

Biopsychosocial and Functional Factors Associated with Quality of Life in Individuals with Chronic Low Back Pain

Kronik Bel Ağrılı Bireylerde Yaşam Kalitesiyle İlişkili Biyopsikososyal ve Fonksiyonel Faktörler

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Abstract

Objective: This study aimed to identify the biopsychosocial and functional factors associated with the physical and mental components of health-related quality of life (HRQoL) in individuals with chronic low back pain (CLBP).

Materials and Methods: This cross-sectional study included 120 adults with CLBP. HRQoL was assessed using the 12-Item Short Form Health Survey. Pain intensity, disability, kinesiophobia, fear-avoidance beliefs, anxiety, depressive symptoms, physical activity, balance, and functional mobility were evaluated using standardized questionnaires and clinical tests. Relationships among the variables were examined using Pearson correlation analysis and hierarchical multiple linear regression analysis.

Results: The Physical Component Summary score was moderately and negatively associated with kinesiophobia, anxiety, and physical activity-related fear-avoidance beliefs ($p<0.05$). The Mental Component Summary score showed weak negative associations with pain, disability, psychological symptoms, fear-avoidance beliefs, and functional mobility, and weak positive associations with physical activity and balance ($p<0.05$). After adjustment for demographic variables, clinical variables explained an additional 36.1% of the variance in physical HRQoL ($\Delta R^2=0.361$) and 19.4% of the variance in mental HRQoL ($\Delta R^2=0.194$). Anxiety independently predicted lower physical HRQoL ($\beta=-0.25$, $p=0.010$) and mental HRQoL ($\beta=-0.27$, $p=0.017$), while age weakly predicted higher mental HRQoL ($\beta=0.19$, $p=0.045$).

Conclusion: Anxiety was the most consistent independent predictor of both physical and mental HRQoL in individuals with CLBP. This finding indicates that psychological status should be considered alongside pain and disability in the assessment of individuals with CLBP.

Keywords: Anxiety, kinesiophobia, low back pain, quality of life

Öz

Amaç: Bu çalışmanın amacı, kronik bel ağrılı (KBA) bireylerde yaşam kalitesinin fiziksel ve mental bileşenleriyle ilişkili biyopsikososyal ve fonksiyonel faktörleri belirlemektir.

Materyal ve Metot: Bu kesitsel çalışmaya KBA'lı 120 yetişkin dahil edildi. SİYK, 12 maddelik kısa form sağlık anketi ile değerlendirildi. Ağrı şiddeti, özürüllük, kinezyofobi, korku-kaçınma inanışları, anksiyete, depresif belirtiler, fiziksel aktivite, denge ve fonksiyonel mobilite standart ölçekler ve klinik testler kullanılarak değerlendirildi. Değişkenler arasındaki ilişkiler Pearson korelasyon analizi ve hiyerarşik çoklu doğrusal regresyon analizi ile incelendi.

Bulgular: Fiziksel Bileşen Özeti puanı; kinezyofobi, anksiyete ve fiziksel aktiviteye yönelik korku-kaçınma inanışlarıyla orta düzeyde negatif ilişkiliydi ($p<0,05$). Mental Bileşen Özeti puanı; ağrı, özürüllük, psikolojik belirtiler, korku-kaçınma inanışları ve fonksiyonel mobiliteyle zayıf düzeyde negatif, fiziksel aktivite ve dengeyle ise zayıf düzeyde pozitif ilişkiliydi ($p<0,05$). Demografik değişkenler kontrol edildikten sonra klinik değişkenler, fiziksel SİYK varyansının ek %36,1'ini ($\Delta R^2=0,361$) ve mental SİYK varyansının ek %19,4'ünü ($\Delta R^2=0,194$) açıkladı. Anksiyete, daha düşük fiziksel SİYK'nin ($\beta=-0,25$; $p=0,010$) ve mental SİYK'nin ($\beta=-0,27$; $p=0,017$) bağımsız prediktörü iken yaş, daha yüksek mental SİYK'nin zayıf bir prediktörüyü ($\beta=0,19$; $p=0,045$).

