutral trunk postures, pushing or pulling forces, and whole-body vibration reported higher pain levels, a pattern supported by occupational epidemiology and case–control studies identifying these exposures as contributors to LBP severity [23,24]. Additionally, mixed or rotating work schedules were associated with higher pain and lower QoL compared with fixed day shifts. This finding aligns with research showing that shift work may increase vulnerability to musculoskeletal symptoms through mechanisms involving sleep disruption, irregular meal timing, metabolic stress, and impaired physiological recovery [22,25]. Night-shift workers, in particular, have been shown to experience shorter sleep duration and more pronounced lifestyle disruptions, which may contribute to heightened pain sensitivity and reduced functional capacity [25].

Overall, the present findings emphasize the multifactorial nature of pain, disability, and QoL in LDH and highlight the influence of sociodemographic and occupational factors on symptom burden. However, the cross-sectional design precludes causal inference, and the observed relationships should be interpreted as associations rather than directional effects. Future longitudinal studies with detailed assessments of occupational exposures, sleep patterns, and modifiable lifestyle factors are warranted to better understand their impact on the progression and management of LDH-related symptoms.

Limitations

This study has several limitations. First, the cross-sectional and single-center design precludes causal inference and may limit the generalizability of the findings, and the lack of long-term follow-up restricts conclusions regarding symptom progression or recovery. In addition, detailed MRI grading—including herniation type, degree of neural compression, and standardized severity scoring—was not available, preventing examination of imaging–symptom relationships. Furthermore, no validated ergonomic or physical workload assessments were administered, which limits the precision of interpretations related to occupational factors. Finally, the unequal sex distribution in the sample may impose restrictions on subgroup comparisons. These limitations should be considered when interpreting the results, and future prospective, multi-center studies incorporating standardized radiological grading and ergonomic assessments are needed.

Conclusion

In this cohort, pain intensity emerged as a salient determinant at the time of diagnosis, with higher pain levels consistently correlating with greater functional disability and lower health-related QoL. The age distribution indicated that diagnosis clustered in young adulthood, emphasizing the importance of early preventive strategies during initial working years. From a public-health perspective, the promotion of back health with regular, appropriately dosed exercise and the maintenance of a healthy bodyweight could assist in deferring progression to clinically significant LBP and reducing symptom burden over time. LBP remains a major public-health concern, being the leading cause of disability worldwide and a source of substantial economic loss via health-care use and productivity decrements. The implementation of population-level interventions that prioritise weight management and systematically integrate physical-activity counselling into routine care is therefore justified. At the workplace level, particularly for young adults, organisational measures, such as increasing access to exercise facilities, embedding brief movement or micro-breaks into shifts, and strengthening ergonomics and workload management can support musculoskeletal health, sustain work capacity, and potentially attenuate the trajectory from early symptoms to diagnosed disease.

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