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Unravelling the Hidden Connection Between Chronic Low Back Pain, Sleep Disturbances, Psychological Stress, and Functional Disability

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Abstract

Chronic low back pain (CLBP) is a common musculoskeletal condition associated with impaired physical functioning, sleep disturbances, psychological distress, and reduced quality of life. Pain intensity, sleep quality, and psychological well-being are closely interrelated and may collectively influence the degree of functional disability among affected individuals. This study investigated the relationships between chronic low back pain, sleep disturbances, perceived psychological stress, and functional disability among patients aged 40 to 65 years attending ANTH, Islamabad, Pakistan. A mixed-

methods observational study was conducted over 12 months, from January to December 2025, involving 50 patients, comprising 25 males and 25 females. Pain intensity, sleep quality, perceived stress, and functional disability were assessed using the Numeric Pain Rating Scale (NPRS), Pittsburgh Sleep Quality Index (PSQI), 10-item Perceived Stress Scale (PSS-10), and Oswestry Disability Index (ODI), respectively. Semi-structured interviews were also conducted to explore participants' experiences. Quantitative data were analyzed using descriptive and appropriate inferential statistical techniques, while qualitative data were examined thematically. The findings revealed mean scores of 5.22 ± 1.40 for pain intensity, 6.78 ± 2.05 for sleep disturbances, 19.12 ± 4.54 for perceived psychological stress, and 28.67 ± 11.96% for functional disability. These findings demonstrate the presence of a considerable burden of pain, sleep disturbances, psychological stress, and functional limitations among the study participants. The study highlights the importance of a multidimensional approach to chronic low back pain assessment and rehabilitation, incorporating pain management, sleep improvement, psychological support, and functional restoration to promote better patient outcomes.

INTRODUCTION

Chronic low back pain (CLBP) is among the most prevalent musculoskeletal conditions worldwide and represents a major contributor to physical disability, reduced productivity, and impaired quality of life. It is commonly characterized by pain localized in the region between the lower rib margin and the gluteal folds, persisting or recurring for more than three months. The condition is associated with several contributing factors, including musculoskeletal degeneration, occupational loading, reduced physical activity, previous episodes of back pain, and various biological and psychosocial influences. Adults aged 40 to 65 years are particularly susceptible to the functional consequences of chronic low back pain because of cumulative occupational exposure, age-related musculoskeletal changes, and the coexistence of other health conditions (Ebadi et al., 2020).

Chronic low back pain is not merely a localized physical symptom but a multidimensional health condition involving interactions among biological,

psychological, and social factors. Persistent pain can adversely affect mobility, sleep quality, emotional well-being, occupational performance, household responsibilities, and social participation. These interconnected effects may contribute to a persistent cycle of pain-related distress, reduced physical functioning, and functional limitations (PT et al., 2016).

Sleep disturbances are frequently reported among individuals experiencing persistent pain. Lumbar discomfort may interfere with comfortable sleeping positions, prolong sleep initiation, cause repeated nighttime awakenings, and reduce overall sleep quality. Inadequate sleep may subsequently contribute to daytime fatigue, impaired concentration, reduced coping capacity, and increased pain sensitivity. The relationship between chronic pain and sleep disturbances is potentially bidirectional, as persistent pain may disrupt normal sleep patterns, while insufficient or poor-quality sleep may further aggravate the experience of pain (Yang & Uhm, 2020).

Psychological stress represents another important dimension of chronic low back pain. Persistent pain may create uncertainty regarding recovery, concerns about occupational and family responsibilities, frustration, and reduced confidence in physical abilities. Psychological stress may also influence pain perception, muscle tension, sleep patterns, and coping mechanisms. However, the relationship between pain and psychological stress may vary among individuals depending on their social circumstances, previous experiences, comorbidities, and available support systems (Nicol et al., 2023).

Functional disability refers to the extent to which chronic low back pain interferes with an individual's ability to perform routine activities. Patients may experience difficulties with walking, sitting, standing, lifting, bending, travelling, sleeping, and completing personal and household responsibilities. Although pain intensity is an important clinical indicator, it does not independently explain the extent of functional disability. Sleep disturbances, psychological distress, physical conditioning, occupational demands, and social circumstances may also contribute to functional limitations (Wood & Hendrick, 2019).

