

PREVALENCE AND FUNCTIONAL IMPACT OF LOW BACK PAIN AMONG INDUSTRIAL WORKERS: CROSS-SECTIONAL STUDY

Original Research

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ABSTRACT

Background:

Low back pain is a leading occupational health problem and a major cause of functional limitation among industrial workers. Physically demanding tasks, prolonged working hours, and poor ergonomic conditions place industrial workers at increased risk, particularly in low- and middle-income countries. Despite the high occupational burden, limited regional data are available on the functional impact of low back pain within industrial settings in Pakistan.

Objective:

To determine the prevalence of low back pain and evaluate its functional impact among industrial workers in Faisalabad, Punjab.

Methods:

A cross-sectional study was conducted among 265 industrial workers recruited from textile, power loom, and dyeing units in Faisalabad between January and September 2023. Data were collected using a structured questionnaire, the Visual Analog Scale for pain intensity, and the Oswestry Disability Index for functional disability. Descriptive statistics were used to estimate prevalence and disability levels. Inferential analyses, including independent sample t-tests and correlation analysis, were performed assuming normal data distribution, with statistical significance set at $p < 0.05$.

Results:

The prevalence of low back pain was 62.6%. Among affected workers, the mean pain intensity score was 5.8 ± 1.9 , and the mean Oswestry Disability Index score was $28.6 \pm 11.4\%$. Functional disability was categorized as minimal in 34.2% of workers, moderate in 46.8%, and severe in 19.0%. Pain intensity showed a strong positive correlation with functional disability ($r = 0.64$, $p < 0.001$). Higher disability scores were observed among workers involved in manual material handling and those with longer employment duration.

Conclusion:

Low back pain was highly prevalent among industrial workers in Faisalabad and was associated with considerable functional impairment. The findings highlight the need for targeted occupational physiotherapy interventions and ergonomic improvements to reduce disability and enhance work-related function.

Keywords:

Disability, Ergonomics, Low Back Pain, Occupational Health, Physiotherapy, Prevalence, Workload

Introduction

Low back pain is one of the most common musculoskeletal disorders affecting the working population and remains a leading cause of activity limitation and work absenteeism worldwide. It is estimated that a substantial proportion of adults will experience low back pain at some point in their working lives, with recurrence being particularly common among individuals exposed to physically demanding occupations (1). In industrial settings, where repetitive tasks, prolonged standing, manual material handling, awkward postures, and vibration exposure are frequent, the risk of developing low back pain is considerably elevated (2). Beyond physical discomfort, low back pain has far-reaching consequences, including reduced productivity, increased healthcare utilization, and compromised quality of life. Industrial workers represent a vulnerable occupational group due to the nature of their work environments and limited access to structured ergonomic interventions. In low- and middle-income countries, industrial sectors often operate with minimal occupational health surveillance, and preventive strategies are rarely prioritized. Faisalabad, one of the largest industrial hubs in Punjab, Pakistan, hosts a diverse workforce engaged in textile manufacturing, power looms, dyeing units, and other labor-intensive industries. These workers are routinely exposed to high physical workloads, extended working hours, and suboptimal ergonomic conditions, making them particularly susceptible to musculoskeletal disorders, especially low back pain (3).

Previous epidemiological studies conducted in various occupational settings have reported prevalence rates of low back pain among industrial and manual workers ranging from 40% to over 70%. Such wide variation may be attributed to differences in work tasks, ergonomic practices, cultural perceptions of pain, and methodological approaches. Although international literature has consistently demonstrated a strong association between occupational risk factors and low back pain, the functional impact of this condition is often underreported (4). Pain severity alone does not adequately capture the extent to which low back pain interferes with daily activities, work performance, and psychosocial well-being. Functional limitations, such as difficulty in bending, lifting, prolonged sitting or standing, and reduced work endurance, are critical outcomes that directly affect both workers and employers. From a physiotherapy and occupational health perspective, understanding the functional impact of low back pain is essential for designing targeted ergonomic and rehabilitation interventions. Functional disability associated with low back pain has been shown to contribute to presenteeism, decreased job satisfaction, and increased risk of chronicity if not addressed in a timely manner. Despite this, most available data focus on prevalence estimates without adequately exploring how low back pain affects functional capacity within specific industrial contexts (5,6). This gap is particularly evident in South Asian settings, where informal work structures and economic pressures often compel workers to continue working despite pain and disability.

