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Comparative Analysis of Functional Disability and Lumbar Movement Patterns in Acute vs. Chronic Low Back Pain: A Cross-Sectional Study

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Abstract

Background: Low back pain (LBP) remains one of the most commonly reported musculoskeletal complaints across the world. This condition often leads to activity restriction and may negatively influence overall quality of life. It is important to distinguish between functional deficits in the acute and chronic forms of these physiological sequelae to enable more effective rehabilitation and further clinical management.**Objective:** To evaluate lumbar movement patterns and functional impairment using standardized clinical assessment toolsin individuals withacute and chronic low back pain.**Methods:**The comparative cross-

sectional study included 50 participants, with 25 in the acute low back pain (LBP) group and 25 in the chronic LBP group. Various outcome measures were used, including the Visual Analog Scale (VAS), Oswestry Disability Index (ODI), Roland–Morris Disability Questionnaire (RMDQ), lumbar range of motion (ROM) measured using a goniometer, and a composite score for functional movement assessment. The t-test for independent samples was applied in the between-group comparison. In all three pain scale scores (VAS, ODI, RMDQ), higher values signify more movement restriction. In the lumbar ROM, a higher score indicates movement restriction.**Results:** Patients with chronic LBP showed significantly greater pain intensity (VAS: 6.92 ± 3.04 vs. 5.24 ± 1.61; p = 0.018), more functional disability (ODI: 23.84 ± 7.80 vs.17.96 ± 5.79; p = 0.004), and higher scores at RMDQ (12.24 ± 3.06 VS 9.92 ± 3.40; P = 0.015) than patients with acute LBP group compare to Acute LBP group. The patients in the chronic LBP group had higher ROM statistical scores (10.32 ± 2.82 vs. 8.56 ± 2.72; p = 0.030), suggesting greater restriction of lumbar mobility in the chronic group than in those with acute LBP. Higher ROM scores reflect increased mobility impairment. The composite functional movement score differed significantly between groups (p = 0.003).**Conclusion:** Patients suffering from chronic LBP have shown significantly greater pain intensity, functional disability, and lumbar mobility restriction compared to those suffering from acute LBP.

Keywords: low back pain; functional disability; range of motion; Oswestry Disability Index; Roland-Morris Disability Questionnaire; Visual Analog Scale.

1. Introduction

The other most common MSK disorder worldwide is low back pain (LBP), which almost everyone suffers from in their life span, as quite a number of them develop a conversion from acute to chronic conditions (1, 2).It can affect individuals across all age groups and socioeconomic backgrounds, often leading to significant functional impairment and a decline in quality of life (3). The issue of pain can cause the reduction in quality of life (3). Globally, LBP contributes substantially to years lived with disability and places a burden on healthcare systems, causing much stress and financial strain in countries' healthcare and economies(3-5). Epidemiological data indicate that 60-80% of patients develop LBP in their lifetime (6).The prevalence rate of LBP in Pakistan is estimated to be around 7,462 out of every 100,000 people in the country in 2021 (6).

Based on symptom duration, low back pain (LBP) is generally classified into two main types: acute and chronic. In many cases, Acute low back pain usually improves within a short duration without long-term complications(7).Painlasting longer than twelve weeks is considered chronic and may involve physical as well as psychosocial factors(8-10).While the pathophysiology of LBP remains unclear, its management has

been based on structural or anatomical models (11, 12).One observation among chronic LBP patients is a difference in biomechanics, neuromuscular function, muscle guarding, and behavior, leading to restricted spinal mobility, loss of functional capacity, and disability(13, 14).Although knowledge regarding the aforementioned factors continues to grow steadily, there remains a gap in clinical practice regarding systematic categorization of pain in such patients. Lack of identification of the main mechanism underlying a patient's pain results in mismanagement of their condition, especially in cases involving chronic or non-specific LBP (15, 16).In assessing pain and associated limitations, the following widely validated tests may be considered. The degree of pain is often measured using the Visual Analog Scale (VAS) (17). The level of functional disability, by contrast, can be assessed using various standardized tests, including the Oswestry Disability Index (ODI) (18)and the Roland-Morris Disability Questionnaire (RMDQ)(19). Moreover, there are objective measures, including goniometric measurement of lumbar spine flexibility, as well as functional movement tests such as forward bend, finger-to-floor test, and sit-to-stand test (20).