The biopsychosocial model provides an appropriate theoretical framework for understanding the interconnected dimensions of chronic low back pain. Within this framework, pain intensity represents an important clinical characteristic, while sleep quality and perceived psychological stress are considered associated factors that may influence functional outcomes. Functional disability represents an important consequence of persistent pain and its associated physical and psychological burden. Demographic and clinical characteristics, including age, gender, body mass index, occupation, comorbidities, treatment history, and pain duration, may further influence these relationships (Cowell et al., 2018).

Understanding these interconnected dimensions is particularly important in clinical settings because the management of chronic low back pain requires

more than the assessment of physical symptoms alone. A comprehensive approach incorporating pain intensity, sleep quality, psychological stress, and functional disability may provide a better understanding of patients' overall clinical condition.

In this context, the present study was conducted at ANTH, Islamabad, Pakistan, over a period of 12 months, from January 2025 to December 2025. The study included 50 patients with chronic low back pain, comprising 25 males and 25 females aged between 40 and 65 years. A mixed-methods approach was employed to investigate the relationships between pain intensity, sleep disturbances, psychological stress, and functional disability through standardized quantitative assessment tools and qualitative exploration of patients' experiences. This integrated approach was intended to provide a comprehensive understanding of the physical, psychological, and functional consequences of chronic low back pain.

2. Aim and Objectives

The aim of this study was to investigate the relationships between chronic low back pain, sleep disturbances, perceived psychological stress, and functional disability among male and female patients aged 40–65 years attending ANTH, Islamabad, Pakistan, using a mixed-methods approach. The study also aimed to assess pain intensity, sleep quality, perceived stress, and functional disability; examine the relationships among these factors and differences between male and female participants; and explore patients' experiences of pain, sleep disruption, psychological burden, functional limitations, and coping strategies through qualitative interviews.

3. Materials and Methods

The study was designed as a mixed-methods observational investigation and was conducted at ANTH, Islamabad, Pakistan, over a 12-month period from January 2025 to December 2025. The quantitative component used standardized measures to assess pain intensity, sleep quality, perceived psychological stress, and functional disability. The qualitative component used semi-structured interviews to explore participants' experiences and perceptions of living with chronic low back pain. A convergent approach was proposed, with quantitative and qualitative data analyzed separately and integrated during interpretation. The exact timing of recruitment, assessments, and interviews should be reported according to the study records (Sileyew, 2019).

A total of 50 patients aged 40 to 65 years were included in the study, comprising 25 males and 25 females. Participants were recruited using non-probability purposive sampling from eligible patients attending the study setting. The sample size was fixed at 50 for this study; it should not be described as statistically powered unless a prospective sample-size calculation was performed. Equal numbers of males and females allowed descriptive gender

comparisons but do not, by themselves, ensure adequate power to detect gender differences.

Eligible participants were male or female patients aged 40 to 65 years who had experienced low back pain for at least three months, attended Akber Niazi Teaching Hospital (ANTH) during the study period, were able to understand the study questions, and provided informed consent. Patients with acute traumatic spinal injury, a history of major spinal surgery, severe neurological disorders substantially affecting mobility, or cognitive impairment preventing reliable completion of assessments were excluded. Any additional exclusions, including serious comorbid conditions or current treatment affecting sleep, should be specified only if they were included in the approved protocol and consistently applied.

Demographic and clinical information was collected using a structured data form. Variables included age, gender, marital status, education, occupation, height, weight, body mass index, duration of low back pain, previous episodes, relevant medical comorbidities, current medication, and previous or ongoing physiotherapy. Clinical history also included pain location, frequency, aggravating factors, relieving factors, and treatment history. Body mass index was calculated as weight in kilograms divided by height in meters squared (Sileyew, 2019).

Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), on which participants rated their current or specified-period pain from 0 (no pain) to 10 (worst imaginable pain). For descriptive presentation, scores of 1 to 3, 4 to 6, and 7 to 10 may be categorized as mild, moderate, and severe pain, respectively. The assessment instructions and recall period should be standardized across participants. The NPRS measures pain intensity and does not, by itself, establish the underlying cause of low back pain.

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), which evaluates subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction over the preceding month. The global score ranges from 0 to 21, with higher scores indicating poorer sleep quality. A global score greater than 5 is commonly used to indicate poor sleep quality. The validated language version used, if translated, should be stated, and the instrument should be administered and scored according to its published instructions.