Sonuç: Anksiyete, KBA'lı bireylerde fiziksel ve mental SİYK'nin en tutarlı bağımsız prediktörüyü. Bu bulgu, KBA değerlendirmesinde ağrı ve özürüllüğün yanı sıra psikolojik durumun da dikkate alınması gerektiğini göstermektedir.

Anahtar Kelimeler: Anksiyete, bel ağrısı, kinezyofobi, yaşam kalitesi

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INTRODUCTION

Low back pain (LBP) is highly prevalent and contributes substantially to disability across the world.¹ When symptoms continue for longer than three months, the condition is classified as chronic low back pain (CLBP). Its consequences extend beyond pain and may include difficulty performing daily activities, reduced work capacity, and restricted social participation.² Accordingly, contemporary models describe CLBP as a complex condition arising from interactions among biological, psychological, and social influences.^{2,3}

Health-related quality of life (HRQoL) often worsens as pain and disability become more severe in people with CLBP.⁴ Nevertheless, patients reporting comparable pain levels may differ considerably in psychological well-being and functional ability, indicating that pain alone does not account for the full burden of the condition. Fear of movement and fear-avoidant beliefs (FAB) can promote withdrawal from movement and routine activities, which may, in turn, reduce physical capacity and reinforce disability.^{5,6} Anxiety and depressive symptoms may further alter pain appraisal, activity participation, and perceived health.⁷

Physical inactivity may also contribute to the functional deterioration observed in CLBP. Repeated avoidance of activity because of pain or concern about reinjury can progressively diminish fitness and everyday performance.⁸ Disturbances in postural control and balance have also been reported in this population. Such impairments, together with limited mobility, may reduce independence and participation, thereby adversely affecting quality of life (QoL).^{9,10}

Previous CLBP research has mainly emphasized pain severity, disability, and psychological characteristics as correlates of QoL.¹¹ Far fewer studies have examined performance-related measures, including activity level, balance, and mobility, within the same biopsychosocial framework.^{12,13} Importantly, previous studies have often examined psychological factors or physical functioning separately. The novelty of the present study lies in evaluating self-reported psychological and clinical variables alongside performance-based measures of balance and functional mobility within a single biopsychosocial model. This integrated approach may help determine whether performance-based factors contribute to HRQoL independently of pain, disability, fear-related beliefs, and emotional symptoms. Simultaneous consideration of these domains may clarify which factors have unique relationships with QoL once their overlap is accounted for.

This study, therefore, investigated the biopsychosocial and functional correlates of HRQoL in adults with CLBP. The assessment battery covered pain, disability, kinesiophobia, FAB, anxiety, depressive symptoms, physical activity, balance, functional mobility, and QoL. We expected poorer HRQoL to accompany greater pain, disability, and psychological symptoms, as well as lower activity, poorer balance, and more limited mobility.

MATERIALS AND METHODS

Ethics Committee Approval: Approval was granted by the Kırşehir Ahi Evran University Health Sciences Scientific Research Ethics Committee (Date: 21.04.2026, decision no. 2026-08/123). All procedures followed the Declaration of Helsinki. Each participant provided written informed consent before taking part.

Study Design: Participants were recruited and assessed between May and June 2026. A cross-sectional investigation was carried out among 120 patients diagnosed with CLBP by a specialist physician at the Physical Medicine and Rehabilitation Outpatient Clinic of Kırşehir Ahi Evran University.

Sample Size Calculation: The required sample was estimated using preliminary data from 10 individuals. In the pilot sample, depressive symptoms and the mental HRQoL component were weakly correlated ($r=.275$). A two-sided calculation based on this effect, $\alpha=0.05$, and 80% power indicated that at least 102 participants were needed. The recruitment target was increased to 120 to account for an anticipated 15% data loss.

Participants: Eligibility required ages 18–65 years, LBP persisting for 3 months or longer, independent ambulation, and the ability to complete all assessments. Exclusion criteria included a history of lumbar surgery or major spinal trauma; radiculopathy or neurological deficits; vertebral fracture; malignancy; spinal infection; inflammatory rheumatic disease; severe systemic, cardiopulmonary, neurological, or psychiatric disorders; vestibular dysfunction; and musculoskeletal conditions that could affect gait, balance, or the performance of the study assessments. Pregnant individuals and those who declined to participate were also excluded.