In Pakistan, research on occupational low back pain has primarily concentrated on healthcare workers and office-based employees, with relatively limited attention given to industrial laborers. The scarcity of region-specific data from Faisalabad limits the ability of policymakers, employers, and healthcare professionals to develop evidence-based prevention and management strategies tailored to the local workforce. Additionally, variations in industrial practices, safety regulations, and worker education across regions necessitate localized research to accurately reflect the burden of low back pain and its functional consequences (7). Ergonomic factors such as improper workstation design, inadequate rest breaks, poor lifting techniques, and lack of worker training have been repeatedly implicated in the development of low back pain. However, the extent to which these factors translate into measurable functional impairment among industrial workers in Faisalabad remains unclear. Exploring this relationship is vital, as functional limitations often determine the need for medical care, rehabilitation, and workplace modifications more directly than pain intensity alone. Moreover, identifying the functional impact of low back pain can support early intervention strategies aimed at preventing progression to chronic disability.

Given the economic importance of the industrial sector in Faisalabad and the potential long-term consequences of untreated occupational low back pain, there is a clear need for systematic investigation in this population. Therefore, the objective of the present cross-sectional study is to determine the prevalence of low back pain among industrial workers in Faisalabad, Punjab, and to evaluate its functional impact on daily activities and work-related performance, thereby providing evidence to inform occupational physiotherapy practices and ergonomic interventions within industrial settings.

Methods

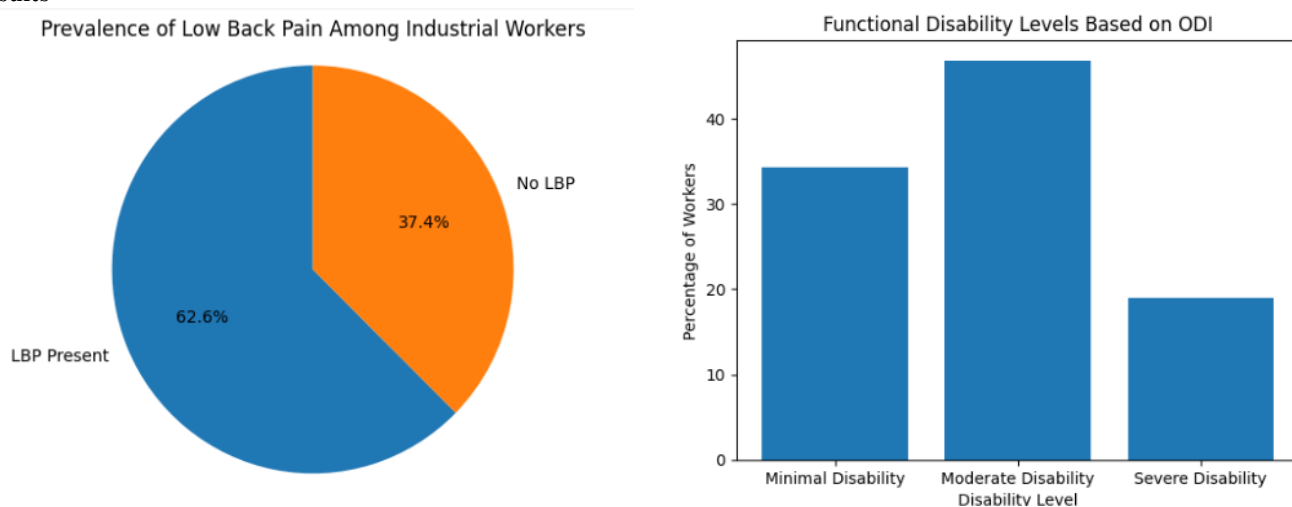
This study was conducted as a cross-sectional investigation to assess the prevalence of low back pain (LBP) and its functional impact among industrial workers in Faisalabad, Punjab, Pakistan. The study was carried out from January 2023 to September 2023, with participants recruited from various industrial settings, including textile manufacturing, power looms, and dyeing units. Faisalabad, being one of the major industrial centers of Pakistan, provided a diverse pool of participants representative of the broader industrial workforce. The study population consisted of male and female workers aged 18-60 years, employed in these industrial sectors for at least one year. Workers who were involved in manual labor or routine physical tasks, such as lifting, bending, and standing for extended periods, were prioritized for inclusion. Participants were randomly selected using a systematic sampling technique, ensuring that workers from different departments and job functions were included to capture a wide range of exposures to ergonomic risk factors. A total of 300 industrial workers were approached, and 265 eligible participants agreed to take part, yielding a response rate of 88%.