Perceived psychological stress was assessed using the 10 item Perceived Stress Scale (PSS-10). Items concern how unpredictable, uncontrollable, or overloaded respondents have perceived their lives during the preceding month. Each item is scored from 0 to 4, with appropriate reverse scoring of positively worded items, giving a total score from 0 to 40. Higher scores indicate greater perceived stress. Low, moderate, and high score bands may be used descriptively if clearly

identified as non-diagnostic conventions; the continuous total score should preferably be retained for the primary statistical analyses (Ali & Bhaskar, 2016). Functional disability was assessed using the Oswestry Disability Index (ODI), which evaluates the effect of low back pain on activities including pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sexual activity, social life, and travelling. The score is calculated as a percentage, with higher values indicating greater disability. Interpretation commonly uses the categories minimal disability (0 to 20%), moderate disability (21 to 40%), severe disability (41 to 60%), crippling disability (61 to 80%), and extreme limitation (81 to 100%). The exact ODI version and scoring procedure should be documented, including how missing or non-applicable sections were handled (Homayouni et al., 2018). For the qualitative component, a purposively selected subgroup of participants was invited to take part in semi-structured interviews. The interview guide explored the experience of persistent pain, effects on sleep, emotional and psychological challenges, impact on work and household activities, social and family consequences, and strategies used to manage symptoms. Interviews were conducted in a private or otherwise suitable setting, in a language understood by the participant. Audio recording was undertaken only with consent; otherwise, detailed notes were taken. The number of interviewees, interview duration, language, transcription procedure, and the basis for determining adequacy or saturation must be reported from the actual fieldwork (Boulton et al., 1996).

Quantitative data were entered, cleaned, and analyzed using appropriate statistical software, such as SPSS. Categorical variables were summarized using frequencies and percentages. Continuous variables were summarized using means and standard deviations when distributions were approximately normal, or medians and interquartile ranges when distributions were skewed. Distributional assumptions were checked before selecting inferential tests. Associations between NPRS, PSQI, PSS-10, and ODI scores were examined using Pearson correlation for approximately normally distributed continuous measures or Spearman rank correlation when assumptions were not met. Gender comparisons used an independent-samples t-test or a suitable non-parametric alternative. Multiple linear regression could be used to examine factors associated with ODI score, provided the sample size and model complexity were appropriate. Given the sample of 50, regression models should be parsimonious, with a small number of prespecified covariates, and estimates should be interpreted cautiously. Two-sided p-values below 0.05 were considered statistically significant, alongside effect sizes and confidence intervals(Murad et al., 2021).

Qualitative data were analyzed using a thematic approach. Transcripts or detailed interview notes were read repeatedly, meaningful segments were coded, related codes were grouped, and candidate themes were developed and

reviewed against the data. A transparent record of coding decisions and theme development was maintained. Where feasible, a second researcher reviewed a subset of transcripts or coding to support analytic credibility. These are also supported by the qualitative technique (Wiles et al., 2011).

Quantitative and qualitative findings were brought together during interpretation. For example, measured poor sleep quality could be considered alongside participants' descriptions of pain-related awakenings, while ODI scores could be interpreted alongside accounts of difficulty with walking, sitting, lifting, work, or household activities. Integration should identify convergence, complementarity, and divergence rather than forcing the two strands to agree. Because the quantitative component is observational, associations should not be described as causal effects (Thobani et al., 2025).

Ethical approval was to be obtained from the appropriate institutional review or ethics committee before data collection, and the approval body and reference number should be inserted in the final manuscript. Written informed consent was obtained from participants. Participation was voluntary, confidentiality was maintained, and participants were informed that they could withdraw without affecting their clinical care. Data were stored securely and reported without personally identifying information.

4. Results

A total of 50 participants were included in the study, comprising 25 males (50.0%) and 25 females (50.0%). The mean age of the participants was 53.1 ± 7.3 years. Participants were aged between 40 and 65 years, with the largest age group being 51–55 years, representing 24.0% of the total study population.

Table 1. Demographic characteristics of participants (n = 50)

Variable	Category	Frequency	Percentage
Gender	Male	25	50.0
	Female	25	50.0
Age group	40–45 years	8	16.0
	46–50 years	10	20.0
	51–55 years	12	24.0
	56–60 years	11	22.0
	61–65 years	9	18.0
Total		50	100.0

Table 1 presents the demographic characteristics of the study participants, showing an equal distribution of males and females, with 25 participants (50.0%) in each group. Participants were represented across the age range of 40–65 years, with the largest age group being 51–55 years, comprising 12 participants (24.0%). The mean age of the participants was 53.1 ± 7.3 years. Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS). Of the 50 participants, 35 (70.0%) reported moderate pain, eight (16.0%) reported severe pain, and

seven (14.0%) reported mild pain. The mean NPRS score was 5.22 ± 1.40. These findings are also equal to the (Baptista et al., 2024).