Outcome measures: Age, sex, body mass index (BMI), symptom duration, and other sociodemographic and clinical information were documented on a standardized form.

Health-Related Quality of Life: HRQoL was quantified with the 12-item Short Form Health Survey (SF-12), which yields Physical Component Summary (PCS) and Mental Component Summary (MCS) scores. Item responses are combined using the instrument's standard weighted scoring procedure. Scores are commonly

expressed on a 0–100 scale, with higher values representing more favorable perceived physical or mental health. The Turkish version of the SF-12 has demonstrated acceptable validity and reliability.¹⁴

Pain Intensity: Current LBP severity was recorded on a 10-cm Visual Analog Scale (VAS). The line was anchored by “no pain” at 0 and “unbearable pain” at the opposite end. Participants placed a mark corresponding to their pain, and the distance from zero was measured in centimeters. Thus, possible scores ranged from 0 to 10, with larger values denoting more intense pain.¹⁵

Low Back Pain–Related Disability: The Oswestry Disability Index (ODI) was used to quantify disability attributable to LBP. Its 10 domains address pain and limitations in personal care, lifting, walking, sitting, standing, sleeping, social life, travel, and sexual activity. Responses are rated from 0 to 5, summed, and converted to a percentage; a larger percentage reflects greater disability. The Turkish version of the ODI has been reported to be a valid and reliable measure of disability in individuals with LBP.¹⁶

Kinesiophobia: Fear of movement or reinjury was evaluated with the 17-item Tampa Scale for Kinesiophobia (TSK). Items are rated on a four-point scale. After the four reverse-worded items are recoded, the item scores are summed to yield a total score ranging from 17 to 68, with higher totals indicating greater kinesiophobia. The Turkish version of the TSK has demonstrated satisfactory validity and reliability in individuals with musculoskeletal pain.¹⁷

Fear-Avoidance Beliefs: FAB were measured with the 16-item Fear-Avoidance Beliefs Questionnaire (FABQ). Each item is rated from 0 to 6. The questionnaire provides a physical activity subscale (0–24) and a work subscale (0–42); higher subscale scores represent stronger fear-avoidance beliefs. The Turkish version of the FABQ has shown adequate validity and reliability in patients with LBP.¹⁸

Anxiety and Depressive Symptoms: Anxiety and depressive symptom severity were measured using the Hospital Anxiety and Depression Scale (HADS). Seven items contribute to the anxiety subscale and seven to the depression subscale. Each item is scored from 0 to 3, resulting in separate 0–21 totals, with higher values indicating more symptoms. The Turkish version of the HADS has demonstrated acceptable validity and reliability for assessing anxiety and depressive symptoms.¹⁹

Physical Activity Level: The short form of the International Physical Activity Questionnaire (IPAQ) was administered to estimate activity during the preceding seven days. Participants reported the frequency and duration of vigorous activity, moderate activity, walking, and sitting. Activity-specific duration and frequency values were multiplied by standard metabolic equivalent coefficients and summed as MET-minutes/week; higher totals indicate more physical activity.²⁰

Balance: Balance was examined with the Berg Balance Scale (BBS). Fourteen tasks sample abilities required in daily life, including transfers, unsupported standing, reaching, turning, and stepping. Each task receives 0–4 points, giving a maximum of 56. A higher total denotes better balance, while a lower score indicates greater impairment and fall risk. The Turkish version of the BBS has demonstrated high validity and reliability.²¹

Functional Mobility: Functional mobility was assessed using the Timed Up and Go Test (TUG). From a standard chair, participants stood, walked 3 meters, turned, walked back, and sat down. Completion time was recorded in seconds. Faster times represent better mobility, whereas longer times indicate greater limitation.²²