Although there is limited evidence from comparative studies that simultaneously evaluate pain intensity, functional disability, and movement patterns within the same population, particularly in the Pakistani context. An extensive literature search was conducted to ensure that the findings obtained in this study were consistent with the existing body of literature. The articles used for this purpose included randomized controlled trials, systematic reviews, and cross-sectional studies.

The foundation for measuring functional impairment in patients with low back pain using the Oswestry Impairment Index and the Roland-Morris was established by Waddell (1987) and Deyo et al. (1998) (18, 19). In the study, goniometric ROM assessment was employed to compare the lumbar ROM between chronic LBP patients and healthy controls. These results further support the validity of goniometric assessment tools in LBP evaluation(21). The validity and sensitivity of the goniometric assessment technique for evaluating LBP are further supported by these results, which also corroborate this. As such, the current investigation extends the validity of the existing evidence (22) by providing a direct and simultaneous comparison using the multi-tool assessment.

Therefore, the current investigation employs proven clinical evaluation techniques to assess lumbar movement patterns and functional impairment in individuals with acute and chronic low back pain using standardized tools. By providing a detailed comparative analysis, this study aims to enhance clinical evaluation and

establish focused rehabilitation techniques in physiotherapy practice by offering a comprehensive functional profile.

Objectives

The general aim of this investigation was:

- To compare functional disability using both ODI and RMDQ.
- To compare pain intensity using a Visual Analog Scale.
- To compare lumbar range of motion using goniometric measurements, and to assess functional capability using forward bending, standing to sitting, and fingertip-to-floor tests.
- To analyze the relationship between pain, disability, and movement patterns.

Rationale of the Study

The importance of understanding the unique functional characteristics between individuals suffering from acute and chronic LBP cannot be overstated. Despite similar lower back pain in both cases, their underlying conditions, levels of dysfunction, and movement restrictions vary considerably (23). The difference between acute and chronic patients is clearly highlighted in the research currently under publication. However, the comprehensive simultaneous assessment of the functional profile in the young adult population is scarce.

The present study aims to bridge the existing knowledge gap by applying multiple standardized tools, including VAS, ODI, RMDQ, goniometric ROM, and functional movement assessment, to create an extensive comparative functional profile(18-20). The purpose is to provide an evidence-based guide for the assessment and rehabilitation process in physiotherapy.

Research Question

Is there a significant difference between individuals with acute and chronic low back pain in terms of lumbar range of motion, Oswestry Disability Index (ODI) scores, and Roland–Morris Disability Questionnaire (RMDQ) scores?

Hypothesis

Null Hypothesis (H_0): There is no significant difference between patients suffering from acute and chronic LBP in their lumbar movement or functional disabilities.

Alternative Hypothesis (H_1): The lumbar movement disability and functional disability observed in patients suffering from chronic LBP are significantly higher than in patients suffering from acute LBP.

Implications of the Study

The results obtained from the study provide a very clear indication for distinguishing between acute and chronic LBP among patients. These results have implications for helping physiotherapists plan more effective assessments and treatment plans.

Study Gap

Despite the abundance of research on low back pain, few studies have included functional performance assessments and goniometric range-of-motion measures in a homogeneous group of young people. The present study provides a comprehensive and dimensional functional comparison.

2. Materials and Methods

Study Design

The functional impairment and lumbar mobility patterns of individuals with acute and chronic low back pain were compared using a cross-sectional design. It is the most time-efficient method for collecting data on multiple outcome variables at a single time point within well-defined participant groups. It is best suited for hypothesis-generating research in clinical physiotherapy.

Duration of Study

Data collection was conducted in physiotherapy clinics and university-affiliated healthcare centers during the study period, from 12th February to 30th March 2026. The data for each individual was collected in one sitting only.