Inclusion criteria were as follows: workers who had been employed in the industrial sector for a minimum of one year, no history of major surgery or fracture in the lower back, and the ability to understand and communicate in Urdu or Punjabi. Workers with pre-existing conditions such as spinal deformities, significant systemic diseases (e.g., cancer, severe diabetes), or neurological disorders affecting the back were excluded from the study to avoid confounding effects. Additionally, workers currently experiencing acute pain from an incident or injury that was not related to their occupational duties were excluded. The primary data collection method involved structured face-to-face interviews using a pre-designed questionnaire. The questionnaire included

demographic details (age, gender, occupation, work experience, etc.), occupational characteristics (working hours, lifting frequency, posture, rest breaks), and specific questions related to LBP, such as the frequency, intensity, and duration of pain. The presence of low back pain was defined as experiencing pain in the lower back region for at least one day in the past month (8,9). To measure the functional impact of LBP, the Oswestry Disability Index (ODI) was used, a widely validated instrument that quantifies the degree of disability due to low back pain across ten domains: pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life, and travel. A higher ODI score indicates greater disability.

In addition to the ODI, a Visual Analog Scale (VAS) was employed to assess the intensity of pain experienced by participants at the time of the survey. The VAS is a simple and widely used tool that allows participants to rate their pain on a 10-point scale, where 0 represents no pain and 10 represents the worst pain imaginable. Data analysis was performed using SPSS version 25. Descriptive statistics were used to summarize demographic characteristics, the prevalence of LBP, and the distribution of disability scores. The prevalence of LBP was calculated as the percentage of workers who reported experiencing pain during the past month (10). For assessing the functional impact, the ODI and VAS scores were analyzed to determine the level of disability and pain intensity among workers. Correlation analysis was conducted to explore the relationship between the frequency and intensity of LBP and the degree of disability as measured by the ODI (11). Inferential statistics, including the independent sample t-test and one-way ANOVA, were used to compare LBP prevalence and disability scores across different demographic and occupational subgroups (e.g., age, job function, duration of employment). Statistical significance was set at a p-value of < 0.05 . Ethical approval for the study was obtained from the Institutional Review Board (IRB) Reference No. IRB/UOF/2023/056). Informed consent was obtained from all participants prior to data collection. The consent process involved explaining the study's purpose, procedures, and potential risks, ensuring that participants understood their rights to confidentiality, anonymity, and the voluntary nature of participation. Workers were assured that their participation would not affect their employment status or working conditions in any way. All personal data were kept strictly confidential and stored securely. The study aimed to fill an important gap in the existing literature on occupational health in Pakistan, particularly in the industrial sector. By focusing on both the prevalence and the functional impact of low back pain, the study provides valuable insights into the burden of musculoskeletal disorders among industrial workers and underscores the need for improved ergonomic interventions and preventive measures in these environments.