Statistical Analysis: Analyses were conducted in R 4.4.1, JASP 0.95.1.0, and Python 3.13.2. Means and standard deviations summarized continuous data, and categorical data were described by number and percentage. Distributional assumptions were evaluated with Shapiro–Wilk tests and Q–Q plots. Pearson coefficients quantified the bivariate associations between PCS and MCS and clinical measures; absolute coefficients were classified as high (0.70–1.00), moderate (0.40–0.69), or weak (<0.40).²³ Separate hierarchical linear regression analyses were performed for PCS and MCS. Age, BMI, sex, and symptom duration formed Block 1, followed in Block 2 by activity pain, disability, kinesiophobia, FAB, anxiety, depression, physical activity, balance, and mobility. Activity pain was selected because the three VAS measures were strongly correlated, and the FABQ work score was omitted because of conceptual overlap with kinesiophobia. HC3 robust standard errors were applied. The contribution of Block 2 was assessed through ΔR^2 , the F-change statistic, and Cohen's f^2 . Variance inflation factors, Breusch–Pagan testing, residual Shapiro–Wilk tests and Q–Q plots, and Cook's distance were used to examine multicollinearity, heteroskedasticity, residual normality, and influential cases. All tests were two-sided with $p < .05$ defining statistical significance.

RESULTS

The final analysis included 120 adults with low back pain; 56 were females (46.7%), and the mean age was 40.2 ± 13.8 years. Participant characteristics are summarized in Table 1.

Table 1. Sociodemographic and clinical characteristics of the participants (N = 120).

Variable	Data
Age (years), Mean $\pm$ SD	40.15 $\pm$ 13.79
BMI (kg/m ²), Mean $\pm$ SD	25.60 $\pm$ 4.50
Sex, n (%)	
Female	56 (46.7)
Male	64 (53.3)
Symptom duration (months), Mean $\pm$ SD	9.18 $\pm$ 5.00
SF-12 PCS, Mean $\pm$ SD	31.25 $\pm$ 7.50
SF-12 MCS, Mean $\pm$ SD	33.20 $\pm$ 9.39
TSK, Mean $\pm$ SD	38.51 $\pm$ 7.67
VAS-activity (cm), Mean $\pm$ SD	7.08 $\pm$ 1.57
VAS-rest (cm), Mean $\pm$ SD	4.82 $\pm$ 1.30
VAS-night (cm), Mean $\pm$ SD	4.78 $\pm$ 1.27
ODI (%), Mean $\pm$ SD	26.90 $\pm$ 8.80
HADS-A, Mean $\pm$ SD	8.00 $\pm$ 3.94
HADS-D, Mean $\pm$ SD	6.72 $\pm$ 3.63
FABQ-physical, Mean $\pm$ SD	16.10 $\pm$ 5.90
FABQ-work, Mean $\pm$ SD	16.60 $\pm$ 13.86
IPAQ (MET-min/week), Mean $\pm$ SD	664.35 $\pm$ 733.03
BBS, Mean $\pm$ SD	50.67 $\pm$ 3.53
TUG (s), Mean $\pm$ SD	14.64 $\pm$ 2.04

BMI: Body mass index; SD: Standard deviation; SF-12 PCS: 12-Item Short Form Health Survey Physical Component Summary; SF-12 MCS: 12-Item Short Form Health Survey Mental Component Summary; TSK: Tampa Scale for Kinesiophobia; VAS: Visual Analog Scale; ODI: Oswestry Disability Index; HADS-A: Hospital Anxiety and Depression Scale–Anxiety subscale; HADS-D: Hospital Anxiety and Depression Scale–Depression subscale; FABQ: Fear-Avoidance Beliefs Questionnaire; IPAQ: International Physical Activity Questionnaire; MET: Metabolic equivalent of task; BBS: Berg Balance Scale; TUG: Timed Up and Go test.