Participants and Sampling

There were 50 subjects involved in this research, evenly distributed across the groups: 25 with acute low back pain and 25 with chronic low back pain. Males and females aged 18-25 years participated in this study.

Inclusion Criteria

Criteria that should be met before an individual is selected for the research study include being between 18 and 25 years old. They must be affected by either acute lower back pain, less than six weeks old, or chronic lower back pain, more than twelve weeks old. They must be able to give informed consent. They have to be able to participate in data evaluation. Both males and females were selected.

Exclusion Criteria

Those with a history of spinal surgery, those with spine fractures or vertebral malignancies, radiculopathy with neurological impairment, patients who are pregnant, inflammatory arthropathy or systemic disease impairing ambulation, or those receiving physiotherapy rehabilitation treatment.

Outcomes

Functional limits (ODI and RMDQ), lumbar range of motion (goniometric ROM), pain intensity (VAS), and composite functional movement performance were considered primary outcomes. Determining restrictions in activities and functional limitations across domains, including ambulation, standing, lifting, sitting, and leisure activities, was considered a secondary outcome.

Assessment Tools

Visual Analog Scale (VAS)

Pain was assessed using the Visual Analog Scale (VAS). Subjects were instructed to rate the amount of their pain on a scale, with "no pain" at one extreme and "worst possible pain" at the other. The distance marked by the participant was recorded as the pain score. The VAS has been widely used as a dependable method for assessing pain severity in individuals with low back pain, with reported excellent reliability(24).

Oswestry Disability Index (ODI)

The functional disability associated with low back pain was determined through the use of the Oswestry Disability Index. The index has ten parts that measure the impact of pain on everyday activities such as taking care of oneself, carrying objects, walking, sitting, standing, sleeping, socializing, and traveling. Six possible answers ranging from 0 to 5 were provided for each part. The ODI is widely recognized as a standard measure for evaluating disability related to spinal conditions (25).

Roland Morris Disability Questionnaire (RMDQ)

The Roland-Morris Disability Questionnaire was used to assess the extent of physical disability caused by low back pain. The questionnaire contains 24 statements describing daily activities that may be affected by back pain. Respondents selected the items that matched their circumstances on the test day(26).

Goniometer:

Lumbar range of motion was assessed using a universal goniometer to measure spinal flexion, extension, right and left lateral flexion, and right and left rotation. All movements were recorded in degrees and compared with accepted normal ranges for lumbar mobility.

For statistical analyses, ROM values were assigned to a four-point restriction scale for each lumbar motion (0 = normal, 1 = slightly restricted, 2 = moderately restricted, and 3 = severely restricted) based on their percentage of ROM.

Summation of all restrictions in the six motions resulted in a total ROM restriction score between 0 and 18 points.

Forward Bending Test: This test was evaluated on the smoothness of the movement, the presence of pain, and compensatory mechanisms. Fingertip-to-Floor Test: It evaluates the gap between the fingertips and the floor during maximum forward bending (27).

Sit-to-Stand Test: The sit-to-stand test was performed to assess the ability to rise from a seated position without assistance from the upper limbs(28).

Procedure

Each participant was evaluated by physiotherapists who had received prior training for the research protocol. Here, demographic data and clinical history were collected. Then, all participants completed the VAS, ODI, and RMDQ. Lower extremity alignment was assessed using clinical observation and a standard screening form. Goniometric measurements included a standard sequence: flexion, extension, right and left lateral flexion, and right and left rotation. Then, functional movement was done in a standard sequence: forward bending, finger-to-floor, and sit-to-stand.

Statistical Analysis

The collected data were processed and analyzed using SPSS software (version 26.0; IBM Corp., Armonk, NY, USA). Continuous variables were summarized using descriptive statistics, including mean, standard deviation, median, and range. To examine whether the data followed a normal distribution, the Shapiro–Wilk test was applied. For comparisons between groups, independent-samples t-tests were used when the data were normally distributed. A p-value below 0.05 was considered to indicate statistical significance, with significance levels reported as ($p < 0.05$) and ($p < 0.01$).