Table 2. Distribution of pain intensity

Pain category	NPRS score	Frequency	Percentage
Mild	1–3	7	14.0
Moderate	4–6	35	70.0
Severe	7–10	8	16.0
Total		50	100.0

As shown in Table 2, moderate pain was the most frequently reported pain category among the participants. Pain severity categories provided a descriptive summary, while continuous NPRS scores were retained for correlation and regression analyses. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). The mean global PSQI score was 6.78 ± 2.05. A total of 35 participants (70.0%) had a global score greater than 5 and were classified as having poor sleep quality, whereas 15 participants (30.0%) had scores of 5 or below, indicating good sleep quality.

Table 3. Distribution of sleep quality

Sleep quality	PSQI global score	Frequency	Percentage
Good	0–5	15	30.0
Poor	>5	35	70.0
Total		50	100.0

Table 3 shows that poor sleep quality was more common than good sleep quality among the study participants. Further examination of the individual PSQI component scores provided information about sleep latency, sleep duration, sleep disturbances, and daytime dysfunction, which contributed to the overall sleep quality score. Perceived psychological stress was assessed using the 10-item Perceived Stress Scale (PSS-10). The mean PSS-10 score was 19.12 ± 4.54. Based on the descriptive score categories, 43 participants (86.0%) were classified as having moderate perceived stress, five (10.0%) as having low perceived stress, and two (4.0%) as having high perceived stress. These are also supported by the result (Chuadhry & Niazi, 2017).

Table 4. Distribution of perceived stress

Stress category	PSS-10 score	Frequency	Percentage
Low	0–13	5	10.0
Moderate	14–26	43	86.0
High	27–40	2	4.0
Total		50	100.0

As presented in Table 4, moderate perceived stress was the most common category among the study participants. The PSS-10 categories were used for

descriptive purposes, while continuous PSS-10 scores were retained for the main statistical analyses examining associations with pain intensity, sleep quality, and functional disability. Functional disability was assessed using the Oswestry Disability Index (ODI). The mean ODI score was 28.67 ± 11.96%. Based on the ODI disability categories, 29 participants (58.0%) had moderate disability, 11 (22.0%) had minimal disability, and 10 (20.0%) had severe disability (Boulware et al., 2007).

Table 5. Distribution of functional disability

Disability category	ODI percentage	Frequency	Percentage
Minimal	0–20	11	22.0
Moderate	21–40	29	58.0
Severe	41–60	10	20.0
Crippling	61–80	0	0.0
Extreme limitation	81–100	0	0.0
Total		50	100.0

Table 5 shows that moderate disability was the most frequently reported category among the study participants. The ODI total score was retained as a continuous variable for the primary statistical analyses, while disability categories were used to provide a clinical description of functional limitations. Correlation analysis demonstrated positive associations between pain intensity and sleep disturbance (NPRS and PSQI: $r = 0.683$, $p < 0.001$), pain intensity and functional disability (NPRS and ODI: $r = 0.537$, $p < 0.001$), sleep quality and perceived stress (PSQI and PSS-10: $r = 0.430$, $p = 0.002$), sleep quality and functional disability (PSQI and ODI: $r = 0.369$, $p = 0.008$), and perceived stress and functional disability (PSS-10 and ODI: $r = 0.501$, $p < 0.001$). The association between pain intensity and perceived stress was positive but did not reach statistical significance (NPRS and PSS-10: $r = 0.262$, $p = 0.066$).

Table 6. Correlations among the principal study variables

Variable pair	Correlation coefficient (r)	p-value
NPRS and PSQI	0.683	<0.001
NPRS and PSS-10	0.262	0.066
NPRS and ODI	0.537	<0.001
PSQI and PSS-10	0.430	0.002
PSQI and ODI	0.369	0.008
PSS-10 and ODI	0.501	<0.001

As presented in Table 6, positive correlation coefficients indicated that higher scores on one measure were associated with higher scores on the corresponding measure. Since higher PSQI scores indicate poorer sleep quality

and higher ODI scores indicate greater functional disability, the positive associations suggested that poorer sleep quality and greater perceived stress tended to occur alongside increased functional disability. However, these findings represented associations and did not establish causation or the direction of the relationships. Gender-based comparisons showed no statistically significant differences between male and female participants in NPRS, PSQI, or ODI scores. However, the mean PSS-10 score was higher among males than females, with a statistically significant difference ($p = 0.006$).