As shown in Table 2, the SF-12 PCS showed moderate negative correlations with TSK ($r=-0.499$, $p<0.001$), HADS-A ($r=-0.429$, $p<0.001$), and FABQ-physical ($r=-0.437$, $p<0.001$). Weak negative correlations were observed between the PCS and VAS-activity, ODI, HADS-D, FABQ-work, and TUG, whereas weak positive correlations were found with IPAQ and BBS ($p<0.05$). The correlations of the PCS with VAS-rest and VAS-night were not statistically significant ($p>0.05$). The SF-12 MCS showed weak negative correlations with TSK, VAS-activity, VAS-rest, VAS-night, ODI, HADS-A, HADS-D, FABQ-physical, FABQ-work, and TUG ($p<0.05$). Weak positive correlations were observed between the MCS score and IPAQ and BBS ($p<0.05$). The strongest correlations with the MCS were observed for FABQ-work ($r=-0.372$, $p<0.001$) and HADS-A ($r=-0.336$, $p<0.001$).

Table 2. Correlations between SF-12 physical and mental component scores and clinical variables.

Variables		TSK	VAS-activity	VAS-rest	VAS-night	ODI	HADS-A	HADS-D	FABQ-physical	FABQ-work	IPAQ	BBS	TUG
SF-12 PCS	r	-0.499	-0.200	-0.178	-0.166	-0.332	-0.429	-0.196	-0.437	-0.307	0.298	0.334	-0.393
	p	<0.001	0.029	0.052	0.070	<0.001	<0.001	0.032	<0.001	0.001	0.001	<0.001	<0.001
SF-12 MCS	r	-0.255	-0.206	-0.234	-0.212	-0.224	-0.336	-0.296	-0.278	-0.372	0.245	0.258	-0.260
	p	0.005	0.024	0.010	0.020	0.014	<0.001	0.001	0.002	<0.001	0.007	0.004	0.004

SF-12 PCS: 12-Item Short Form Health Survey Physical Component Summary; SF-12 MCS: 12-Item Short Form Health Survey Mental Component Summary; TSK: Tampa Scale for Kinesiophobia; VAS: Visual Analog Scale; ODI: Oswestry Disability Index; HADS-A: Hospital Anxiety and Depression Scale–Anxiety subscale; HADS-D: Hospital Anxiety and Depression Scale–Depression subscale; FABQ: Fear-Avoidance Beliefs Questionnaire; IPAQ: International Physical Activity Questionnaire; MET: Metabolic equivalent of task; BBS: Berg Balance Scale; TUG: Timed Up and Go test; r: Pearson's correlation coefficient; p: probability value.

Demographic variables explained only 0.3% of the variance in the SF-12 PCS, whereas the inclusion of clinical variables increased the total explained variance to 36.5%. The additional contribution of the clinical block was statistically significant and large ($\Delta R^2=0.361$, F-change (9,106)=6.70, $p<0.001$, $f^2=0.57$). After adjustment for all other variables, HADS-A was identified as the only independent negative predictor of the SF-12 PCS ($B=-0.48$,

95% CI [-0.85, -0.12], $\beta = -0.25$, $p = 0.010$). The remaining demographic and clinical variables were not independent predictors of the SF-12 PCS ($p > 0.05$).

Table 3. Hierarchical multiple linear regression analysis of factors associated with the SF-12 PCS

Predictor		B [95% CI]	β	p	sr
Block 1 Demographic	Age	-0.05 [-0.13, 0.04]	-0.09	0.269	—
	BMI	0.14 [-0.13, 0.42]	0.09	0.301	—
	Sex	1.61 [-0.88, 4.10]	—	0.206	—
	Symptom duration	0.06 [-0.22, 0.35]	0.04	0.669	—
	VAS-activity	0.04 [-0.89, 0.96]	0.01	0.941	0.01
Block 2 Clinical	ODI	-0.11 [-0.28, 0.07]	-0.13	0.224	-0.10
	TSK	-0.11 [-0.38, 0.16]	-0.11	0.439	-0.05
	FABQ-physical	-0.08 [-0.40, 0.25]	-0.06	0.637	-0.04
	HADS-A	-0.48 [-0.85, -0.12]	-0.25	0.010	-0.20
	HADS-D	0.05 [-0.36, 0.46]	0.03	0.799	0.02
	IPAQ	-0.78 [-2.47, 0.92]	-0.09	0.371	-0.07
	BBS	0.27 [-0.09, 0.64]	0.13	0.145	0.11
	TUG	-0.50 [-1.14, 0.13]	-0.14	0.121	-0.11