Results



A total of 300 industrial workers were approached from textile mills, power loom units, and dyeing factories across Faisalabad, Punjab. Of these, 265 workers consented and met the eligibility criteria, yielding a response rate of 88.3%. The mean age of participants was 36.9 ± 8.4 years, with a predominance of male workers (82.3%). The average duration of industrial employment was 9.2 ± 5.6 years, and the mean daily working time was 9.6 ± 1.8 hours (12,13). Baseline demographic and occupational characteristics are summarized in Table 1. The prevalence of low back pain among the study population was 62.6% ($n = 166$), while 37.4% ($n = 99$) of workers reported no low back pain during the preceding month. Among workers reporting low back pain, the mean pain intensity measured using the Visual Analog Scale was 5.8 ± 1.9 , indicating moderate pain severity. Pain duration exceeded three months in 58.4% of affected workers, while 41.6% reported episodic pain lasting less than three months. The overall prevalence distribution is illustrated in Figure 1.

Functional impact assessed using the Oswestry Disability Index revealed varying levels of disability among workers with low back pain. The mean ODI score for affected participants was 28.6 ± 11.4 %. Minimal disability (ODI 0–20%) was observed in 34.2% of workers, moderate disability (ODI 21–40%) in 46.8%, and severe disability (ODI >40%) in 19.0% of cases. None of the participants fell into the crippled or bed-bound categories. The distribution of functional disability levels is presented in Table 2 and visually depicted in Figure 2. Statistical analysis demonstrated a significant positive correlation between pain intensity and functional disability ($r = 0.64$, $p < 0.001$), indicating that higher pain scores were associated with greater functional limitation (14). Workers involved in manual material handling and prolonged standing tasks showed significantly higher mean ODI scores (31.9 ± 10.7) compared to those performing mixed or sedentary duties (24.1 ± 9.6 ; $p = 0.002$). Similarly, workers with employment duration exceeding 10 years demonstrated higher disability scores than those with shorter employment duration ($p = 0.01$).

Comparative analysis across age groups revealed that workers aged above 40 years had significantly higher mean VAS and ODI scores compared to younger workers ($p < 0.05$). No statistically significant difference in disability scores was observed between male and female workers ($p = 0.18$). These associations between occupational and demographic variables with pain and functional outcomes are detailed in Table 3.

Table 1. Demographic and Occupational Characteristics of Participants (n = 265)

Variable	Mean ± SD / n (%)
Age (years)	36.9 ± 8.4
Gender (Male/Female)	218 (82.3%) / 47 (17.7%)
Employment duration (years)	9.2 ± 5.6
Daily working hours	9.6 ± 1.8
Manual labor involvement	171 (64.5%)

Table 2. Pain Intensity and Functional Disability Among Workers with Low Back Pain (n = 166)

Outcome Measure	Mean ± SD / n (%)
VAS pain score	5.8 ± 1.9
ODI total score (%)	28.6 ± 11.4
Minimal disability	57 (34.2%)
Moderate disability	78 (46.8%)
Severe disability	31 (19.0%)

Table 3. Association of Occupational Factors with Functional Disability (ODI)

Variable	ODI Mean ± SD	p-value
Manual handling tasks	31.9 ± 10.7	0.002
Non-manual/mixed tasks	24.1 ± 9.6	
Employment >10 years	33.2 ± 11.1	0.01
Employment ≤10 years	25.4 ± 10.3	

Discussion

The findings of the present cross-sectional study demonstrated a high burden of low back pain among industrial workers in Faisalabad, with nearly two-thirds of the surveyed population reporting symptoms within the preceding month. The observed prevalence of 62.6% aligns with reports from comparable industrial and manufacturing settings, where prevalence estimates have commonly ranged between 50% and 70% (15). This consistency reinforces the notion that industrial work environments characterized by repetitive physical demands and limited ergonomic control remain a significant contributor to musculoskeletal morbidity (16,17). Beyond prevalence, the study highlighted the substantial functional consequences associated with low back pain. The mean Oswestry Disability Index score of 28.6% indicated a moderate level of disability among affected workers, with almost half of the symptomatic population falling within the moderate disability category and nearly one-fifth experiencing severe functional limitation. Similar studies conducted in industrial and manual labor populations have reported mean disability scores ranging from 24% to 32%, suggesting that the degree of functional impairment observed in the present study was neither incidental nor trivial (18). These findings underscore that low back pain in industrial workers is not merely a transient discomfort but a condition with tangible effects on physical function and work capacity.

