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Relationship Between Functional Disability and Functional Ability in Women with Postpartum Low Back Pain Following Vaginal Delivery: A Secondary Analysis of a Randomized Controlled Trial

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KEYWORDS

Postpartum low back pain; Oswestry Disability Index; Back Pain Functional Scale; Functional disability; Functional ability; Vaginal delivery; Physiotherapy; Secondary analysis.

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Abstract

Background
Postpartum low back pain is a common musculoskeletal condition that adversely affects functional independence and quality of life in women following childbirth. Pregnancy-related hormonal, biomechanical, and muscular adaptations often persist during the postpartum period, resulting in pain, reduced spinal stability, and limitations in daily activities. Although the Oswestry Disability Index (ODI) and the Back Pain Functional Scale (BPFS) are widely used to assess disability and functional ability, respectively, evidence regarding their relationship in postpartum women remains limited.

Objective
To determine the relationship between functional disability, measured using the Oswestry Disability Index, and functional ability, measured using the Back Pain Functional Scale, among women with postpartum low back pain following vaginal delivery.

Methods
This study was a secondary analysis of data derived from a randomized controlled trial involving 60 postpartum women (18–35 years) with low back pain within three months following vaginal delivery. Functional disability was assessed using the ODI, and functional ability was evaluated using the BPFS at baseline and after completion of a six-week rehabilitation programme. Descriptive statistics were expressed as mean ± standard deviation (SD). Pearson's correlation coefficient was used to determine the association between ODI and BPFS scores, with statistical significance set at $p < 0.05$.

Results
The mean baseline ODI and BPFS scores were 29.52 ± 6.40 and 28.92 ± 6.14, respectively. Pearson's correlation analysis demonstrated a very strong negative correlation between baseline ODI and BPFS scores ($r = -0.986$, $p < 0.001$). Following the intervention, the mean ODI score decreased to 22.93 ± 6.60, while the mean BPFS score increased to 36.42 ± 6.79. A strong negative correlation remained between post-intervention ODI and BPFS scores ($r = -0.737$, $p < 0.001$), indicating that lower disability was associated with better functional ability.

Conclusion
Functional disability is strongly and inversely associated with functional ability in women with postpartum low back pain following vaginal delivery. The combined use of the ODI and BPFS provides a comprehensive evaluation of disability and functional performance and may assist physiotherapists in monitoring recovery and planning individualized rehabilitation programmes.

INTRODUCTION

Pregnancy and childbirth are accompanied by profound anatomical, physiological, hormonal, and biomechanical adaptations that enable fetal growth and successful delivery. Although these changes are essential for maternal and fetal well-being, they also increase the susceptibility to musculoskeletal disorders, particularly low back pain. Among women who have

recently delivered, postpartum low back pain remains one of the most frequently reported health concerns and may persist for several months after childbirth. Persistent pain during this period not only affects physical recovery but also interferes with maternal responsibilities, infant care, occupational activities, and overall quality of life.

The prevalence of postpartum low back pain varies considerably across different populations, with previous studies reporting that approximately 25–50% of women continue to experience low back pain after delivery. While many women demonstrate spontaneous recovery during the first few months postpartum, a considerable proportion continue to experience pain, reduced mobility, and functional impairment well beyond the immediate postpartum period. Persistent symptoms have been associated with previous episodes of back pain, increased body mass index, occupational workload, poor postural habits, reduced physical activity, and inadequate rehabilitation after childbirth.

Several physiological mechanisms contribute to postpartum low back pain. During pregnancy, hormones such as relaxin, progesterone, and estrogen increase ligamentous laxity, allowing greater mobility of the pelvic joints to facilitate childbirth. Although beneficial during pregnancy, this increased laxity reduces passive stability of the lumbopelvic region and places greater demands on the surrounding musculature. Simultaneously, progressive weight gain, enlargement of the uterus, and anterior displacement of the body's center of gravity increase lumbar lordosis and alter normal spinal biomechanics. These adaptations increase compressive and shear forces across the lumbar spine and pelvic girdle, predisposing women to pain and functional limitations.

The abdominal musculature also undergoes substantial changes throughout pregnancy. Progressive stretching of the abdominal wall, particularly the rectus abdominis, often results in reduced core muscle strength and, in many women, separation of the rectus muscles known as diastasis recti. Weakness of the abdominal musculature compromises spinal stability and decreases the effectiveness of load transfer between the trunk and pelvis. In addition, pelvic floor muscles become elongated and weakened during pregnancy and vaginal delivery, further contributing to impaired lumbopelvic stability. These deficits frequently persist during the early postpartum period and may delay complete musculoskeletal recovery.