B: unstandardized regression coefficient; CI: confidence interval; β : standardized regression coefficient; p: probability value; sr: semipartial correlation coefficient; BMI: body mass index; VAS: Visual Analog Scale; ODI: Oswestry Disability Index; TSK: Tampa Scale for Kinesiophobia; FABQ-physical: Fear-Avoidance Beliefs Questionnaire-Physical Activity subscale; HADS-A: Hospital Anxiety and Depression Scale-Anxiety subscale; HADS-D: Hospital Anxiety and Depression Scale-Depression subscale; IPAQ: International Physical Activity Questionnaire; BBS: Berg Balance Scale; TUG: Timed Up and Go test.

As shown in Table 4, demographic variables explained 1.9% of the variance in the SF-12 MCS ($R^2 = 0.019$). After the clinical variables were added, the explained variance increased to 21.2% (adjusted $R^2 = 0.116$), indicating a significant and medium incremental contribution of the clinical block ($\Delta R^2 = 0.194$, F-change (9,106) = 2.89, $p = 0.004$; $f^2 = 0.25$). Age and HADS-A were the only significant independent factors. Older age was associated with a higher SF-12 MCS ($B = 0.13$, 95% CI [0.003, 0.25]; $\beta = 0.19$; $p = 0.045$), whereas higher HADS-A scores were associated with a lower SF-12 MCS ($B = -0.64$, 95% CI [-1.17, -0.12]; $\beta = -0.27$; $p = 0.017$; $sr = -0.21$). The remaining demographic and clinical variables were not independently significant (all $p > 0.05$). Model diagnostics suggested no major violations of the regression assumptions.

Table 4. Hierarchical multiple linear regression analysis of factors associated with the SF-12 MCS

Predictor		B [95% CI]	β	p	sr
Block 1 Demographic	Age	0.13 [0.003, 0.25]	0.19	0.045	—
	BMI	-0.12 [-0.47, 0.22]	-0.06	0.486	—
	Sex	-1.39 [-4.88, 2.11]	—	0.437	—
	Symptom duration	-0.13 [-0.55, 0.29]	-0.07	0.554	—
Block 2 Clinical	VAS-activity	-0.32 [-1.50, 0.86]	-0.05	0.595	-0.04
	ODI	-0.13 [-0.37, 0.11]	-0.12	0.274	-0.10
	TSK	-0.10 [-0.45, 0.25]	-0.08	0.570	-0.04
	FABQ-physical	-0.34 [-0.81, 0.14]	-0.21	0.168	-0.13
	HADS-A	-0.64 [-1.17, -0.12]	-0.27	0.017	-0.21
	HADS-D	-0.07 [-0.65, 0.50]	-0.03	0.805	-0.02
	IPAQ	1.41 [-0.97, 3.79]	0.14	0.245	0.11
	BBS	0.02 [-0.56, 0.61]	0.01	0.937	0.01
	TUG	-0.62 [-1.69, 0.45]	-0.14	0.253	-0.11

B: unstandardized regression coefficient; CI: confidence interval; β : standardized regression coefficient; p: probability value; sr: semipartial correlation coefficient; BMI: body mass index; VAS: Visual Analog Scale; ODI: Oswestry Disability Index; TSK: Tampa Scale for Kinesiophobia; FABQ-physical: Fear-Avoidance Beliefs Questionnaire-Physical Activity subscale; HADS-A: Hospital Anxiety and Depression Scale-Anxiety subscale; HADS-D: Hospital Anxiety and Depression Scale-Depression subscale; IPAQ: International Physical Activity Questionnaire; BBS: Berg Balance Scale; TUG: Timed Up and Go test.