3. Results

Demographic Characteristics

The overall sample size for this study was 50 subjects, with 25 participants in each of the two groups: Group 1, focusing on acute LBP, and Group 2, focusing on chronic LBP. Table 1 shows demographic information on the subjects in both groups below.

Table 1: *Comparison of demographic characteristics between acute and chronic low back pain groups*

Characteristic	Group 1 (Acute LBP) n = 25	Group 2 (Chronic LBP) n = 25
Sample Size	25	25
Male	16 (64.0%)	11 (44.0%)
Female	9 (36.0%)	14 (56.0%)

Age (Mean ± SD)	21.36 ± 1.91	21.48 ± 2.12
Age Range (years)	18–25	18–25

Between-Group Comparisons: Indicators of Outcome Measures

The independent t-test results revealed no demographic differences between the acute and chronic LBP groups. There was no statistical difference regarding age between groups (p = 0.835).

As shown in Table 2, the descriptive statistics and inter-group differences for all clinical outcome measures are provided. Individuals with chronic low back pain (LBP) had higher VAS scores than those with acute LBP (6.92 ± 3.04 vs. 5.24 ± 1.61), and the difference was statistically significant (p = 0.018). Similarly, ODI scores were notably greater in the chronic group (23.84 ± 7.80) than in the acute group (17.96 ± 5.79), indicating a moderate level of disability among chronic LBP patients, with a highly significant difference observed (p = 0.004).

Table 2: *Comparison of Outcome Measures Between Acute and Chronic LBP Groups*

Variable	Group 1 Mean ± SD	Median	Range	Group 2 Mean ± SD	Median	Range	t-stat	p-value
Age (years)	21.36 ± 1.91	21.00	18–25	21.48 ± 2.12	21.00	18–25	0.210	0.834
VAS Score	5.24 ± 1.61	6.00	2–8	6.92 ± 3.04	6.00	3–10	2.440	0.018
ODI (%)	17.96 ± 5.79	18.00	4–27	23.84 ± 7.80	25.00	3–45	3.025	0.004
RMDQ Score	9.92 ± 3.40	11.00	3–15	12.24 ± 3.06	13.00	6–19	2.535	0.014
ROM Score	8.56 ± 2.72	9.00	0–14	10.32 ± 2.82	9.00	5–16	2.242	0.029
Functional Total	12.92 ± 3.29	14.00	4–18	16.28 ± 4.18	17.00	8–23	3.159	0.002

Significance codes: $p < 0.05$; $p < 0.01$; NS = Not Significant. VAS = Visual Analog Scale; ODI = Oswestry Disability Index; RMDQ = Roland-Morris Disability Questionnaire; ROM = Lumbar Range of Motion (composite score)

RMDQ scores also differed significantly between the two groups, with chronic LBP patients reporting higher values (12.24 ± 3.06) than those with acute LBP (9.92 ± 3.40; $p = 0.015$). In addition, the ROM restriction score was higher in individuals with chronic LBP (10.32 ± 2.82) than in the acute group (8.56 ± 2.72), suggesting greater limitation of lumbar mobility, and this difference was statistically significant ($p = 0.030$). Composite functional performance values were significantly higher among participants with chronic LBP as opposed to those with acute LBP (16.28±4.18) compared to (12.92±3.29; $p=0.003$).

Graphical Representation

Comparison of Outcome Measures Between Acute and Chronic LBP Groups

As shown in Figure 1, a comparison of the means between the acute LBP and chronic LBP groups can be made. The findings showed that the mean score was higher in the chronic LBP group than in the acute LBP group.