Following childbirth, mothers are required to perform numerous repetitive physical activities including lifting the infant, breastfeeding, prolonged sitting, bending, carrying the baby, and performing household tasks. These activities are often undertaken in sustained or awkward postures while sleep deprivation and fatigue reduce muscular endurance and recovery capacity. Consequently, the lumbar spine remains exposed to repetitive mechanical stress, increasing the likelihood of persistent pain and disability.

Beyond physical discomfort, postpartum low back pain has significant functional implications. Women experiencing persistent pain often report difficulty performing daily activities such as walking, climbing stairs, prolonged standing, household work, and infant care. Functional limitations during this period may contribute to reduced independence, decreased participation in family and social activities, emotional distress, and diminished quality of life. Therefore,

comprehensive assessment of functional disability and physical performance is essential for planning effective rehabilitation programmes.

Patient-reported outcome measures play an important role in evaluating musculoskeletal disorders. The **Oswestry Disability Index (ODI)** is regarded as one of the most reliable and valid instruments for measuring disability associated with low back pain. It evaluates the influence of pain on activities including personal care, lifting, walking, sitting, standing, sleeping, travelling, and social participation. Higher ODI scores indicate greater disability and more severe functional limitations.

In contrast, the **Back Pain Functional Scale (BPFS)** provides an activity-oriented assessment by evaluating an individual's ability to perform specific functional tasks commonly affected by low back pain. Unlike disability questionnaires that primarily quantify perceived limitations, the BPFS focuses on practical functional performance and therefore provides valuable insight into recovery during rehabilitation. Because these instruments evaluate complementary aspects of musculoskeletal health, simultaneous assessment using both tools offers a more comprehensive understanding of patient status.

Although ODI and BPFS are widely used individually in clinical practice, relatively few studies have specifically investigated the relationship between these outcome measures in postpartum women with low back pain. Understanding this relationship is clinically important because it may help physiotherapists determine whether increasing disability consistently corresponds with reduced functional ability and whether improvements in disability are reflected by meaningful gains in functional performance. Such information may improve clinical decision-making, facilitate individualized rehabilitation planning, and enhance monitoring of treatment outcomes.

The present study was therefore undertaken to determine the relationship between functional disability measured using the Oswestry Disability Index and functional ability measured using the Back Pain Functional Scale among women with postpartum low back pain following vaginal delivery. By examining the association between these two validated outcome measures, the study aims to provide evidence that may assist physiotherapists in selecting appropriate assessment tools and optimizing postpartum rehabilitation programmes.

MATERIALS AND METHODS

Study Design

This secondary analytical study utilized data obtained from a randomized controlled trial conducted to evaluate the effectiveness of a structured exercise programme in women with postpartum low back pain following vaginal delivery. The present study aimed to determine the relationship between functional disability and functional ability using validated outcome measures.

Study Setting

The study was conducted at the Department of Physiotherapy, Pacific Medical College and Hospital, Udaipur, Rajasthan, India.

Participants

A total of **60 postpartum women** with low back pain following vaginal delivery were included in the study. Participants were recruited using convenience sampling and were randomly allocated in the original trial

into an exercise group (n = 30) and a control group (n = 30). Data from both groups were included in the present correlation analysis.

Eligibility Criteria

Inclusion Criteria

- Women aged **18–35 years**
- Vaginal delivery
- Postpartum duration of **0–3 months**
- Presence of low back pain
- Ability to understand and follow study instructions
- Willingness to participate and provide written informed consent

Exclusion Criteria

- Caesarean section
- Previous spinal surgery
- History of spinal fracture
- Neurological disorders
- Inflammatory spinal diseases
- Congenital spinal deformities
- Pregnancy-related complications requiring prolonged medical management
- Any serious medical condition restricting participation in exercise

Outcome Measures

Oswestry Disability Index (ODI)

Functional disability was assessed using the Oswestry Disability Index (ODI), a validated questionnaire consisting of ten items evaluating disability associated with low back pain. Scores range from 0 to 100%, with higher scores indicating greater disability.

Back Pain Functional Scale (BPFS)

Functional ability was assessed using the Back Pain Functional Scale (BPFS), a 12-item questionnaire evaluating performance during activities commonly affected by low back pain. Total scores range from 0 to 60, with higher scores indicating better functional ability.