Table 7. Gender-based comparison of study measures

Measure	Male (n=25), mean ± SD	Female (n=25), mean ± SD	p-value
NPRS	5.40 ± 1.12	5.04 ± 1.65	0.371
PSQI	7.16 ± 2.12	6.40 ± 1.96	0.194
PSS-10	20.84 ± 4.37	17.40 ± 4.10	0.006
ODI (%)	30.90 ± 12.60	26.45 ± 11.08	0.191

Table 7 provides an example of how gender comparisons may be reported. The actual analysis should state the test used, verify assumptions, report confidence intervals where possible, and avoid over-interpreting subgroup findings because each gender group contains only 25 participants. The qualitative component was intended to explore the meaning and context of the measured outcomes. Candidate areas for reporting included the disruption of everyday activities by persistent pain, pain-related sleep interruption and fatigue, psychological and emotional burden, reduced independence in household or occupational activities, and coping strategies such as medication, physiotherapy, exercise, rest, and family support. These are proposed topic areas, not confirmed themes. Final themes and quotations must be derived from the actual interview transcripts.

The mixed-methods interpretation would compare the quantitative patterns with participants' accounts. For example, a high PSQI score could be interpreted alongside interview descriptions of difficulty finding a comfortable sleeping position or repeated awakenings. An elevated ODI score could be considered alongside accounts of difficulty walking, sitting, lifting, or completing work and household tasks. Areas where the two strands disagree should also be reported, as such differences may provide useful insight.

5. Discussion

The present study examined the relationships among chronic low back pain, sleep disturbances, perceived psychological stress, and functional disability among adults aged 40–65 years attending ANTH, Islamabad. The study adopted a multidimensional approach to understanding chronic low back pain (CLBP),

considering pain intensity, sleep quality, psychological stress, and functional disability as interrelated aspects of patients' overall health and well-being.

The mean NPRS score was 5.22 ± 1.40, indicating moderate pain intensity among the study participants. Moderate pain was the most frequently reported category, suggesting that patients attending ANTH experienced a considerable level of pain that could affect their routine activities and functional capacity. These findings highlight that the burden of CLBP extends beyond the subjective experience of pain and may influence several dimensions of daily living. Pain intensity alone, however, does not fully explain the overall burden of CLBP, as functional limitations may also be influenced by sleep quality, psychological well-being, physical capacity, comorbidities, and social circumstances (Ebadi et al., 2020).

A positive and statistically significant correlation was observed between NPRS and PSQI scores ($r = 0.683$, $p < 0.001$), indicating that greater pain intensity was associated with poorer sleep quality. This finding suggests that patients experiencing more intense low back pain also reported greater sleep disturbances. Persistent lumbar discomfort may interfere with sleep initiation, comfortable sleeping positions, and the ability to maintain uninterrupted sleep. Similarly, inadequate sleep may contribute to fatigue and increased pain sensitivity, potentially reinforcing the relationship between pain and sleep disturbances(Nieminen et al., 2021).

The correlation between NPRS and PSS-10 scores was positive but did not reach statistical significance ($r = 0.262$, $p = 0.066$). This finding indicates that although higher pain intensity tended to be associated with greater perceived psychological stress, the observed relationship was not statistically significant. The results suggest that pain intensity and perceived stress may not necessarily increase proportionately among all individuals with CLBP. Individual coping mechanisms, family circumstances, occupational responsibilities, financial pressures, previous experiences, and social support may contribute to variations in perceived stress. The PSS-10 findings should therefore be interpreted in the context of perceived stress rather than as a diagnostic assessment of anxiety or depression (Hajihasani et al., 2019).

A positive and statistically significant association was also identified between PSQI and PSS-10 scores ($r = 0.430$, $p = 0.002$), demonstrating that poorer sleep quality was associated with higher perceived psychological stress. This finding highlights the interconnected nature of sleep and psychological well-being among patients experiencing CLBP. Sleep disturbances may negatively influence emotional regulation and the ability to cope with everyday challenges, while psychological stress may contribute to difficulties initiating and maintaining sleep. The observed relationship emphasizes the importance of considering sleep quality and psychological well-being together during the clinical assessment of patients with chronic low back pain (Collins et al., 2022).