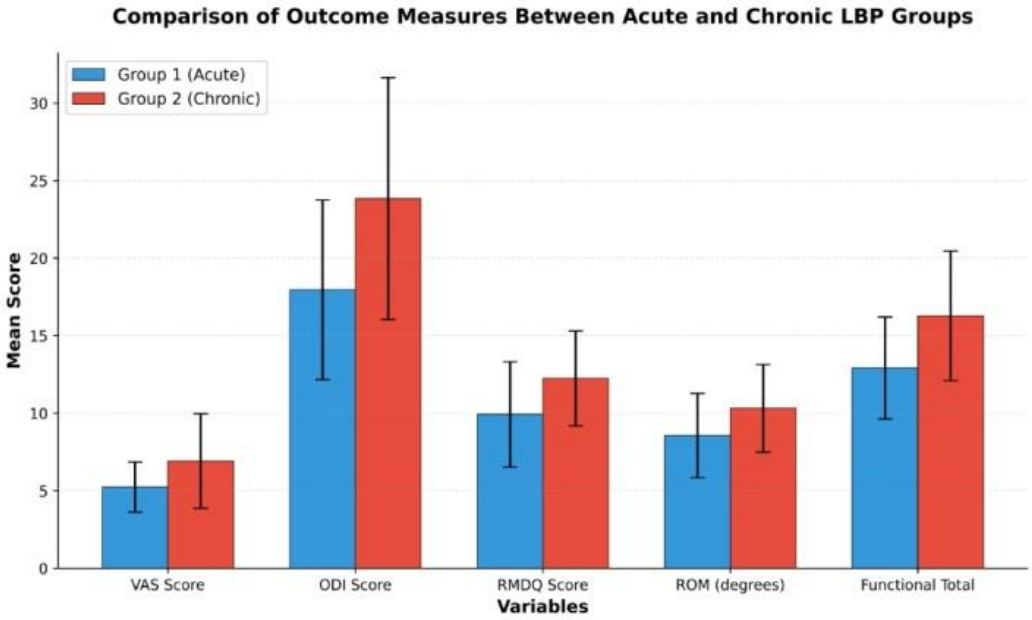

Figure 1. Comparison of VAS, ODI, RMDQ, ROM, and Functional scores between acute and chronic LBP groups

Distribution of Outcome Measures by Groups

The data dispersion is evident from the Box plot shown in Figure 2. Chronic LBP sufferers show a wider range than acute sufferers, implying that chronic sufferers present more dispersed clinical outcomes. The higher median values in chronic cases further highlight their seriousness.

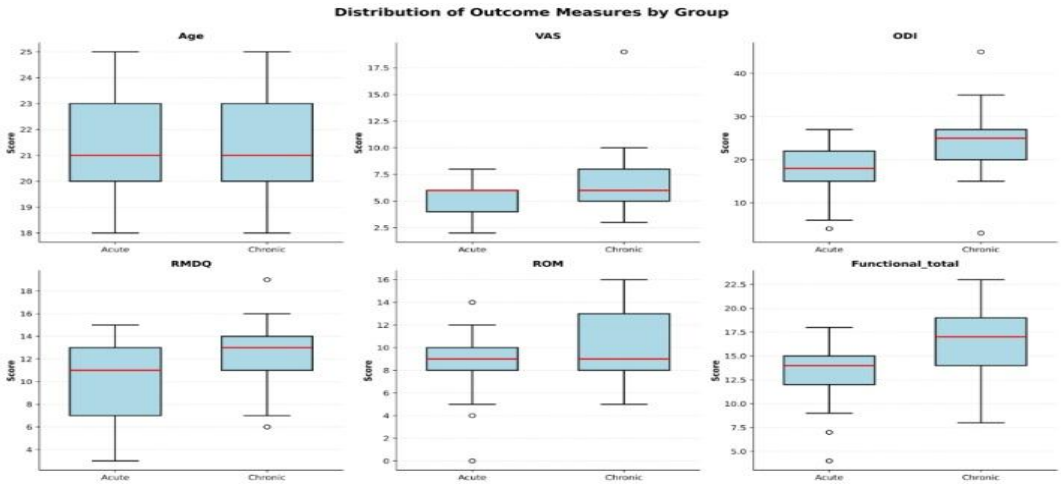

Figure 2. Box plots showing the distribution of outcome measures by group.

Correlation Analysis Between Outcome Measures

In Figure 3, the graphs plotted against the regression line indicate how clinical factors such as pain, disability, and range of motion correlate with one another. Pain intensity was found to be positively associated with functional disability. Besides, there is also a relation between the restricted range of motion and disability.