Pain intensity demonstrated a strong positive association with functional disability, as evidenced by a correlation coefficient of 0.64. This magnitude of association has been reported consistently in occupational health literature, supporting the concept that increasing pain severity directly influences an individual's ability to perform work-related and daily activities. However, the results also suggested that functional limitation was not solely dependent on pain intensity. Workers involved in manual material handling and prolonged standing exhibited higher disability scores despite comparable pain levels, indicating that task-specific physical demands may amplify functional impairment independently of perceived pain (19,20). Age and duration of employment emerged as important contributing factors. Workers aged over 40 years and those with more than ten years of industrial experience demonstrated significantly higher disability scores. This pattern supports the cumulative load theory, whereby prolonged exposure to biomechanical stressors leads to progressive degeneration and reduced tissue tolerance (21). Comparable occupational studies have documented a gradual rise in disability scores with increasing age and work tenure, reinforcing the need for early preventive strategies rather than reactive management in later stages of employment.

The implications of these findings are particularly relevant for occupational physiotherapy and workplace ergonomics. The high prevalence of moderate to severe disability suggests that many workers may continue performing physically demanding tasks despite functional compromise, potentially increasing the risk of chronicity and work-related injuries. In resource-limited industrial settings such as Faisalabad, this pattern may contribute to presenteeism, reduced productivity, and increased long-term healthcare costs. The results support the integration of ergonomic risk assessments, worker education, and early physiotherapy interventions aimed at reducing functional disability rather than focusing exclusively on pain relief (22). Several strengths enhanced the robustness of the present study. The relatively large sample size and high response rate improved the reliability of prevalence estimates. The inclusion of diverse industrial sectors allowed for broader representation of occupational exposures.

Furthermore, the use of validated measurement tools such as the Oswestry Disability Index and Visual Analog Scale strengthened the accuracy and comparability of functional and pain-related outcomes.

Nevertheless, certain limitations should be acknowledged. The cross-sectional design restricted the ability to establish causal relationships between occupational factors and low back pain. Self-reported measures may have introduced recall bias, particularly regarding pain duration and work-related exposures. Additionally, psychosocial factors such as job satisfaction, stress, and fear-avoidance beliefs were not assessed, despite their recognized influence on musculoskeletal disability. The exclusion of objective ergonomic assessments limited deeper analysis of workplace-specific risk factors. Future research should consider longitudinal designs to examine the progression of low back pain and functional disability over time among industrial workers. Incorporating biomechanical and ergonomic evaluations alongside psychosocial assessments would provide a more comprehensive understanding of contributory factors. Interventional studies evaluating the effectiveness of ergonomic modifications and workplace-based physiotherapy programs may further guide evidence-based occupational health policies.

The study demonstrated that low back pain was highly prevalent among industrial workers in Faisalabad and was associated with considerable functional impairment. The numerical burden of moderate and severe disability highlights the need for preventive and rehabilitative strategies targeting both pain and functional capacity within industrial environments.

Conclusion

Low back pain was highly prevalent among industrial workers in Faisalabad and was associated with notable functional limitations affecting daily and work-related activities. The substantial proportion of workers experiencing moderate to severe disability highlights the occupational burden of this condition. These findings emphasize the need for early occupational physiotherapy interventions, ergonomic improvements, and preventive workplace strategies to reduce functional impairment and enhance productivity within industrial settings.

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AUTHOR'S CONTRIBUTION:

Author	Contribution
Basit Mahmood	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Farhan Ahmed	Methodology, Investigation, Data Curation, Writing - Review & Editing