Data Collection Procedure

Demographic information was recorded before assessment. ODI and BPFS were administered at baseline before intervention and repeated after completion of the six-week rehabilitation programme. The obtained scores were used for the present secondary correlation analysis.

Statistical Analysis

Data were analysed using **IBM SPSS Statistics version 26.0** (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Pearson's correlation coefficient was used to determine the relationship between ODI and BPFS scores before and after intervention. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of Pacific Medical University, Udaipur. Written informed consent was obtained from all participants prior to enrolment, and all procedures were conducted in accordance with the Declaration of Helsinki.

RESULTS

Participant Characteristics

A total of **60 postpartum women** with low back pain following vaginal delivery were included in the study. The participants were divided equally into an exercise group (n = 30) and a control group (n = 30). The mean age of the participants was **25.55 ± 3.81 years** (range: 19–34 years).

Table 1. Demographic Characteristics of Participants

Variable	Value
Total participants (n)	60
Exercise group, n (%)	30 (50%)
Control group, n (%)	30 (50%)
Age (years), Mean ± SD	25.55 ± 3.81
Minimum age (years)	19
Maximum age (years)	34

Descriptive Statistics of Outcome Measures

The mean pre-intervention ODI score was **29.52 ± 6.40**, which decreased to **22.93 ± 6.60** following the intervention period. Conversely, the mean BPFS score increased from **28.92 ± 6.14** at baseline to **36.42 ± 6.79** after intervention, indicating improvement in functional ability.

Table 2. Descriptive Statistics of ODI and BPFS Scores (n = 60)

Outcome Measure	Mean ± SD
Pre-intervention ODI	29.52 ± 6.40
Post-intervention ODI	22.93 ± 6.60
Pre-intervention BPFS	28.92 ± 6.14
Post-intervention BPFS	36.42 ± 6.79

Correlation Between Functional Disability and Functional Ability

Pearson's correlation analysis demonstrated a **very strong negative correlation** between baseline ODI and BPFS scores (**$r = -0.986$, $p < 0.001$**). This indicates that participants with greater functional disability reported lower functional ability before intervention.

Following the intervention, a **strong negative correlation** remained between post-intervention ODI and BPFS scores (**$r = -0.737$, $p < 0.001$**), suggesting that although functional disability decreased and functional ability improved, the inverse relationship between the two outcome measures persisted.

Table 3. Pearson Correlation Between ODI and BPFS

Variables	Pearson's *r*	*p*-value	Interpretation
Pre-intervention ODI vs Pre-intervention BPFS	-0.986	<0.001	Very strong negative
Post-intervention ODI vs Post-intervention BPFS	-0.737	<0.001	Strong negative

Interpretation of Findings

The findings demonstrate a statistically significant inverse relationship between functional disability and functional ability among postpartum women with low back pain. Participants with higher ODI scores consistently exhibited lower BPFS scores, indicating greater limitations in performing functional activities. Improvements observed following the intervention were accompanied by reductions in disability and corresponding gains in functional ability.

Figure 1. Scatter plot showing the correlation between pre-intervention ODI and BPFS scores.