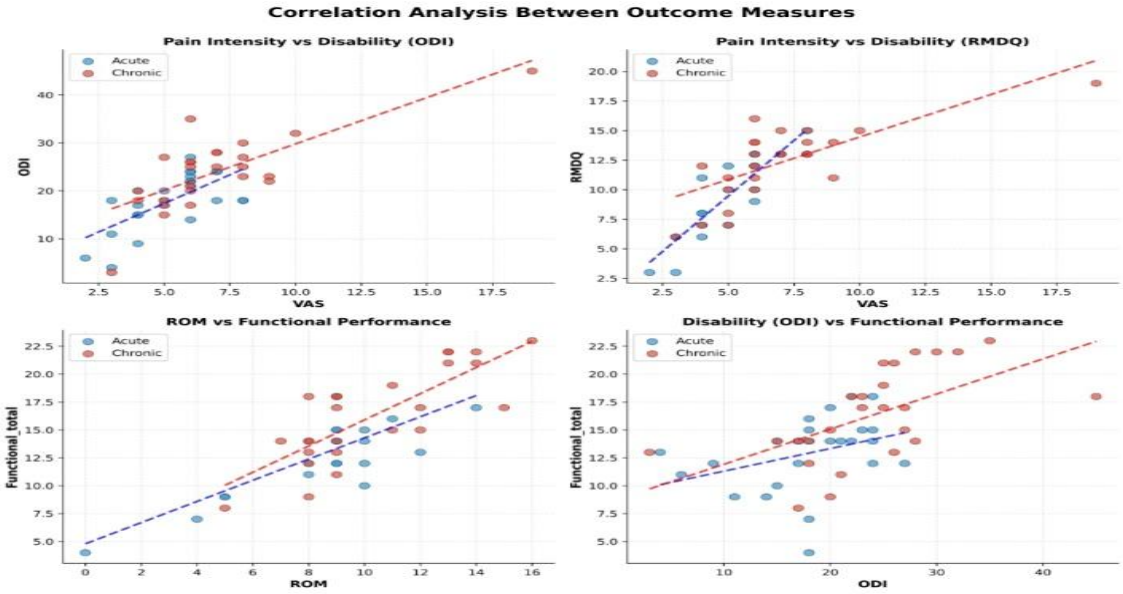

Figure 3: Scatter plots with regression lines showing correlations

Distribution Comparison of Key Clinical Measures

In Figure 4, the violin charts show the density distributions of clinical measurements in both populations. In terms of Chronic LBP, the density distribution is wider and skewed, suggesting a high concentration of severe readings. On the other hand, Acute LBP has relatively narrow density distributions.

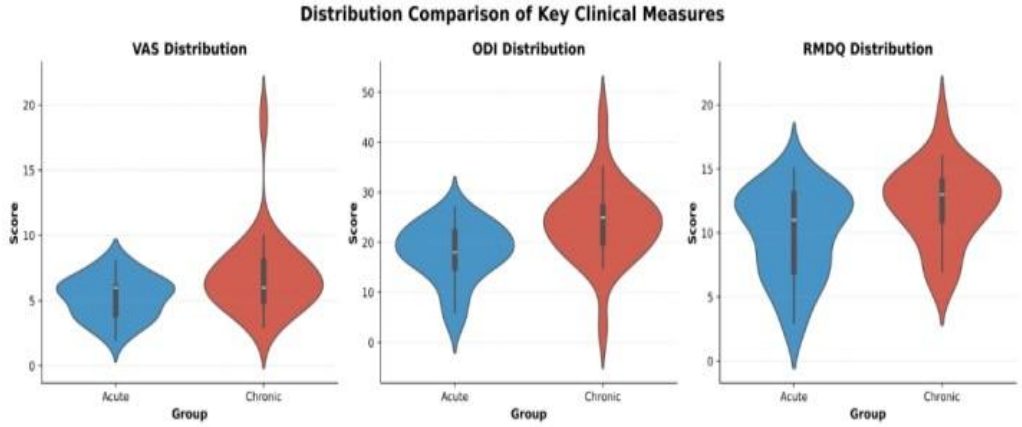

Figure 4.Violin plotsshowing the distribution of key clinical measures

Correlation Analysis by Groups

In Figure 5, the heat maps display the nature of the relationships among the measured variables. There is a strong positive correlation between pain, disability, and functional impairment. The colors used to present the relationship have been effective in depicting the degree of correlation between the variables measured.