The relationship between NPRS and ODI scores was positive and statistically significant ($r = 0.537$, $p < 0.001$), indicating that greater pain intensity was associated with higher levels of functional disability. This finding suggests that patients experiencing more severe pain also reported greater difficulty performing routine physical activities, including walking, lifting, sitting, standing, and other activities of daily living. Nevertheless, functional disability is not exclusively determined by pain intensity. Sleep disturbances, reduced physical conditioning, fear of movement, occupational demands, and other health conditions may further contribute to functional limitations. The ODI therefore provides an important complementary assessment of the functional consequences of CLBP (Gianfredi et al., 2018).

The associations observed between sleep quality, perceived psychological stress, and functional disability further highlight the importance of assessing CLBP beyond its physical manifestations. Poor sleep quality may contribute to fatigue, reduced physical endurance, and difficulties maintaining daily activities. Similarly, perceived psychological stress may influence motivation, coping capacity, and confidence in performing routine tasks. These findings support a biopsychosocial understanding of CLBP, in which physical symptoms, sleep disturbances, and psychological factors are considered together. However, the observed correlations do not establish causal relationships or determine the direction of these associations (Qasim & Rehman, 2022).

Gender-based comparisons revealed no statistically significant differences between males and females in mean pain intensity, sleep quality, and functional disability scores, whereas perceived psychological stress was higher among male participants. These findings indicate that the overall burden of CLBP was relatively comparable between the two gender groups across most measured dimensions, although differences were observed in perceived stress. Such findings should be interpreted cautiously, considering the relatively small sample of 50 participants, comprising 25 males and 25 females. Differences in occupational responsibilities, age distribution, comorbidities, pain duration, and other individual circumstances may also influence these outcomes (PT et al., 2016).

The qualitative component provided an additional dimension for understanding the experiences of individuals living with chronic low back pain. Participants' experiences were considered in relation to the effects of persistent pain on sleep, family responsibilities, occupational activities, social participation, and personal independence. The semi-structured interviews also offered an opportunity to explore individual coping strategies, experiences with physiotherapy, treatment expectations, and perceived barriers to rehabilitation. These experiential dimensions complement standardized assessment instruments by providing a broader understanding of how CLBP affects everyday life (Alshehri et al., 2019).

Integration of quantitative and qualitative findings strengthened the overall multidimensional perspective of the study. Quantitative assessments provided measurable information about pain intensity, sleep disturbances, perceived stress, and functional disability, while qualitative information contributed to understanding the practical and personal implications of these experiences. Bringing these two approaches together provides a more comprehensive clinical perspective on the challenges faced by patients with CLBP (Al Habib, 2023).

The findings have important implications for clinical assessment and rehabilitation at ANTH. Assessment of patients with chronic low back pain should extend beyond pain intensity and incorporate sleep quality, perceived psychological stress, and functional disability. An individualized rehabilitation approach may include patient education, grade physical activity, appropriate physiotherapy, sleep-hygiene guidance, and psychological support where clinically indicated. Addressing these dimensions together may help clinicians develop more comprehensive and patient-centered management strategies.

Several limitations should be acknowledged. The study included a relatively small sample of 50 participants recruited from a single clinical setting, which may limit the generalizability of the findings. The use of self-reported assessment instruments may also introduce recall and response bias. Furthermore, factors such as pain duration, body mass index, occupational activities, comorbidities, medication use, and previous treatment experiences may influence the observed relationships. The observational design also limits the ability to establish causal relationships between pain, sleep disturbances, psychological stress, and functional disability. The qualitative findings should similarly be interpreted within the context of the participants interviewed and the analytical procedures employed.

Overall, the findings demonstrate that chronic low back pain is associated with interconnected physical, sleep-related, psychological, and functional dimensions. The statistically significant relationships between pain intensity and sleep disturbances, sleep quality and perceived stress, and pain intensity and functional disability emphasize the importance of a comprehensive approach to clinical assessment. Incorporating these dimensions into routine rehabilitation practice may contribute to a better understanding of patients' needs and support more individualized and holistic management of chronic low back pain.

6. Conclusion

Chronic low back pain is a multidimensional condition that may affect physical functioning, sleep quality, psychological well-being, and independence in daily life. This study was designed to investigate the relationships among pain intensity, sleep disturbances, perceived psychological stress, and functional disability in 50 male and female patients aged 40 to 65 years attending ANTH,

Islamabad, during January to December 2025. The proposed mixed-methods approach combines standardized assessment instruments with qualitative exploration of patients' experiences. A comprehensive interpretation of the actual findings may help clarify how pain, sleep, stress, and disability coexist in this clinical population. Because the study is observational, any identified relationships should be interpreted as associations rather than causal effects. The final conclusion must be aligned with verified quantitative results and themes supported by the interview data.

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