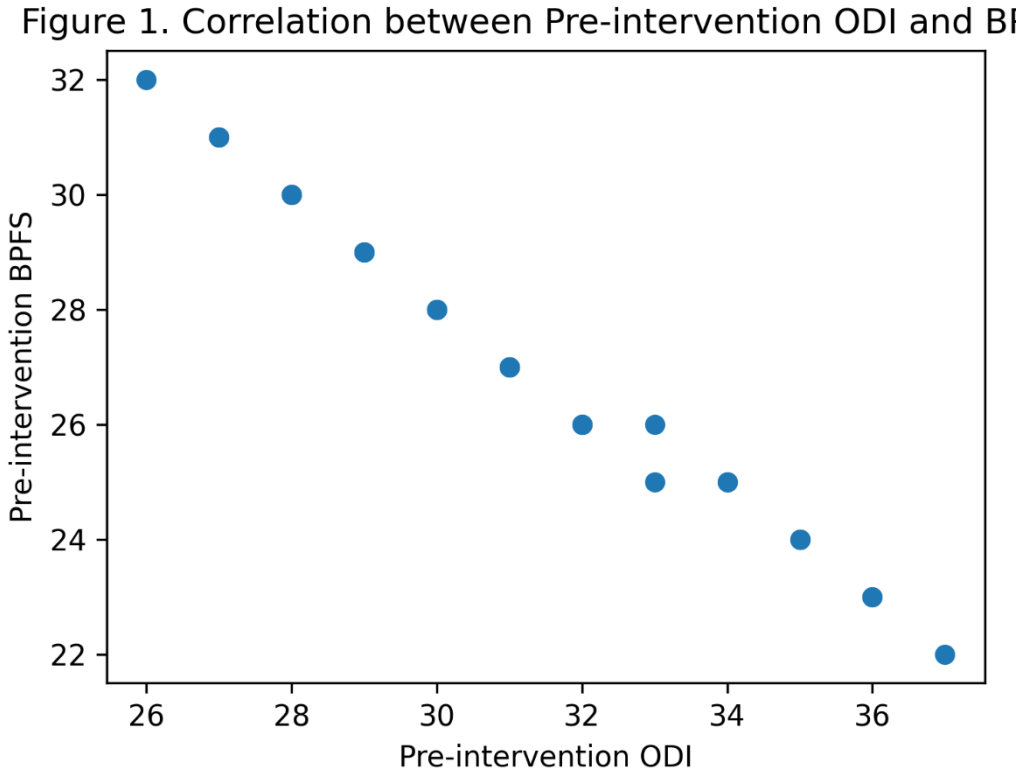

Figure 2. Scatter plot showing the correlation between post-intervention ODI and BPFS scores.

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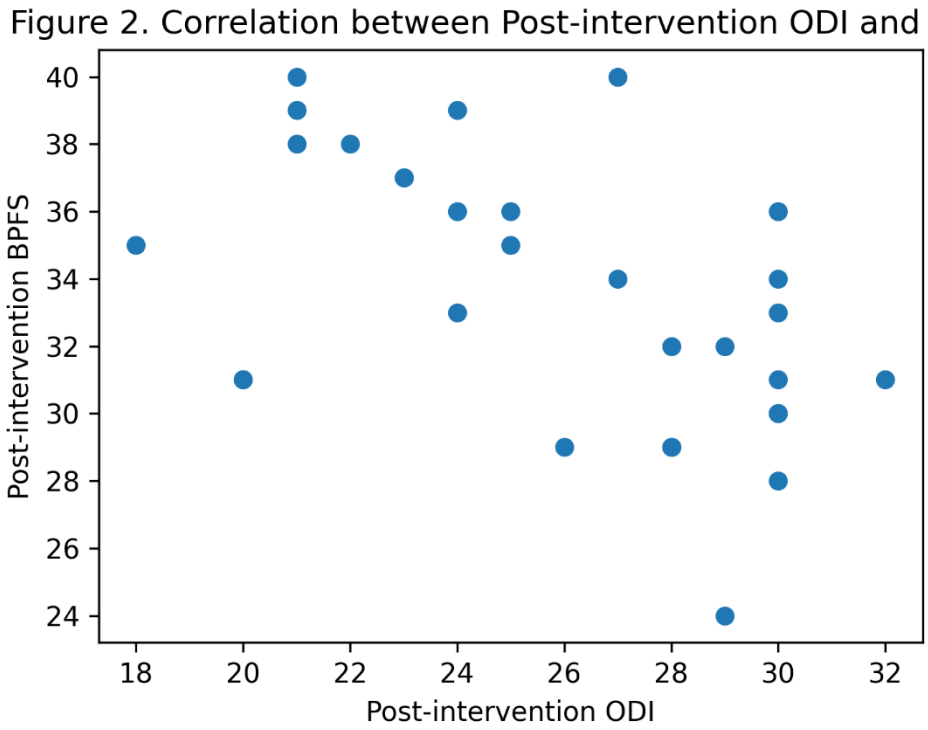


Figure 3. Box plot comparing pre- and post-intervention ODI scores.