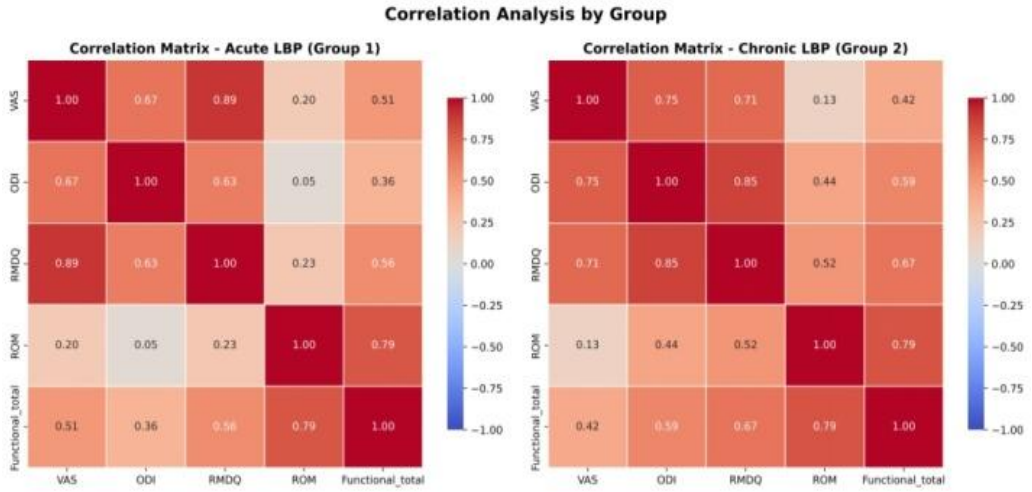

Figure 5. Correlation heat maps for acute and chronic LBP groups

4. Discussion

The objectives of the cross-sectional study were to investigate disparities in pain intensity, functional disability, and lumbar range of motion between patients with acute and chronic LBP. The results show that patients suffering from chronic LBP report experiencing high levels of pain, functional disability, and limited lumbar range of motion.

The fact that higher VAS scores were noted among the subjects with chronic low back pain would indicate the presence of increased pain sensitivity on the whole. This finding may reflect changes in pain perception mechanisms that occur with long-standing symptoms, which are characteristic of chronic pain. Continuous nociceptive stimulation may cause hyperactivity of the central nervous system, leading to increased pain sensitivity, even in the absence of peripheral tissue injury. Acute low back pain, however, may usually be associated with localized nociceptive activity without disturbances in the functioning of pain modulators (29).

The magnitude of disability based on ODI and RMDQ was considerably higher in the group of patients who had LBP for a long period of time. The above results indicate that the negative effect of prolonged pain is twofold. On the one hand, it influences the severity of pain symptoms. On the other hand, it contributes to significant functional impairment and limitations in activities of daily living. In this regard, the higher disability in chronic LBP might be explained by physical deconditioning, fear-avoidant behaviors, and lack of participation in functional activities. The findings, withhigher scores on the disability measures, are consistent with earlier studies that established the validity and reliability of the ODI and RMDQ as measures of disability in patients with LBP(30).

Lumbar range of motion (ROM), assessed through a composite restriction scoring system, was also significantly more limited in the chronic LBP group. This finding reflects the biomechanical and neuromuscular adaptations associated with chronic pain. Individuals with chronic LBP often demonstrate protective muscle activity, disturbed movement control, and decreased spinal mobility. and may contribute to restricted movement patterns. The use of a composite ROM scoring approach in this study provides a functional perspective of mobility impairment, emphasizing the clinical relevance of movement restriction rather than isolated angular measurements. The reduction of lumbar mobility has been linked significantly with disability in people with chronic LBP.