DISCUSSION AND CONCLUSION

This study explored how psychological, behavioral, clinical, and performance-related characteristics relate to the physical and mental dimensions of HRQoL in CLBP. Although several psychological, clinical, and functional variables were associated with HRQoL in the correlation analyses, the hierarchical regression models showed that anxiety was the only clinical variable independently associated with both SF-12 PCS and MCS. Therefore, the primary interpretation of the findings is based on the independent effects identified in the regression models rather than on the bivariate correlations alone. The clinical block added 36.1% to the explained variance in SF-12 PCS

and 19.4% to the explained variance in SF-12 MCS, highlighting the combined relevance of multiple biopsychosocial domains. Unlike previous studies that often examined psychological or performance-related factors separately, the present study evaluated these domains simultaneously within the same model. This approach demonstrated that anxiety retained an independent association with both physical and mental HRQoL after accounting for pain, disability, fear-related beliefs, physical activity, balance, and mobility. These findings extend previous evidence by showing that the burden of CLBP cannot be explained by pain alone and that psychological status may play a central role in perceived health.²⁴

The most consistent result concerned anxiety, which was independently and inversely associated with both HRQoL components. Thus, increasing anxiety coincided not only with poorer mental well-being but also with less favorable perceptions of physical health. Persistent concern about pain, anticipation of symptom aggravation, and fear of reinjury may discourage movement and participation and may lead individuals to underestimate their physical capabilities. Hnatešen et al.²⁵ similarly linked greater psychological distress in CLBP with poorer QoL, general health, and social functioning. A recent systematic review also identified psychological status, pain, disability, physical function, and social context as major QoL domains.¹¹ Together, these observations support routine consideration of anxiety in CLBP assessment. Recent population-based findings have also shown that adults with CLBP experience poorer mental health, more depressive symptoms, greater limitations in daily and social activities, and lower HRQoL than individuals without CLBP.²⁴ Furthermore, somatic symptom burden has been associated with greater pain and disability and poorer QoL in this population, supporting the need to consider the broader psychological response to persistent symptoms.²⁶ Importantly, anxiety remained independently associated with both physical and mental HRQoL even after pain, disability, fear-related beliefs, physical activity, balance, and mobility were considered simultaneously. This finding suggests that anxiety may represent a central clinical factor in perceived health status rather than merely reflecting the severity of pain or functional limitation. Routine assessment of anxiety may therefore help clinicians identify patients who are at risk of poorer perceived health despite similar levels of pain or physical impairment. Incorporating anxiety screening into rehabilitation planning may support more individualized clinical decisions, including closer monitoring, appropriate referral, and the integration of psychologically informed strategies alongside exercise and functional rehabilitation.

Kinesiophobia and FAB were also inversely related to HRQoL, with stronger associations for its physical component. Expecting movement to provoke pain or injury can encourage avoidance of everyday and social activities. Consistent with this interpretation, Tiaho et al.²⁷ reported poorer QoL among people with CLBP who had greater kinesiophobia. Although kinesiophobia and FAB were significantly associated with HRQoL at the bivariate level, they did not remain independent predictors after adjustment. This may be explained by the substantial conceptual and statistical overlap among anxiety, movement-related fear, FAB, pain, and disability. These constructs may reflect related aspects of a common psychological response to persistent pain, including threat appraisal, fear of symptom aggravation, avoidance behavior, and reduced confidence in movement. When entered simultaneously into the regression models, the variance shared across these variables was accounted for, leaving anxiety as the factor with the strongest unique association with HRQoL. A recent multicenter study similarly demonstrated that stronger physical activity-related FAB in individuals with CLBP were associated with unfavorable clinical characteristics, including pain during activities of daily living and greater use of analgesic medication.²⁸ Therefore, the absence of an independent association in the present regression models may reflect statistical overlap among anxiety, kinesiophobia, FAB, pain, and disability rather than a lack of clinical importance. Activity-related pain and disability were weakly associated with poorer physical and mental HRQoL. Resting and night pain, by contrast, were related only to SF-12 MCS, and night pain was not significantly associated with SF-12 PCS. These patterns suggest that pain intensity by itself provides an incomplete explanation of QoL impairment. Ekediegwu et al.¹³ likewise observed that more severe pain was associated with poorer QoL and greater disability in CLBP. In the present adjusted models, disability may have lost significance because its contribution overlapped with anxiety, FAB, pain behavior, and impaired mobility. Recent evidence further suggests that self-reported physical functioning in people with CLBP is more strongly related to pain behavior and pain interference than to objectively measured physical capacity.²⁹ This distinction may partly explain why self-reported disability and performance-based functional measures did not demonstrate independent associations with HRQoL when they were examined simultaneously with psychological and behavioral factors.