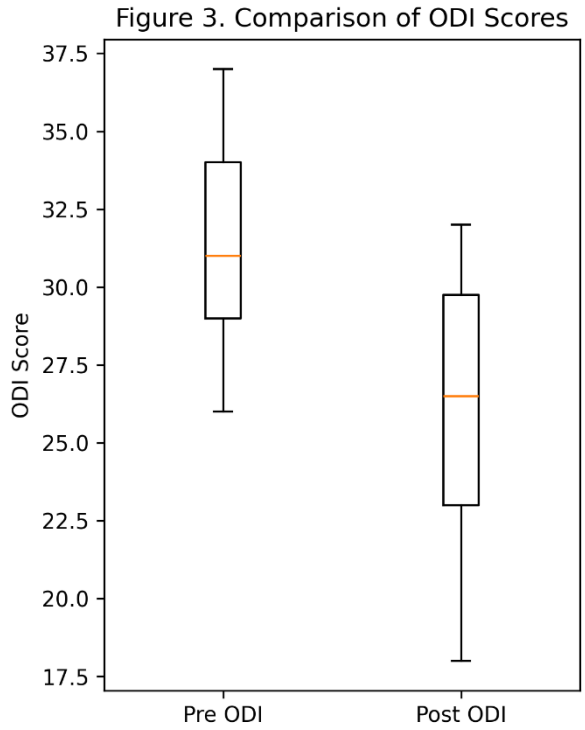
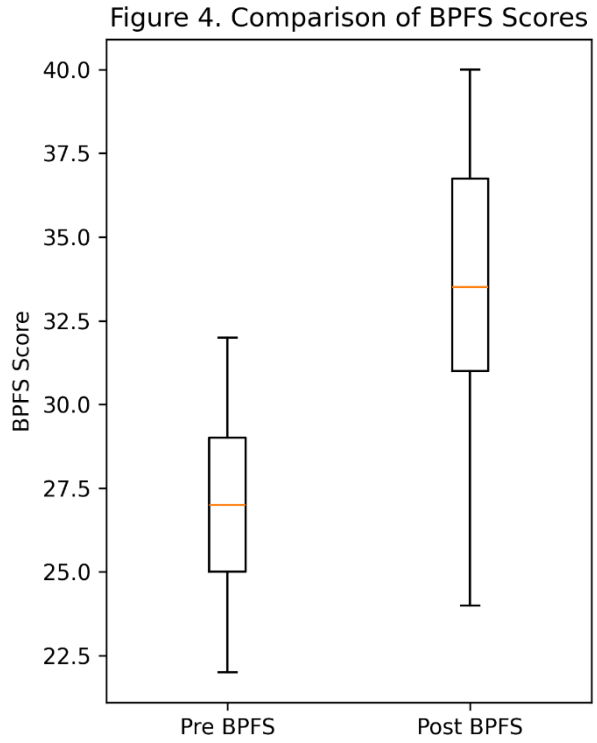


Figure 4. Box plot comparing pre- and post-intervention BPFS scores.



DISCUSSION

The present study investigated the relationship between functional disability, assessed using the Oswestry Disability Index (ODI), and functional ability, assessed using the Back Pain Functional Scale (BPFS), among women with postpartum low back pain following vaginal delivery. The findings demonstrated a statistically significant inverse relationship between the two outcome measures both before and after the intervention. Baseline analysis revealed a **very strong negative correlation** between ODI and BPFS scores (r = –0.986, p < 0.001), while a **strong negative correlation** persisted following the intervention (r = –0.737, p < 0.001). These findings indicate that women reporting greater disability also experienced poorer functional ability, and improvements in disability were accompanied by improvements in functional performance.

Postpartum low back pain is a multifactorial condition resulting from pregnancy-related hormonal, biomechanical, and musculoskeletal changes. Increased ligamentous laxity, reduced trunk muscle strength, altered spinal alignment, and pelvic instability frequently persist after childbirth and adversely affect activities of daily living. Consequently, women often experience difficulty performing routine tasks such as prolonged standing, walking, lifting, bending, carrying their infants, and household activities. The present findings support the concept that disability and functional ability are closely interrelated during postpartum recovery.

The extremely strong negative correlation observed at baseline suggests that the Oswestry Disability Index and the Back Pain Functional Scale measure complementary aspects of the same clinical condition. Participants with higher ODI

scores consistently demonstrated lower BPFS scores, indicating that increased disability is directly associated with reduced functional performance. This relationship emphasizes that patient-perceived disability is reflected in limitations during everyday functional activities.

Following completion of the rehabilitation programme, the mean ODI scores decreased, whereas BPFS scores increased, indicating reduced disability and improved functional ability. Although the strength of correlation decreased slightly after intervention, the association remained statistically significant. This reduction in correlation strength may reflect individual variations in recovery, whereby some participants regained functional independence more rapidly than reductions in perceived disability. Such findings suggest that improvements in physical function may precede complete resolution of pain-related disability in certain postpartum women.