Further evidence is provided by the composite functional movement score, which shows that people with chronic lower back pain have greater difficulty performing functional movements such as forward bends, touching their fingertips to the floor, and standing up from a seated position. The observed impairment in chronic cases suggests that LBP progression affects not only isolated physical parameters but also integrated functional performance.

As seen in the results obtained from this study, there is a correlation among pain intensity, functional impairment, and movement restriction. The interplay among these variables underscores the complexity of LBP, in which pain, mobility, and function are highly interrelated. Pain leads to restricted movements, which eventually cause disabilities. This result underscores the importance of assessing patients comprehensively.

Considering the clinical implications of this study, early identification and appropriate management of acute low back pain are essential to prevent its progression into chronic conditions. The current study demonstrates that treatment for patients with acute LBP should aim to alleviate pain and restore movement and function. Interestingly, previous research indicates that patients often prioritize improvement in disability over pain reduction, emphasizing the importance of functional outcomes (31).

However, several limitations of this study should be recognized. For instance, the small sample size, together with the use of convenience sampling, poses a threat to the external validity of this research. Additionally, because the current study is cross-sectional, it will be difficult to establish causal relationships among the variables examined.

A third possible limitation to consider in this research is self-reporting bias, which could influence results on VAS, ODI, and RMDQ.

In future studies, longitudinal designs could be used to gather data from multiple sources on the course of LBP. The incorporation of psychological factors will enable a more holistic picture of this phenomenon from a biopsychosocial perspective. Furthermore, it will be helpful to use more sophisticated biomechanical analysis methods.

5. Conclusion

This research shows that people suffering from chronic low back pain have increased pain intensities, disability, and reduced lumbar motion compared with those having acute low back pain. The outcomes show that ongoing discomfort may progressively affect both the individual's physical ability and mobility. This can be attributed to the fact that such findings emphasize the need for clinical evaluation and physiotherapy intervention among sufferers of low back pain.

Highlights:

- Chronic low back pain patients reported greater pain intensity than those with acute cases.
- Functional disability was more pronounced in the chronic low back pain group.
- Lumbar mobility restriction was significantly greater in patients with chronic disease.
- Pain severity was associated with reduced functional performance.
- Early physiotherapy assessment may help prevent chronic progression.

List of Abbreviations:

Low Back Pain is abbreviated as LBP, Visual Analog Scale is abbreviated as VAS, Oswestry Disability Index is abbreviated as ODI, Roland–Morris Disability Questionnaire is abbreviated as RMDQ, Range of Motion is abbreviated as ROM, Statistical Package for the Social Sciences is abbreviated as SPSS, Intraclass Correlation Coefficient is abbreviated as ICC, Years Lived with Disability (YLD), Null Hypothesis (H_0), Alternative Hypothesis (H_1), Standard Deviation(SD), Probability Value (p-value).

Acknowledgments

All the data was obtained from Faisalabad, Pakistan.

Statements & Declarations

Author Contributions

Ameer Hamza: Responsible for study conceptualization, development of methodology, software-related work, and preparation of the original manuscript draft.

Hammad Yaseen: Involved in data collection (investigation) and organization of the dataset (data curation).

Muhammad Bilal: Contributed to investigation, data handling, and provision of study resources.

Sadia Riaz: Participated in investigation, data management, and resource support.
Laraib Zahid: Assisted with investigation, data curation, and resource provision.
Sana: Took part in the investigation, data organization, and provided the necessary resources.
Matloob ul Rasool: Participated in investigation, data management, and resource support
Areeba Shabbir: Assisted with investigation, data curation, and resource provision.
Sahiba Noor: Took part in the investigation, data organization, and provided the necessary resources.
Ahsan Saeed Chaudhary: Involved in data collection (investigation) and organization of the dataset.

Ethical Considerations

The Institutional Review Board of Superior University, Faisalabad Campus, granted ethical approval for this study. Before participation, written informed consent was obtained from all individuals included in the study.

Consent to Participate

All participants provided informed consent before being enrolled in the study.

Conflict of Interest

The authors declare that there are no conflicts of interest related to this work.

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