Depressive symptoms correlated with both HRQoL components but did not remain significant after adjustment. Anxiety and depression are closely related constructs and may share common features such as emotional distress, negative appraisal of symptoms, reduced activity participation, and impaired perceived health. Including both

variables in the same model may therefore have reduced the unique variance attributable to depressive symptoms, while anxiety retained the stronger independent association with HRQoL. Recent studies have similarly indicated that mental distress, depressive symptoms, and somatic symptom burden are related to poorer physical functioning and HRQoL among individuals with CLBP.^{24,26} Accordingly, the lack of an independent contribution from depressive symptoms should not be interpreted as evidence that these symptoms are clinically unimportant.

Higher physical activity was associated with more favorable physical and mental HRQoL. Moreno-Ligero et al. found that lower activity among people with CLBP coexisted with more pain, greater functional restriction, poorer mental health, and worse QoL,³⁰ while Ekediegwu et al. also described a positive QoL relationship.¹³ In our multivariable analysis, the absence of an independent effect may reflect overlap with psychological and functional factors, together with measurement error inherent in self-reported activity. The use of objective activity-monitoring methods in future studies may help determine whether habitual physical activity contributes independently to HRQoL after accounting for psychological and functional factors.

Better BBS performance and faster TUG completion were each related to higher SF-12 PCS and MCS scores, although neither remained significant in the adjusted analyses. Balance and mobility are likely to share variance with one another and with pain, disability, activity level, and movement fear. Moreover, the concentration of BBS scores toward the upper limit suggests a possible ceiling effect, which may have restricted score variability and reduced the scale's ability to detect an independent association with HRQoL in the regression models. Recent research has shown that people with CLBP may exhibit altered gait, balance, and physical performance alongside psychological dysfunction, although the associations between objective performance measures and patient-reported outcomes are not always strong.³¹ Similarly, postural sway has been found to have only weak relationships with pain intensity, disability, depression, kinesiophobia, and QoL in individuals with CLBP.³² These findings support the interpretation that performance-based measures provide complementary information but may not independently explain perceived HRQoL.

Demographic characteristics accounted for little HRQoL variance. None of age, sex, BMI, or symptom duration was independently related to SF-12 PCS. Age was the only demographic factor associated with SF-12 MCS, and its small, borderline contribution suggests limited clinical importance. This finding is compatible with systematic review evidence showing that demographic characteristics are generally less consistent determinants of QoL than psychological distress, pain, disability, physical functioning, and social factors in individuals with CLBP.¹¹ The small positive association between age and mental HRQoL should therefore be interpreted cautiously and may reflect unmeasured differences in coping, expectations, adaptation, or social circumstances.

This study has several limitations. Its cross-sectional design precludes causal inferences regarding the relationships between HRQoL and the examined psychological, behavioral, and functional factors. In addition, the single-center setting may limit the generalizability of the findings to other clinical populations and healthcare settings. Finally, reliance on self-reported measures may have introduced recall and response bias. In particular, physical activity was assessed using the self-reported IPAQ, which may be subject to recall bias and measurement error compared with objective activity-monitoring methods.

In conclusion, HRQoL in adults with CLBP was associated with a combination of psychological, behavioral, and functional characteristics. Among the clinical variables examined simultaneously, anxiety demonstrated the clearest independent association with both the physical and mental components of HRQoL. These findings suggest that the assessment and management of adults with CLBP should include psychological status alongside pain, disability, and functional characteristics.

Ethics Committee Approval: Approval was granted by the Kırşehir Ahi Evran University Health Sciences Scientific Research Ethics Committee (Date: 21.04.2026, decision no. 2026-08/123). All procedures followed the Declaration of Helsinki. Each participant provided written informed consent before taking part.

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