The findings of the present study are consistent with previous literature demonstrating that disability and functional performance are strongly associated in individuals with low back pain. Davidson and Keating, who developed the Back Pain Functional Scale, reported that BPFS is highly responsive to functional changes and exhibits excellent construct validity when compared with established disability measures such as the Oswestry Disability Index. Similarly, Fairbank and Pynsent identified the ODI as one of the most reliable instruments for assessing disability associated with low back pain and emphasized its clinical utility in evaluating treatment outcomes. Together, these studies support the use of both instruments to provide a comprehensive assessment of patient status.

Previous investigations involving postpartum women have also highlighted the substantial impact of low back pain on physical functioning and quality of life. Stuge and colleagues demonstrated that individualized stabilization exercises significantly improve pain and functional recovery in women with persistent postpartum pelvic girdle and low back pain. Likewise, Gutke et al. reported that postpartum women experiencing persistent lumbopelvic pain frequently exhibit impaired physical function and reduced participation in daily activities, reinforcing the importance of early rehabilitation and comprehensive functional assessment.

The clinical implications of the present findings are noteworthy. While the ODI primarily quantifies the degree of disability associated with low back pain, the BPFS provides valuable information regarding the patient's ability to perform functional activities. Using both outcome measures together allows physiotherapists to evaluate disability and functional performance simultaneously, facilitating more individualized treatment planning, monitoring of rehabilitation progress, and evaluation of treatment effectiveness. This combined approach may enhance clinical decision-making during postpartum rehabilitation and improve patient-centred care.

A major strength of this study is the use of validated and widely accepted outcome measures to evaluate different dimensions of recovery in postpartum women. Furthermore, analysing data obtained from a randomized controlled trial enhances the reliability of the findings and provides clinically meaningful evidence regarding the relationship between disability and functional ability.

However, several limitations should be acknowledged. The study included

participants from a single institution, which may limit the generalizability of the findings to other populations. The relatively modest sample size may also have influenced the precision of the correlation estimates. In addition, only short-term outcomes were evaluated, and long-term follow-up was not performed. Factors such as psychosocial status, occupational demands, body mass index, physical activity level, and breastfeeding practices were not analysed, although these variables may influence postpartum recovery and functional outcomes.

Future studies should include larger multicentre cohorts with extended follow-up periods to evaluate the long-term relationship between disability and functional recovery after childbirth. Further research should also investigate additional physical and psychosocial factors influencing postpartum low back pain and explore predictive models for identifying women at risk of persistent disability.

Overall, the present study demonstrates that functional disability and functional ability are strongly and inversely related in women with postpartum low back pain following vaginal delivery. These findings support the routine use of both the Oswestry Disability Index and the Back Pain Functional Scale in clinical practice to obtain a comprehensive assessment of patient recovery and guide evidence-based physiotherapy interventions.

CONCLUSION

The present study demonstrated a significant inverse relationship between functional disability and functional ability in women with postpartum low back pain following vaginal delivery. A very strong negative correlation was observed between the Oswestry Disability Index and the Back Pain Functional Scale at baseline, while a strong negative correlation persisted following the intervention. These findings indicate that higher levels of disability are associated with reduced functional ability, and improvements in disability are accompanied by enhanced functional performance.

The combined use of the Oswestry Disability Index and the Back Pain Functional Scale provides a comprehensive assessment of patient status by evaluating both disability and functional capacity. Incorporating these outcome measures into routine clinical practice may assist physiotherapists in monitoring recovery, evaluating treatment effectiveness, and developing individualized rehabilitation programmes for postpartum women with low back pain. Further multicentre studies with larger sample sizes and long-term follow-up are recommended to validate these findings and explore additional factors influencing postpartum functional recovery.

ABBREVIATIONS

Abbreviation	Full Form
ODI	Oswestry Disability Index
BPFS	Back Pain Functional Scale
SD	Standard Deviation

Abbreviation Full Form

RCT	Randomized Controlled Trial
SPSS	Statistical Package for the Social Sciences

DECLARATIONS

Ethics Approval and Consent to Participate

The study protocol was approved by the Institutional Ethics Committee of Pacific Medical University, Udaipur, Rajasthan, India. Written informed consent was obtained from all participants before enrolment, and all procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

Competing Interests

The authors declare that they have no competing interests.

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No external funding was received for this study.

Authors' Contributions

Nivedi Jain contributed to the study conception, data collection, statistical analysis, interpretation of results, and manuscript preparation. **Dr. Smita Barya** supervised the study, contributed to the study design, critically reviewed the manuscript, and approved the final version for publication.

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